Jan-Benedict E.M. Steenkamp

PRODUCT QUALITY

STELLINGEN

1. De kwaliteitsindicatoren beïnvloeden het overall kwaliteitsoordeel via de kwaliteitsattributen.

(dit proefschrift)

2. De persoonlijkheidsvariabele 'kwaliteitsoriëntatie' is een belangrijke variabele om inzicht te krijgen in het kwaliteitsperceptieproces en de rol van kwaliteit in het keuzegedrag.

(dit proefschrift)

3. Het is wenselijk om de kwaliteitsperceptie-benadering te koppelen aan de produktiemanagement benadering aangezien dit de kans vergroot dat de resultaten van marktonderzoek ook daadwerkelijk gebruikt worden voor produktontwikkeling.

(dit proefschrift)

4. Het is aan te bevelen om in informatie-integratie experimenten within-subjects designs te gebruiken.

(dit proefschrift)

5. De algemene geldigheid van het gezegde 'goedkoop is duurkoop' wordt weersproken door empirische gegevens.

(dit proefschrift)

6. Wijdere verspreiding van de resultaten van vergelijkende warenonderzoeking zal de relatie tussen de prijs eenn de kwaliteit van de merken positief beïnvloeden. De Consumentenbond zou dan ook, onder de voorwaarde dat voor een bepaald merk de informatie voor alle testcriteria wordt gepubliceerd, het gebruik van deze testresultaten voor commerciële doeleinden moeten stimuleren in plaats van afremmen.

(Geïnspireerd door: Archibald, R.B., C.A. Haulman en C.E. Moody Jr. (1983), Quality, price, advertising, and published quality ratings, *Journal of Consumer Research*, 9, 347-356.)

7. De recente opkomst van correspondentie-analyse in het marktonderzoek is een voorbeeld van de Amerikaanse 'bias' in de marketing. Hoewel de techniek in Europa reeds lang bestaat, kreeg ze pas grote aandacht nadat ze beschreven werd door Amerikanen in Amerikaanse vakbladen.

8. De twee belangrijkste ontwikkelingen in het afgelopen decennium zijn dat het communisme zijn glans als ideologie heeft verloren en de opkomst van Japan als wereldmacht.

9. De huidige problemen van de Sowjet partijleider en president Michael Gorbatsjov zou men kunnen verklaren met behulp van de politieke theorieën van de 16e eeuwse staatsman Machiavelli. Deze stelde reeds dat iemand die vernieuwingen wil doorvoeren grote moeilijkheden kan verwachten aangezien hij diegenen die van de oude toestand profiteren tot zijn vijanden maakt, terwijl hij doorgaans slechts lauwe verdedigers vindt in hen die van de nieuwe toestand zouden kunnen profiteren.

   (N. Machiavelli, *De Heerser,* Amsterdam: Athenaeum (Nederlandse vertaling), 1982)

10. Kennedy's concept van 'imperial overstretch' kan eveneens op ondernemingen worden toegepast. De recente trend van ondernemingen om zich weer meer op hun kernactiviteiten te richten duidt erop dat deze organisaties beter in staat zijn om imperial overstretch te reduceren dan naties. Naties, en met name de twee supermachten, zouden dan ook op dit punt van ondernemingen veel kunnen leren.

    (P. Kennedy, *The Rise and Fall of the Great Powers,* New York: Random House, 1987)

11. In het collectieve geheugen van de Verenigde Staten staan drie data gegrift: 7 december 1941, 12 april 1945 en 22 november 1963. Het feit dat nog steeds voor veel Amerikanen laatstgenoemde datum een even dramatische en belangrijke dag is als de andere twee data wijst op een gebrek aan historisch perspectief.

12. Het aandringen van Veronica op de oprichting van een commercieel net is moeilijk te rijmen met haar ongunstige kijk- en waarderingscijfers.

Jan-Benedict E.M. Steenkamp
Product Quality: An Investigation into the Concept and how it is Perceived by Consumers
Wageningen, 18 januari 1989

Product Quality

Promotor: dr.ir. M.T.G. Meulenberg, hoogleraar in de marktkunde en het marktonderzoek

PRODUCT QUALITY

An Investigation into the Concept and how it is Perceived by Consumers

Jan-Benedict E.M. Steenkamp

Proefschrift

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To Yvonne

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CONTENTS

1. INTRODUCTION

The issue of product quality has come to the forefront in Europe and the United States. The strategic importance of product quality is acknowledged at the macro level as well as at the micro level in Western societies.

At the macro level, product quality has been identified as a key variable in determining 'national' competitiveness (i.e., competitiveness of a nation as a whole, as distinct from the competitiveness of individual firms). To mention a few examples, Naisbitt (1982) in his book *Megatrends* attributes the decline of American competitiveness to high quality of foreign products and the relative lack of emphasis on quality by U.S. firms and managers. Naisbitt's opinion is shared by scholars such as Leonard and Sasser (1982), Garvin (1983, 1984b), and Takeuchi and Quelch (1983), and by many business people and politicians (*Harvard Business Review* 1987). Kennedy (1987) in his book *The Rise and Fall of the Great Powers* identifies the strong commitment to quality as one of the major causes of the 'Japanese miracle'. He predicts that the economic power of Japan will increase further in the next decades, and expects that high product quality will continue to be a major underlying cause of this trend. The competitive strength of the Federal Republic of Germany has also been traced to the quality of its products (Limprecht and Hayes 1982). A recent report of the Dutch Scientific Council on Government Policy has identified product quality as a key factor determining future growth in Dutch exports and GNP (WRR 1987). National quality programs have been developed in such countries as the USA, Belgium, the Netherlands, Sweden, United Kingdom, and France.

At the micro level, product quality has been identified as an important variable for consumers as well as producers. It has been argued that the search for quality is the most important consumer trend of the 1980s (Rabin 1983). Consumers are now demanding higher quality than ever before (Parasuraman et al. 1985), and are willing to pay more for better products (Sloan et al. 1984, Folkers 1986, Steenkamp and Van Trijp 1989a).

In line with the importance consumers attach to product quality, managers today accord quality its place on the list of paramount strategic issues. In many markets, quality competition has supplanted price competition. Regardless of type of industry, size of the company, and type of manufacturing process, quality has become an essential element of competitive strategy (Wolff 1986). Companies are increasingly making adjustments in product designs, manufacturing processes, and marketing strategies to improve product quality. Frequently, improving quality may even determine whether a company survives in the marketplace.

Porter (1980) posits that superior quality is an effective product differentiation strategy to create customer loyalty, to lower price elasticity, and to present

barriers to competition. Peters and Waterman (1982) in their book *In Search of Excellence* identify quality as one of the key variables determining the success of a corporation.

Empirical research has supported the strategic importance of quality to firms. Studies using the PIMS data base (Schoeffler et al. 1974, Buzzell et al. 1975, Buzzell and Wiersema 1981, Phillips et al. 1983, Buzzell and Gale 1986, Gale 1987, Jacobson and Aaker 1987) have shown that product quality positively affects such key variables as market share, selling price, and profitability. The impact of product quality on cost was, in general, found to be insignificant. This implies that high quality and low costs are not necessarily incompatible. These conclusions concerning the relationship between product quality and costs are supported by evidence from research on production management which shows that certain types of manufacturing processes and production management techniques may contribute to both high quality and low costs (Crosby 1979, Abernathy et al. 1981, Shingo 1981, Wheelwright 1981).

Luchs (1986) has summarized the benefits accruing to firms that offer higher quality as follows: stronger consumer loyalty, more repeat purchases, less vulnerability to price competition, ability to command a higher relative price without affecting market share, not necessarily higher costs, and increase in market share.

Given the obvious importance of product quality as strategic marketing variable, one would expect that it has generated considerable research interest in marketing. The opposite appears to be true. Phillips et al. (1983, p. 42) states: 'It is surprising so little attention has been paid to it [i.e., product quality] by marketing scholars. Marketing management texts generally ignore the topic, and only a handful of empirical studies exist'.

One area in which systematic research is especially lacking is the way consumers form perceptions about the quality of a product (Jacoby and Olson 1985). This is unfortunate as it is ultimately the consumer who decides which products to buy and whose decision is largely determined by the way the quality of the products is perceived. How consumers form quality perceptions of products, and how these perceptions influence consumer decisions have become critically important issues to many marketing practitioners. Insight into the consumer's perspective on quality is a vital point of departure for companies to develop a consumer-based quality strategy. This issue is particularly relevant today as evidenced by the studies cited above.

With the above observations in mind, the objectives of the present study are (1) to review the literature on product quality from different perspectives, (2) to develop a theoretical model of the quality perception process, and (3) to investigate the proposed model empirically. In addition, two issues related to product quality are studied. First, attention is given to price-perceived quality tradeoffs. Second, the relationship between price and objective quality is investigated.

This work only considers the quality of *products*. Service quality entails its own problems which are not adressed here (see e.g., Parasuraman et al. 1985). Therefore, the words 'product quality' and 'quality' are used interchangeably in this study. The same goes for 'perceived product quality' and 'perceived quality'.

The study consists of four parts. Part I (Chapters 2 to 5) presents a theoretical investigation into the quality concept. Chapter 2 introduces four different approaches to product quality, and briefly discusses two of these, the metaphysical approach and the production management approach. Chapter 3 reviews the economic approach. The perceived quality approach is reviewed in Chapter 4. In Chapter 5, a model of the quality perception process is proposed and a number of hypotheses are developed.
Part II (Chapters 6 to 9) reports the results of an empirical investigation into the proposed model of the quality perception process. The data collection procedure is described in Chapter 6. The model is estimated in Chapters 7 and 8. The hypotheses are tested in Chapter 9.
Part III (Chapter 10 to 12) explores two issues related to product quality. The results of an empirical investigation into price-perceived quality tradeoffs are reported in Chapters 10 and 11. Chapter 12 studies the relationship between price and quality in the marketplace.
Part IV (Chapter 13) summarizes the main conclusions of the study and gives suggestions for further research.

Part I

A Theoretical Investigation into the Concept of Product Quality and how it is Perceived by Consumers

2. METAPHYSICAL AND PRODUCTION MANAGEMENT APPROACHES TO PRODUCT QUALITY

2.1. A brief introduction to four approaches to product quality

There is considerable controversy in the literature with respect to the meaning and the content of the product quality concept. The main cause of the lack of unanimity is that quality can be and has been studied from many different perspectives. In order to fully understand the concept of product quality, it is important to have insight into the perspective taken by the various authors. Illustrative is the opinion of Cowan (1969, p. ix): 'Quality is a jewel with many facets, and it is important when using the term, to define, explicitly or implicitly, with which facet one is concerned'. In the literature, four major approaches to product quality can be identified, each considering somewhat different facets of the same concept: (1) the metaphysical approach of philosophy, (2) the production management approach, (3) the economic approach, and (4) the behavioral or perceived quality approach of marketing and consumer behavior (Garvin 1984a).

The metaphysical approach focuses on the being of quality. In the production management approach concern is mainly with standardized manufacturing procedures, quality control, and quality costs. The economic approach studies a broad range of quality-related topics from an economic perspective, such as quality competition, market equilibrium when products vary in quality, and consumer behavior with respect to products that differ in objective quality when consumers have complete knowledge of the market and when they are imperfectly informed. The perceived quality approach concentrates on the quality perception process, i.e., on the way consumers form judgments about the quality of a product on the basis of incomplete information. Attention is also given to the influence of personal and situational variables on the quality perception process.

The metaphysical and the production management approaches to quality, at least in some rudimentary form, date back to before Christ. Chinese and Greek philosophers already dwelt upon the meaning of quality. The huge and elaborate structures of Antiquity clearly show that some kind of quality control and standardization in manufacturing procedures must have existed in ancient times. In contrast, the other two approaches are of recent origin. The economic approach emerged only in the 1930s and the perceived quality approach in the late 1960s, although both approaches count some publications of earlier date. The coexistence of these four approaches is largely responsible for the confusion surrounding the concept of product quality. For example, a philosopher and an economist have in mind something quite different when they speak

about quality. In order to fully appreciate what quality is about, it is necessary to have knowledge of all four approaches. In this chapter the metaphysical and the production management approaches are briefly discussed. The next two chapters review the literature on the economic approach and the perceived quality approach. The latter two approaches are discussed more extensively because they are more relevant to the present study and to marketing theory in general. However, it will be shown that all approaches contribute to our understanding of the quality concept.
At the end of Chapter 4, attention will be given to the relationships between the four approaches.

2.2. The metaphysical approach

The word metaphysics is derived from the Greek 'meta ta physika' which means literally 'after the things of nature'. In modern philosophy metaphysics generally refers to questions about 'the kind of things there are and their modes of being'. It is concerned with the study of the things transcending nature (Walsh 1967). Perhaps the simplest definition of metaphysics is: 'metaphysics is the science of knowing' (Ogg 1965, p. 220).
Since ancient times many philosophers (and other people) have held the opinion that quality is on the one hand something absolute and universally recognizable but on the other hand a concept that cannot be defined precisely. For instance, some 2500 years ago, the Chinese philosopher Lao Tzu stated in his work *Tao Te Ching* that: 'The quality that can be defined is not the absolute quality'. The metaphysical approach to quality bears resemblance to Plato's conception of beauty (Garvin 1984a). In his *Symposium*, Plato argued that beauty is one of the 'forms' and, therefore, cannot be defined. Beauty can be understood only through experience. According to the metaphysical approach, the same goes for quality.
Aristotle also held a metaphysical view on quality. In his work *Categoriae*, he developed the metaphysical concept of 'categories'. Categories constitute the highest classes of entities. Quality is one of the categories. It is one of the circumstances that specify the substance further. For instance, in the statement 'the green apple', apple is the substance and green is the quality that specifies this substance further. Quality cannot exist outside the substance. Aristotle distinguished the following four kinds of quality (Pickel 1987):
- states and conditions;
- capacities and incapacities (potencies);
- affective qualities and affections;
- shape, external form, straightness, curvedness, and anything alike.

Aristotle's view on quality was, in general, shared by the scholastics of the Middle Ages. However, they assumed that there also exist hidden qualities ('qualitates occultae'). According to them, observable qualities can be traced to hidden forces and aspects. The assumption of the existence of the 'qualitates occultae' enabled the scholastics to explain ill-understood natural phenomena such as magnetism. The greatest scholastic was Thomas Aquinas, the Doctor Communis (universal teacher). His most famous work is the *Summa Theologica* (1266-1273). His philosophy is classified as a form of 'realism'. It emphasizes

the superior reality of abstractions. The general idea is more 'real' than the particular, e.g. color is more real than this or that particular color. Thomas' philosophy enabled men in the Middle Ages to criticize individual churchmen while believing in the Church as such. Applied to quality this means that while it is sometimes difficult to recognize the quality of specific objects, the reality of the general concept of quality cannot be doubted.

In the 17th century, Descartes pointed out that objects in fact have properties different from those they seem to have; they appear to possess 'secondary qualities' such as color or smell. Boyle and Locke endorsed this distinction between primary qualities (such as extension, figure, motion, and solidity) and secondary qualities (e.g. color, taste, smell, coldness, hotness, sound). Primary qualities are considered to be objective, fundamental, and inseparable from the physical object. Secondary qualities are subjective and derivative. They are nothing more than the power to produce various sensations; they are but signs or events in real objects. Secondary qualities are derived from the human perception of primary qualities. For example, Boyle argued in *The Experimental History of Colours*, published in 1663, that objects give rise to sensations of color, not because they are themselves colored but because the structure of their corpuscles modifies light in a special way. The word 'color' is most properly applied to the modified light that 'strikes upon the organ of sight and so causes that sensation we call colour'. Although we are used to saying that bodies are colored, this can mean no more than that, by virtue of 'a certain disposition of the superficial particles', they are capable of refracting or reflecting light (Passmore 1967). Because secundary qualities are subjective, they cannot be used to characterize an object. Objects can only be characterized by primary qualities.

Primary and secondary qualities are both sensory impressions. In his *Essay Concerning Human Understanding*, published in 1690, Locke claimed that sense impressions are the only material on which the mind can work (e.g., form quality judgments). True knowledge is derived from experience, sensory impressions, and reflection of the mind on these impressions. Locke held that experience and observation are the sources of truth. Innate ideas, or inevitable dispositions of the human mind to think in certain ways, are rejected altogether. What a person comes to think or believe depends on the environment.

Locke's rejection of innate ideas has been criticized because it ignores all that man potentially or subconsciously knows. Moreover, knowledge derived from the senses does not necessarily exclude innate ideas. For example, the early nineteenth century philosophers Coleridge and Blake argued that Locke's hypothesis cannot explain inspiration and poetry (Ogg 1965).

In time, Locke's total rejection of innate ideas was becoming less acceptable to philosophers. A major contribution to this development was Kant's *Kritik der reinen Vernunft*, published in 1781. Kant held the opinion that the mind is only able to act on data provided by the senses because it is already endowed with intuitions of space and time, prior to sense experience. This is a return to innate ideas because, according to Kant, the mind is already endowed with 'ideas' (Ogg 1965).

It appears that quality received less attention in philosophy in the 19th and 20th century. This might at least partially be caused by the decline of importance of

metaphysics in philosophy. New streams of thought emerged such as positivism (Comte), agnosticism (Spencer, Haeckel), and logical positivism (Russell, Whitehead, Wittgenstein in his earlier work). These approaches have a 'scientific' outlook in common (Palmer and Colton 1983)[1]. Emphasis was on verifiable facts, avoidance of wishful thinking, questioning of all assumptions, and dislike of unprovable generalizations. Logical positivism, for example, approaches philosophy through empirical science, mathematics, and symbolic logic. Another major development concentrates on linguistic analysis. Wittgenstein in his later work rejected the mathematical formulations of logical positivism. He argued that the problems of philosophy need not be similar to those of science. Philosophers should explore language and the ambiguities of language. Some researchers have adopted Wittgenstein's linguistic approach and explored the meaning of quality in terms of everyday use of the word (see Section 4.1).

Recently the metaphysical approach to quality has received a major impetus by Pirsig's (1974) seminal work *Zen and the Art of Motorcycle Maintenance*. Pirsig described the quest of Phaedrus ('Phaedrus', meaning 'wolf', is the title of one of Plato's books) for the answer to the question: 'What is quality?'. The following quotation is typical of Phaedrus' search for the meaning of quality:

'Quality ... you know what it is, yet you don't know what it is. But that's self-contradictory. But some things *are* better than others, that is, they have more quality. But when you try to say what quality is, apart from the things that have it, it all goes *poof*! There's nothing to talk about. But if you can't say what Quality is, how do you know what it is, or how do you know that it even exists? If no one knows what it is, then for all practical purposes it doesn't exist at all. But for all practical purposes it really *does* exist. What else are the grades based on? Why else would people pay fortunes for some things and throw others in the trash pile? Obviously some things are better than others .. but what's the 'betterness'? ... So round and round you go, spinning mental wheels and nowhere finding anyplace to get traction. What the hell is Quality? What *is* it? ' (Pirsig 1974, p. 184).

Phaedrus proved the existence of quality through a philosophical approach called realism. This approach holds that a thing exists if a world without it cannot function normally. His aim was to show that a world without quality functions abnormally, and consequently, quality exists, whether it can be defined or not. Phaedrus substracted quality from a description of the world as we know it and the results were convincing. He showed that the world can function without quality, but life would be so dull as to be not worth living: sports, poetry, arts, etc. would disappear (e.g., there is no need for symphonies when scratches from the record sound just as good), variety in the maketplace would be severely reduced (for example, since quality of flavor would be meaningless, stores would only carry basic grains), and so on.

It is interesting to note that in Pirsig's book, the word quality starts with a capital, as can also be seen in the above citation. Quality is regarded as something universal and sacred. The end of his book clearly underlines Pirsig's metaphysical view on quality. Phaedrus never discovered the meaning of qual-

[1] Comte saw human history as a series of three stages, the theological, the metaphysical, and the scientific stage. According to him, human history was about to enter the scientific stage (1850) after the excesses of metaphysical abstractions in the French Revolutions of 1789 and 1848. The scientific trend in philosophy as embodied by positivism coincided with similar trends in literature and arts (called 'realism'), religion ('skepticism'), and politics ('real politik').

ity. The metaphysical complexities of this issue drove him mad before he could find an answer to the question.
As will be clear from the brief review of the metaphysical literature, there is not one uniform metaphysical approach to quality. However, it can be concluded that many authors hold the opinion that quality is synonymous with innate excellence (Garvin 1984a). It is a mark of uncompromising standards and high achievement. A case in point is Barbara Tuchman (1980, p.38) who regarded quality as 'a condition of excellence implying fine quality as distinct from poor quality .... Quality is achieving or reaching for the highest standard as against being satisfied with the sloppy or fraudulent'. Further, she 'unhesitatingly' opts for the view that 'quality is something inherent in a given work'. The metaphysical approach regards quality as a unanalyzable property that an individual can learn to recognize only through experience. People differ about quality not because quality is different but because people are different in terms of experience.
The metaphysical approach has had a profound influence on the thinking about quality. Often quality is considered to be an elusive concept (a recent example in the marketing literature is Parasuraman et al. 1985). Many people hold the opinion that the measurement and analysis of concepts such as beliefs, attitude, preference, etc. present problems that are negligible compared to the problems encountered when one investigates quality. While this may be partially true, a strong metaphysical orientation hinders research on quality.

2.3. The production management approach

Quality parameters
In contradistinction to the metaphysical approach, the production management approach does not regard quality as something unanalyzable. On the contrary, quality is seen as an objectively measurable concept that can be described in technical specifications. In this approach quality is usually defined as 'conformance to technical specifications' (e.g., Garrett and Silver 1973, Juran 1974b, Crosby 1979, Luchs 1986). The better the product conforms to its prescribed specifications, the better its quality is. Any deviation implies a reduction in quality.
Product quality is achieved and maintained by four basic interrelated quality-determining parameters: quality of design, quality of production, continuity of service, and customer service after sale (Juran and Gryna 1970, Juran 1974a). Because of the importance of these parameters for the development of a quality policy by companies, each of them will be discussed in some detail.
Basically, quality of design refers to the determination of the quality level (or 'grade') the product must possess. Another term for quality of design is the well-known 'degree of excellence'. Quality of design pertains to three activities (Juran 1974a): (1) identification of what the consumer means by quality and identification of the consumer's quality needs, (2) development of a product concept that meets these needs of the consumer, and (3) translation of this concept into a detailed set of specifications which, if the product fulfills these specifications, will meet the consumer's needs. Quality of design is crucial to the marketing success of the product. If the wrong quality level is chosen, the

product might fail in the marketplace. Besides, no matter how much effort is expended on the other quality parameters, the quality level of the product cannot be raised above the inherent design specifications. At best, quality can be kept at that level (Landers 1963). It is also important to realize that the extent to which other quality activities, such as rework and maintenance, have to be carried out are heavily influenced by the quality of design. Generally speaking, a well thought-out product design will lower total quality costs (see below).

An important tool to achieve quality of design is reliability engineering. It involves (1) constructing designs from their basic parts, (2) determining the failure probabilities of each system and subsystem, and (3) trying to strengthen the weak links in the chain by product redesign or by incorporating more reliable components (Garvin 1983).

The second quality-determining parameter is the quality of production.[2] Once the design specifications for a product are defined, the production process should be organized in such a way that the product samples meet the design specifications. Quality of production refers to all activities undertaken to meet the design specifications during the production process. Due to all kinds of causes (variation in input materials, operator fatigue, wear and tear of tools, etc.), not every product sample will conform exactly to all specifications. Most product specifications therefore include tolerances, i.e., acceptable deviations from a specification. The tolerances must be determined such that the unit cost of production is minimized, i.e., the sum of the production system costs and the costs associated with rejects (Garrett and Silver 1973). In some situations it can be more economical to accept a high level of rejects than to redesign the production system.[3]

Quality of production is controlled in essentially two ways. The first is the final inspection to make sure that, on the average, no more than a predetermined maximum level of defects will leave the factory. The final inspection is usually carried out by acceptance sampling. The two basic types of acceptance sampling are (1) attribute sampling, which is simply a categorization of the product as acceptable or unacceptable, and (2) variable sampling, which requires detailed measurement of characteristics instead of a simple acceptable-unacceptable categorization. For details on these techniques, see Wiesen (1974) and Schilling (1974).

The second method of controlling quality of production is the direct control of the production process itself. This method permits adjustments to be made before defects occur. Production process control is often implemented by statistical control charts (for details, see Bicking and Gryna 1974).

In the production management approach, quality of design and quality of production constitute the relevant quality-building parameters for nondurable products (Juran 1974a). For durable products two additional parameters are important: continuity of service and customer service after sale.

[2] Other terms are quality of conformance, manufacturing quality, and quality of product (Juran 1974a).

[3] This view on quality is held by many American authors but is rejected in the Japanese philosophy on production management (see below).

Continuity of service refers to the situation that the product is in an operative state, i.e., that the product can be used (almost) immediately. It is determined to a large extent by the quality of design. The two most important factors influencing continuity of service are (Juran 1974a): (1) reliability (i.e., the probability that it will function successfully, when required, for a specified period of time under a prescribed operating environment), and (2) maintainability (i.e., ease of maintenance). Especially product reliability has received much attention. It is usually measured by the mean time between failures (MTBF) or its reciprocal, the product failure rate (FR). In general, reliability calculations are based on historical data (for details, see Smith 1969).
Customer service after sale is often regarded as the fourth quality-determining variable (Juran 1974a, Takeuchi and Quelch 1983). It includes speed, competence, and integrity of the after sales service.

Quality costs
A company that strives for maintaining a certain quality level will incur quality costs. These costs can be categorized into (Lundvall and Juran 1974, Feigenbaum 1983):

- prevention costs, which are incurred to keep failure and appraisal costs to a minimum, e.g., employee training, quality reporting and improvement projects;
- appraisal costs, or the costs incurred in measuring a firm's output against quality specifications. These include inspection and testing costs;
- internal failure costs, caused by products that do not meet the quality specifications. These include scrap, rework and spoilage;
- external failure costs, caused by defective products reaching the customer, including warranty charges, complaint adjustments, and loss of goodwill and future sales.[4]

The distribution of total quality costs over these cost categories is to some extent company- and industry-specific. However, on the average, 60-70 percent of the quality costs involve internal and external failure costs, 25-35 percent are appraisal costs, and only 5 percent are prevention activities (Garrett and Silver 1973, Veen 1982). It has frequently been pointed out (e.g., Garrett and Silver 1973, Lundvall and Juran 1974, Crosby 1979, Veen 1982, Feigenbaum 1983, Garvin 1983) that an increase in prevention costs to about 10-15% of the total quality costs both reduces total quality costs and increases the quality of the output. This has given rise to the notion 'quality is free' (Crosby 1979).
Most quality control programs aim at minimizing total quality costs, not at minimizing the number of defects. It is frequently stated that very few or no defects are not economical because such 'perfectionism' would cause the cost of preventing defects to exceed the cost of having the defects (e.g., Garrett and Silver 1973, Lindvall and Juran 1974, Riggs 1981). For example, Garrett and Silver (1973, p. 647) stated: 'A firm can generally earn a greater profit by allowing the shipment of a certain minimum level of defects than by striving for the elimination of all defects'. This 'classic' view on the defects issue is being

[4] Loss of goodwill and loss of future sales due to product failures are usually not considered. They should be included because, especially in the long run, these costs can be substantial.

increasingly contested, especially by the Japanese (Juran 1978, Ross and Shetty 1985). The Japanese philosophy with respect to the acceptable number of defects is clearly formulated in Gibney (1982, p. 158):

'The Japanese believe that quality is good and better quality is therefore better than lesser quality. They will go beyond any sort of rational trade-off to achieve this. For example, if you analyze the percentage defects in a process and the costs of making that percentage less, you will very often find that it makes sense to go from five percent defects to one percent defects. If you then ask whether it makes sense to go from one percent defects to 1/10 of a percent defects, the economics will generally say, 'No, that does not make sense'. And the American firm will not, therefore, take that step. The Japanese firm will. If you say to them, 'That's silly. It makes no economic sense,' they will answer, 'We don't care. Better quality is better than poorer quality.' Once they get to 1/10 of one percent, they will go to 1/100 or 1/1000 of one percent. Then they will look at you with a disarming smile and say, 'That's what makes us such fierce competitors. You may be satisfied with one percent defects, but we are not.'

At first sight, the Japanese philosophy seems uneconomical. However, if the loss of goodwill and future sales are taken into account (see above), this need not be the case. Given the success of Japanese firms on the export markets it can indeed be economical to strive for zero defects and it seems that this opinion is gaining ground in other countries as well (Takeuchi and Quelch 1983, Ross and Shetty 1985, Wolff 1986).

3. THE ECONOMIC APPROACH TO PRODUCT QUALITY

3.1. The Chamberlinian revolution: Product differentation in economic theory

Economic theory has long ignored the concept of quality (Abbott 1955). The product is assumed to be given and homogeneous (i.e., of uniform quality). Consumers select the bundle of goods which maximizes utility subject to the budget constraint. Consumers are assumed to be fully informed about the market and to act rationally. Consumers maximize their utility if they spend their income on different products in such a way that the marginal utility they derive from spending a dollar on any one product is equal to the marginal utility they get from spending a dollar on any other product. Or stated another way, they adjust their purchases of products so that the ratio of the products' marginal utilities will be equal to the ratio of their prices.

With respect to the supply side of the market, economists have long concentrated on models of pure price equilibrium in which the product is homogeneous and its price is adjusted by the firm in order to maximize profit. In a purely competitive market, the firm will maximize short-run profits at that output where price equals marginal cost. Long-run equilibrium is established at the output where price equals marginal cost *and* unit cost. At this output, the unit cost function is at a minimum.

In pure monopoly, equilibrium price exceeds marginal cost, and this situation may persist over time. Compared with perfect competition, the monopolist sells less and at a higher price. The perfectly competitive market is the 'ideal state' for economists since it is Pareto optimal (Wonnacott and Wonnacott 1979).[1]

In the 1930s, it became evident that the main forms of market structure are not the purely competitive market and monopoly, but oligopoly and monopolistic competition which allow for sellers of *differentiated* products (Chamberlin 1946, Robinson 1933, White 1936, Triffin 1940).[2] Many firms try to strengthen their position in the market not through price competition but through product competition by creating differentiated products that appeal to different buyer segments. Chamberlin was among the first economists to recognize the importance of product differentiation for the analysis of economic activities.[3] In his

[1] Pareto optimal refers to the situation that no rearrangement in the market is possible that leaves someone better off without worsening the position of others. In a Pareto optimal market equilibrium, the marginal utility for all consumers is equal to the marginal cost for all procedures.

[2] The first edition of Chamberlin's book *The Theory of Monopolistic Competition* was published in 1933. The fifth edition published in 1946 is used here.

[3] Early writers on this subject are Clark (1918a, b), Sraffa (1926), and Hotelling (1929). For instance, Clark (1918a, p.16) pointed out that: 'there is so wide a field in which a difference between the goods offered by the different makers is one of the essential features of the competitive struggle that this is really the typical case rather than the exception'. The breakthrough, however, came only in the 1930s with *The Theory of Monopolistic Competition* (Schneider 1967).

classic work *The Theory of Monopolistic Competition* he stated: 'It is evident that virtually all products are differentiated, at least slightly, and that over a wide range of economic activity differentiation is of considerable importance' (Chamberlin 1946, p. 57). He argued that a general class of products is differentiated if any significant basis exists for distinguishing the goods or services of one seller from those of another. Such a basis may be real or fancied, so long as it leads to a preference of one brand of the product over another. Where such differentiation exists, even though it may be slight, buyers will be paired by sellers, not by chance, as under pure competition, but according to their preferences.

Chamberlin used the word 'product' in a broad sense to include its *quality* (materials, ingredients, mechanical construction, design, durability, etc.), its packaging, service and location aspects of the seller, and any other factor having significance to the buyer. Product differentiation might be based on any of these factors. Chamberlin devoted most attention, however, to quality as a basis for product differentiation. In this way the concept of quality was introduced in economic theory.

In his book and in his influential article *The product as an economic variable* published in 1953, Chamberlin developed a number of ideas that were further elaborated by others and are still relevant. He pointed out that, instead of the traditional variables price and quantity, four variables play a part in the competition between firms: price, quantity, product, and advertising. These four variables were considered to be mutually dependent. Chamberlin's theory thus gives explicit recognition to three of marketing's four P's, product, price, and promotion, and implicitly acknowledges the role of the fourth, place, since place is included in his concept of product.

Further, he recognized that it is probable that many buyers possess imperfect product knowledge: 'It is relatively easy for the buyer to know the *price* of a product; but as to its *qualities* and their significance to him, perfect ignorance would often be a better assumption than perfect knowledge' (Chamberlin 1953, p. 4). He pointed out that imperfect knowledge about the quality of the product could have effects on the product's elasticity of demand. The extent to which people can observe product changes will influence the way they react to those changes. The imperfect knowledge of consumers provides a market for consumer agencies such as the Consumer Union. He held the opinion that there is a positive correlation between product quality and product price: 'People will naturally recognize that the lower price will be accompanied by poorer quality and their response to it will be diminished; it may even be negative'(Chamberlin, 1953, p. 6).

The implications of this 'Chamberlinian revolution' in microeconomic theory (Gill 1973, p. 541) are numerous. For example, how do firms compete on quality? Under what market conditions do quality differences tend to increase or decrease? What causes producers to alter quality? What is the influence of buyers on quality determination? What is the optimum quality for a firm? How can product heterogeneity be integrated into the economic theory of consumer behavior? What are the implications for economic theory on quality if it is recognized that most consumers are imperfectly informed about product quality? These and other questions will be adressed in this chapter. It will be shown

that economic theory enhances our understanding of the role quality plays in the marketplace.

3.2. Quality as a competitive weapon of the firm

A large part of the economic literature on quality has been devoted to the role quality can play as a competitive weapon of firms. Competition can be defined as (Abbott 1955, p. 108):

'A contest – or, more usually, a succession of contests – in which independent sellers enter products of their own choosing, at prices of their own choosing, for appraisal and purchase by independent buyers, the products being substitutes for each other in the sense of being alternative means to the attainment of some activity or experience, the buyers being free to select or reject any bargain offered and to make their own offers of terms, and all participants being guided in their decisions by their own conceptions of their best interest.'

Abbott (1955) distinguished two ideal types of competition: pure price competition and pure quality competition.[4] Pure price competition denotes the traditional situation, described in all economic textbooks, of a market situation in which competing sellers offer products whose quality is uniform and unchanging. Competition is only based on price. Some commodity markets approximate the pure price competition model.
A market situation in which the price of all competing goods is uniform and fixed, and the resulting competition is based only on quality is called pure quality competition. In markets characterized by price rigidity, e.g., because the prices are regulated, pure quality competition can be approximated. The newspaper market (at least in the Netherlands) provides such an example.
This section reviews economic models on quality competition. At the end of the section: (1) the strengths and weaknesses of the different models are discussed, and (2) the relationships between the models are highlighted.

Chamberlin
Chamberlin (1946) has proposed a model of pure quality competition in which quality differences are monopolistic, each producer's position is impregnable, and the cost and demand functions of every possible product the producer might select are fully known to him. In his model quality changes affect cost of production as well as market demand. Chamberlin developed the equilibrium situation for the individual firm and for a group of firms. He showed that in individual equilibrium the most profitable product is not necessarily the one that minimizes unit costs or the one for which the demand is greatest. He also developed a model in which both price and quality are variable. This model is very rudimentary and qualitative. Price and quality decisions are assumed to be taken independently of each other. The graphic representation of this comprehensive equilibrium shows little more than the equilibrium under pure price competition (Chamberlin 1946, pp. 98-99).

[4] Other kinds of competition such as advertising competition can be distinguished as well. Given the scope of this study, the attention is focused on quality as a competitive weapon of the firm. See Comanor and Wilson (1979) for a review of the economic literature on advertising and competition.

Abbott

Abbott (1953, 1955) recognized that pure quality competition is difficult to analyze because it can take many different forms. To structure this problem he distinguished three types of quality variation: vertical, horizontal, and innovational.

Vertical quality variation refers to different grades of quality (that can be labeled as 'lower' and 'higher', 'superior' or 'inferior', and so on). Two special characteristics of vertical quality variation are: the 'superior' of any two qualities is preferred by virtually all buyers, and it entails higher costs. Vertical differences in quality consist of real differences in some desired attribute. Examples are the number of hours of light of an electric bulb, fuel consumption of a car, vitamin content of vegetables, etc. According to Abbott, vertical quality variation can never be excessive for the consumer. (Note that, for many product aspects, this is not realistic. Frequently, consumers prefer a certain amount of an attribute above more or less of that attribute.)

Horizontal quality variation refers to qualitative attributes (such as style, design, taste) that do not involve any appreciable differences in costs. These attributes simply have different appeal to various groups of buyers. Differences in horizontal quality cannot be described by words such as 'better' and 'worse' but by words such as 'more suitable' or 'more appealing'. Such a statement is only meaningful in reference to a particular buyer since the evaluation of horizontal quality variation is idiosyncratic. Koutsoyiannis (1982) provides the following examples of horizontal quality variation: neckties (of the same vertical quality grade but with different colors), records (of the same vertical quality grade but with different kinds of music), and shoes (of the same vertical quality grade but with different height of heels).

Innovational quality variation refers to the introduction of a new quality which is considered superior to the existing quality grades by most or all buyers, regardless of the additional (if any) cost involved, e.g., the introduction of pneumatic tires. The existing range of quality grades eventually becomes obsolete.

Abbott (1953, p. 829) admitted that actual quality changes are often a combination of more than one type of quality variation. For example, the development of a new brand of margarine that contains more polyunsaturated fatty acids and has a novel taste is a hybrid of vertical and horizontal quality change. However, Abbott and other economists have tended to ignore these hybrid changes and have concentrated on one kind of quality variation because hybrid changes raise enormous analytical difficulties (Koutsoyiannis 1982).

Abbott has developed separate models for pure horizontal quality competition and for pure vertical quality competition. These models will be discussed in some detail because of their impact on thinking about quality in economic theory (Kawlath 1969, Koutsoyiannis 1982).[5]

Underlying Abbott's approach are a number of assumptions, retained in all his models, to keep the analysis manageable: (1) each firm offers only one variety of the product, (2) each firm can offer any variety, (3) quality is a continuous variable, (4) all buyers act rationally and have perfect knowledge, (5) buyers'

[5] See Koutsoyiannis (1982) for an extensive introduction to Abbott's work.

preferences and demand functions remain constant, (6) technology is given, (7) firms have identical cost structures, average cost varying with rate of output and with vertical quality, but not with horizontal changes in quality, (8) average cost curves are U-shaped, (9) there is no collusion between firms, (10) firms have perfect knowledge of the market, (11) innovational quality changes do not occur, (12) within each quality grade, the preferences of the buyers are evenly distributed.

Abbott's model of horizontal quality competition examines how firms reach equilibrium by adjusting the variety of their product *within* a given (vertical) quality grade and given a fixed market price. The product is horizontally variable in only one dimension. It is assumed that the possible varieties can be ranked along the dimension considered. For example, apple varieties can be ranked from sourest to sweetest. Buyers' preferences are distributed evenly along the horizontal quality scale.[6] Each buyer purchases exclusively the variety that lies closest to his/her ideal variety on the (horizontal) quality scale, but the number of units demanded decreases as the difference between this variety and the buyer's optimum is larger. Abbott assumed that the demand function is given by:

$$(3.1) \quad q = m\,(1 - d/z)$$

where

- q = number of units of the variety demanded by buyers located at the same position on the quality axis;
- m = maximum number of units demanded, that is, the quantity that would be bought if the variety were considered ideal by those buyers;
- d = difference between the actual and the ideal variety;
- z = difference between the actual and the ideal variety at which demand drops to zero (if $d = z$, then $q = 0$).

Note that equation (3.1) is actually an aggregation of the individual demand functions of those buyers that have the same ideal variety. This is possible because it is assumed that z and the maximum number of units demanded per buyer (and, consequently, m, under the assumption of evenly distributed preferences) are equal for all buyers in the market.

Figure 3.1 shows an example of Abbott's demand function for the sweetness of apples.

In the absence of competitors, the salable output of a firm producing apple variety X is shown by the area ABC. If there are rivals and if firms seek to maximize profits, Abbott showed that short-run equilibrium is achieved when the varieties are 'equidistant' in quality (as measured on the horizontal scale). All firms have equal market shares. If firms earn abnormal profits (price > average cost), new firms will enter the market up to the point where only

[6] If the assumption of evenly distributed preferences is abandoned the equilibrium market situation is not so clear-cut (Abbott 1955, p. 149). Firms may or may not have the same market share, depending on the particular distribution of preferences. However, competition will be strongest in those regions of the quality scale where buyers' preferences are concentrated. See also Steiner (1952).

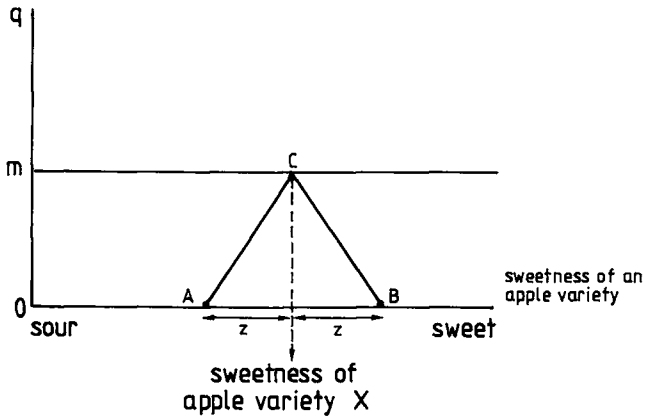

Figure 3.1. Demand function in Abbott's model of horizontal quality competition for buyers located at the same position on the sweetness dimension.
Based on: Koutsoyiannis (1982)

normal profits are earned (price = average cost). In the long-run equilibrium market situation, each firm has the same market share and the products are 'equidistant' in horizontal quality.

The model of horizontal quality competition can be modified by assuming that firms aggressively seek to increase their market share, instead of profit maximization, by eliminating smaller competitors. In this model, it is assumed that frequent horizontal quality changes increase the minimum optimal scale of production.[7] Further, it is assumed that firms have unequal market shares. Aggressive larger firms can drive smaller rivals out of the market by frequent product changes that increase the minimum optimal scale of production up to the point that smaller rivals cannot cover their unit costs anymore (given the market price). Menge (1962) has argued that the annual style changes (i.e., horizontal quality competition) of automobiles in the USA by the 'Big Three' (General Motors, Ford, Chrysler) has resulted in the elimination of smaller firms.

Abbott has also developed a model of pure vertical quality competition. In this model it is assumed that horizontal equilibrium has already been reached (Abbott 1955, p. 152). Price is fixed and does not vary with the quality grade offered. Vertical quality differentiation is restricted to a single dimension. Consumer demand is an increasing function of quality (given the fixed market price). The goal of the firm is profit maximization. The problem of the firm is to select the quality grade that, given the market price, will maximize its profit. To solve this problem, Abbott introduced two new curves (the average cost option curve and the marginal cost option curve) and developed a number of diagrams to derive equilibria under vertical quality differentiation. It would take us too far to present Abbott's analysis in detail. Only his main conclusions are presented here.

[7] The minimum optimal scale of production is the level of output at which all known economies of scale are exhausted.

Abbott showed that in short-run equilibrium, and given the model's assumptions, all firms have the same market share and offer products of the same quality level but in a different variety (horizontal differentiation). Firms earn abnormal profits and thus attract the entry of new firms. This process continues until abnormal profits have disappeared. In the long-run equilibrium, product variety has increased because more firms compete with each other. However, under the assumption that the size of the market remains constant or at least does not increase proportionally with the entry of new firms, vertical quality competition leads to a decrease in the output of each firm and hence to unexhausted economies of scale.

The model of vertical quality competition can be modified by assuming that firms seek to maximize sales subject to the condition that they never sell below unit cost. In this situation equilibrium is achieved by producing a quality grade that is higher than the quality grade obtained under the profit maximization assumption because sales maximization can only be obtained by improving the quality grade of the product. Sales are higher and profits lower. Buyers are better off because they can obtain a product of higher quality at the same price.

An even more interesting model can be developed if the assumption that firms are unwilling to accept temporary losses for the sake of growth is dropped. In the model of aggressive sales maximization, firms seek to maximize their sales by aggressive quality improvement. It is assumed that, initially, unit costs of the higher quality grade are not covered by the price because demand falls short. Losses are incurred and the financially weaker firms are driven out of the market. In long-run equilibrium, the number of firms is smaller (as compared with the models of profit and sales maximization), and each firm will earn normal profits on an increased level of output of a higher quality. However, less varieties are offered on the market. Thus, buyers must choose from fewer varieties of higher quality. Further quality improvement to increase sales is no longer possible because price is equal to the minimum possible unit cost.

In Abbott's models of vertical quality competition it was assumed that the price is fixed, regardless of the quality. Subsequent research has relaxed this assumption. In these studies the effect of a price increase on quality in regulated industries was investigated. It was concluded that the effect is positive, i.e. price increase will lead to quality improvement (White 1972, Levhari and Peles 1973, Douglas and Miller 1974, DeVany 1975, Anderson and Enomoto 1986). The relevance of this finding is clearly stated by Douglas and Miller (1974, p. 657). Douglas and Miller argued that, while quality is nearly impossible to control by regulators directly, it can indirectly be controlled through price. The conclusion that an increase in the regulated price will lead to quality improvement is consistent with Abbott's model of vertical quality competition if all other variables of his model are held constant.

Dorfman and Steiner

Dorfman and Steiner (1954) developed a general equilibrium model of the firm with respect to sales volume, price, quality, and advertising. Quality was defined as 'any aspect of a product, including the services' (p. 831). Quality improvement refers to any change in quality which shifts the demand curve to the right and raises the curve of average variable cost. Thus, Dorfman and

Steiner are concerned with vertical quality differentiation. They assumed that the relationship between the quantity the firm can sell per unit of time q, its price p, its quality index x, and its advertising budget s is given by:

(3.2) $q = q(p, x, s)$

The unit variable cost of production c is a function of q and x:

(3.3) $c = c(q, x)$

Note that advertising is treated as fixed costs. The functions q and c are assumed to be continuous and differentiable. The goal of the firm is to maximize its profit. Dorfman and Steiner proved that, under these conditions, the firm is maximizing its profit if the parameters price, advertising, and product quality are set at such levels that the price elasticity of demand e_p, the marginal revenue product of advertising MRP_A, and the quality elasticity times price over unit cost e_x p/c, are equal.[8] This is the well known Dorfman-Steiner theorem. In formula:

(3.4) $e_p = MRP_A = e_x\, p/c$

The general level of quality in a market tends to be higher the greater the sensitivity of consumers to quality variation, the lower the sensitivity of consumers to price variation, and the lower the effect of quality changes on average costs.[9] This conforms to one's intuitive feeling about the market situation.

Brems

In his article of 1948, Brems (p. 418) defined quality as 'the multitude of physical and chemical properties which characterize the product'. He recognized that quality per se is not easily measurable but solved this problem by measuring quality indirectly through costs. His model deals with quantitative as well as qualitative dimensions of quality (and selling effort). Brems postulated that, due to existing technology, quality dimensions (and, to a lesser extent, selling effort dimensions) are highly interdependent. According to him, models assuming that each quality dimension can be independently optimized lack realism. To solve the problem of interdependence between quality (and selling effort) dimensions he developed a new type of marginal cost function. Each point on this function represents, for a certain output, the minimum marginal cost of quality improvement and/or selling effort, on a single dimension or on several dimensions simultaneously, that is required to sell one additional unit of product. Such marginal cost functions are developed for a number of prices. To develop the functions, numerous alternative acts of quality improvement and increase in sales effort must be evaluated to determine the alternative that has minimum marginal cost. Under the assumption of profit maximization, the

[8] The quality elasticity of demand is the ratio between the percentage change in demand and the percentage change in average variable cost, both induced by a small change in quality. See for details Dorfman and Steiner (1954) or Lilien and Kotler (1983).

[9] This follows directly from equation (3.4). See Dorfman and Steiner (1954).

optimal quality (and selling effort) for each dimension, and the optimal price and output can be determined. Thus, a general equilibrium of the firm is established. His approach, however, is not very convincing. In practice, it is almost inconceivable that a firm is able to determine Brems's marginal cost curves.

A more promising approach is presented by Brems in his article of 1957. As in his previous model of 1948, quality is regarded as a multidimensional concept. He developed a model of optimal quality and optimal price choice that is completely quantifiable and relatively easy to operationalize. To achieve this, he introduced Leontief's input coefficients a_i in the theory of quality. a_i refers to the number of physical units of the product of industry i (including labor) used per unit of product by the firm in question. Brems (1957, p. 106) defined quality and selling effort 'as a complete specification of the production and distribution process of the product in question', i.e., quality and selling effort are completely specified by a_i's.[10]

Brems made the following assumptions with respect to a_i: (1) a_i refers to physical units, (2) a_i is independent of the number of physical units of the product, q, produced and sold annually by the firm[11], and (3) the a_i's can be varied independently. With the third assumption he avoided the problems encountered in his model of 1948.

Other important parameters in his model are:

q = number of physical units of the product produced and sold annually by the firm;
c = cost (in dollars) incurred annually by the firm;
z = profit (in dollars) earned annually by the firm;
y_i = price of the input used from industry i (i = 1,.....,m), a parameter;
p = price of the output produced by the firm.

Brems's model consists of three equations. The demand equation is:

$$(3.5) \quad q = q(p, a_1, \ldots\ldots, a_m)$$

which says that the demand for the product depends on its price, and on its quality and selling effort as expressed by the input coefficients.

The cost equation is given by:

$$(3.6) \quad c = q \sum_{i=1}^{m} y_i a_i$$

where $\sum_{i=1}^{m} y_i a_i$ denotes unit cost.

Profit is equal to revenue minus cost:

[10] Selling effort is also regarded as multidimensional, e.g., television advertising, radio advertising, billboards, etc.

[11] This assumption is very important because it allows Brems to use a_i as a representation of quality and sales effort. If this Leontiefian assumption is not adopted it is not possible to determine whether a change in a_i is caused by a change in level of output or by a change in quality or selling effort.

(3.7) $z = pq - c$

The demand and cost functions are assumed to be continuous and differentiable.
Brems showed that a profit-maximizing firm should improve its quality and intensify its selling effort along each of the m dimensions until the ratio between the price of an input and the marginal 'productivity' of the corresponding input coefficient is the same for all m inputs.[12] In formula:

(3.8) $$y_1 \Big/ \frac{\partial q}{\partial a_1} = y_2 \Big/ \frac{\partial q}{\partial a_2} = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots = y_m \Big/ \frac{\partial q}{\partial a_m}$$

Brems also developed the condition for general equilibrium of the firm with respect to price, quality, selling effort, and sales volume. The firm is in equilibrium if the sum of the price elasticity of demand e, and the quality and sales effort elasticity of demand H, is equal to -1. In formula:

(3.9) $e + H = -1$

H is the sum of the separate elasticities of demand faced by the firm with respect to each a_i. In other words, if all a_i's are increased by the same small percentage, H is the ratio between the percentage change in q and the percentage change in all a_i's.[13]

Leland
In Leland's (1977) model, attention is focused on the welfare implications of firms' quality decisions. He considered the conditions that are necessary in order that firms' quality decisions are Pareto optimal. Product quality is simply defined as the amount of each characteristic provided per unit of the product. Consumers may differ in their evaluation of quality changes. It is assumed that consumers only agree that quality is improved when a quality change is realized by increasing the amount of all characteristics per unit of product. The amount of a characteristic consumed by an individual i depends on the bundle of the goods bought and consumed, and on the quality of those goods. Consumers select the bundle of goods that maximizes utility subject to the budget constraint.
Leland showed that two properties, spanning and competitive implicit characteristics prices, are sufficient to satisfy the necessary conditions of Pareto optimality of the quality choices of the firms.[14] Spanning refers to changes in patterns of characteristics consumed. The spanning property says that any small change in characteristics effected by quality change can also be effected by some

[12] As pointed out by Brems, the similarity to production theory, in which the competitive firm maximizes its profit if the ratios between prices of factors of production and their respective marginal products are equal, is evident.
[13] H is derived from equation (3.8). See Brems (1957, pp. 108-110). It suffices to say here that in equilibrium, equation (3.8) is also satisfied.
[14] See Koutsoyiannis (1979) for details on the conditions of Pareto optimality.

portfolio change of the goods consumed (Leland 1977, pp. 131-132). Leland showed that if the spanning property is met, all consumers have the same willingness to pay for a small change in the quality of the product in question. The assumption of competitive implicit characteristics prices guarantees that, in equilibrium, profit-maximizing firms will have the same tradeoff between price change and quality change as consumers have.[15]
If both properties are satisfied an intriguing result is obtained. It is then possible for the manager (in his/her role as consumer) to use his/her own willingness to pay for quality changes to determine the optimal quality of the product. If the market is competitive this quality choice will maximize the firm's profit, and is also Pareto optimal.

Leffler
Leffler's model (1982) has a more limited scope. A product contains only two attributes: a priced quantity attribute X and an unpriced quality attribute Z. At given prices for all other goods consumers are assumed to prefer the same combination of X and Z. Product quality is defined by the amount of Z per unit of X. This means that Leffler considered only one quality dimension of the product.[16] For instance, the quality of strawberry jam could refer to the amount of strawberries (Z) per unit of weight (X). Thus, higher quality is unambiguously defined whereas in Leland's model it depends upon the consumer in question (because Leland considered more than one quality attribute). This allowed Leffler to investigate the quality level offered by firms. Leffler showed that in a perfectly competitive market, competition will force firms to make Pareto-optimal quality decisions. The result is that in equilibrium firms will offer higher quality than the quality level most profitable to the firm. He also investigated the effects of monopoly, price controls, quantity constraints, and excise taxes on quality choices of the firm. No definite conclusions could be drawn. The resulting quality level depends on the shape of the different curves such as the total cost function.

Conclusions
In this section, a number of economic models on quality as a competitive weapon of the firm are reviewed. Chamberlin was the first economist to develop a model of quality competition. A limitation of Chamberlin's model is that his group equilibrium is indeterminate. It is not possible to define the exact point of equilibrium. A second limitation is that the concept of 'group' poses some difficulties. In Chamberlin's model, a group consists of firms producing differentiated but very similar products, and having high price and cross-elasticities. This definition leads to conceptual and empirical difficulties (Triffin 1940). For instance, how high should the price and cross-elasticities be before

[15] An implicit price of a characteristic is the implicit price per unit of characteristic. The price of a good equals the sum of its characteristics weighted according to their implicit prices. These prices must be competitive in the sense that a firm perceives the characteristics prices as parameters and not as entities that can be influenced by its decisions.
[16] Another interesting model of one-dimensional quality choice by firms is presented by DeVany and Saving (1983). In their model quality is inversely related to the wait required to obtain the product in question. More specifically, quality is the reciproque of the expected waiting cost.

one can consider a firm as belonging to the group? Chamberlin's model of quality competition did not have the impact his model of price competition had because it is not fully developed and is tedious to work with (Koutsoyiannis 1982).

A more promising approach has been developed by Abbott. Abbott's models not only deal with the classic economic assumption of profit maximization but also with sales maximization. The latter assumption is often more typical of the behavior of firms than the former one. Abbott's models give insight into the way quality is used in the competition between firms in markets where prices are regulated. The effects of aggressive horizontal and vertical quality competition can be analyzed.

The main limitation of Abbott's approach (as with most economic models) lies in its assumptions. Quality is varied only along a single dimension which limits its applicability to real world situations where products usually differ from each other on several quality dimensions. Many quality changes have some innovational element, an aspect not considered in his models. Buyers often do not have perfect knowledge of the products, and frequently do not behave rationally. Firms can compete on other aspects than product quality. For instance, advertising can be used to support, or even as a substitute for, quality competition (an early reference is Buchanan 1942; see Comanor and Wilson 1979 for a review of the literature on advertising as a competitive weapon).

One of the points of criticism levied against Abbott's model has been that quality is the only competitive variable studied. In this respect, Abbott's models have been extended by Dorfman and Steiner. They showed that Abbott's model of vertical quality competition (fixed price, fixed advertising budget) is a specific case of their approach. A drawback of the Dorfman-Steiner model is that it is difficult to operationalize. How should a firm adjust the quality index of a product to maximize its profit (and how should it be measured)? Further, it is a model for optimizing the behavior of the individual firm. Reactions of rivals are not considered. Dorfman and Steiner also assumed that advertising and product quality are independent decision variables which can be optimized separately. This assumption has been contested in the economic literature, particularly when the demand side of the market is also taken into account (see Section 3.5.4). The generality of the formulation of the Dorfman-Steiner approach has the disadvantage that it becomes more difficult to analyze the effects of quality changes, excessive quality competition, the entry of firms, etc. It should also be noted that horizontal quality competition is not included in the Dorfman-Steiner theorem. Finally, quality is regarded as a one-dimensional concept (Dorfman and Steiner used a quality index)[17], whereas many authors have noted that it is based on a number of quality characteristics (e.g., Chamberlin 1953).

Brems has developed a model that treats quality as a multidimensional concept. To his opinion, approaches treating quality as a one-dimensional concept, such as the Dorfman-Steiner model, are of limited value because the firm must know exactly how far to go in each quality dimension. In principle, his model allows the researcher to determine the optimal quality level for each dimension within

[17] Abbott also reduced quality variation to one dimension (see above).

the framework of the general equilibrium of the firm in quantifiable terms. In this respect, he extended the analyses of Chamberlin, Abbott, and Dorfman and Steiner. A limitation of his approach is that the quality of the product is measured by input coefficients. This operationalization of quality is only tenable under the assumption of efficient production. Otherwise, a company that wastes more materials and labor has a better product! The Leontiefian assumption that a_i is independent of level of output is also not realistic. The model is ill-equipped to cope with the substitution of materials (for example, using plastic instead of steel), the services rendered by capital goods (but see Brems 1968), and the quality of an input coefficient (e.g., using recycled steel instead of new steel in cars). The model disregards the behavior of competitive firms and horizontal quality variation.

Leland and Leffler extended previous approaches by taking the demand side of the market more fully into account. They adopted the Lancastrian assumption that goods themselves do not provide utility, but rather provide basic characteristics which consumers value (see Section 3.3.2). The characteristics are assumed to be physically measurable.

The main weakness of Leland's model is the Lancastrian assumption that all quality attributes are objectively measurable. If sensory and psychological attributes are also of importance to consumers in evaluating quality, it is unlikely that Pareto optimality is achieved. (See for more detailed criticism on Lancaster's assumptions Section 3.3.2.) Even if the Lancastrian assumption of objectively measurable attributes is retained, the properties of spanning and/or competitive implicit prices will often not be satisfied.[18] Spanning is only possible if there is a sufficiently large number of differentiated product alternatives available on the market. Further, it is likely that in oligopolistic and monopolistic markets firms do not regard implicit characteristics prices as parameters but as variables that can be influenced by advertising, selective distribution, etc. Leffler's model suffers from many limitations characteristic of other one-dimensional quality models.

In sum, quality equilibrium models show that quality competition performs essentially the same functions to the firm as price competition, a point often ignored in economic analyses. The main problem of the economic models dealing with quality as a strategic competitive weapon of the firm is that the assumptions are frequently unrealistic. Koutsoyiannis (1982, p. 50) correctly stated that much work remains to be done before definite conclusions can be drawn regarding the effects of quality variations on market conduct and performance. Work along the lines of Abbott's models seems especially promising. Vertical and horizontal quality variation must be combined and integrated with other competitive variables such as price, advertising, and selling effort. Ideally, innovational quality variation should also be taken into account, but this will prove to be very difficult. In these integrated models, attention should also be given to 'managerialist' variants, such as sales/market share maximization, to enhance the realism of the model.

[18] In principle it is possible to achieve Pareto optimality without spanning. In that case the manager cannot use his/her own marginal valuation of quality changes but should use individuals' implicit prices weighted according to their share of the total consumption of the good in question. Leland admitted, however, that this is easier said than done because individuals' implicit prices are in general unobservable.

3.3. Quality and the demand side of the market

The most influential economic models of consumer choice that take quality into account are the Houthakker-Theil model and Lancaster's model (Hanemann 1982). Both models view the product as a bundle of characteristics. Since Lancaster's model is the most comprehensive economic model of multiattribute consumer choice behavior (Ratchford 1975), this section is mainly devoted to his approach. Prior to the discussion of Lancaster's model, the older Houthakker-Theil model will be briefly reviewed.

3.3.1. The Houthakker-Theil model

Houthakker (1952) and Theil (1952) were among the first economists who explicitly dealt with the effects of quality on consumer choices. They addressed the problem of the optimal distribution of the consumer's income across different generic goods and their qualities, in other words, they analyzed the interdependent decisions: (1) how much to spend on each generic good, and (2) which qualities to buy.[19]

In their approach the quantities of the generic goods purchased as well as their qualities are arguments in the utility function. The quality of a generic good i ($i = 1,\ldots\ldots,n$) is assumed to be completely described by means of a vector $b_i = (b_{i1},\ldots\ldots,b_{im})$ where b_{ij} denotes the amount of characteristic j per unit of good i. The characteristics may be quantitative or qualitative. However, because of the difficulties incurred if qualitative characteristics are included, the model is usually specified in terms of quantitative characteristics.

It is assumed that there is a continuous spectrum of qualities for each generic good. A consumer chooses only one quality (i.e., product) of each generic good. The consumer maximizes utility subject to the budget restriction. Thus, the consumer's problem may be stated as:

$$(3.10) \quad \max U(x_1,\ldots\ldots,x_n, b_1,\ldots\ldots,b_n)$$

subject to:

$$(3.11) \quad y = \sum_{i=1}^{n} x_i\, p_i(b_i)$$

where y is the consumer's income, x_i is the quantity bought of generic good i, b_i is the vector of its characteristics per unit of quantity (i.e., b_i is the quality vector), and $p_i(b_i)$ is the unit price of the generic good as a function of its vector of characteristics.[20]

[19] See Hanemann (1982) for a more extensive introduction to the Houthakker-Theil model.

[20] Houthakker (1952) assumed a linear relationship between the price of a brand and its characteristics. The linear price-characteristics specification is also used in hedonic studies. In fact, as pointed out by Hanemann (1982), the Houthakker-Theil model has stimulated application of the hedonic approach although important differences exist between the two approaches (e.g., hedonic theory also takes the supply side of the market into account, and concentrates on consumer choices with respect to a single commodity). See Section 3.4 for a detailed discussion of the hedonic approach.

First-order conditions for utility maximization were derived by Theil (1952). Stated briefly, utility is maximized if consumers distribute their income over the generic goods and qualities so that: (1) the marginal utility of x_i is proportional to its price p_i, and (2) the marginal utility of a characteristic b_{ij} of the vector b_i is proportional to the corresponding quantity x_i times the partial derivative of the price p_i with respect to b_{ij} (Theil 1952, p. 132).[21]

3.3.2. The Lancaster model

The model

Lancaster's (1966a, b, 1971) point of departure is that consumers do not value goods for their own sake but because of the utility-bearing characteristics they possess. He postulated that:

'The interest of consumers is in characteristics, not in goods per se. Thus the individual consumer has preferences, in the first instance, over the set of characteristics collections. Any preferences concerning collections of goods are derived preferences, a particular goods collection being preferred over another only because the collection of characteristics associated with the former is preferred to the collection of characteristics associated with the latter.' (Lancaster 1971, p. 20).

Lancaster noted that many goods possess more than one characteristic, many characteristics can be produced by more than one good, and goods may be used in combination to yield characteristics (e.g., a frozen meal and a microwave oven can be used to produce vitamins, proteins, etc.).

The relation between goods and characteristics is specified by the consumption technology matrix B. The relationship is:

$$(3.12) \quad z = Bx$$

where z is the (r x 1) vector of characteristics, x is the (n x 1) vector of goods, and B is an (r x n) matrix which transforms the n goods into r characteristics. An element of matrix B, b_{ij}, shows the amount of a certain characteristic z_i that is delivered by one unit of good x_j.

An important aspect of Lancaster's model is that the characteristics (or qualities, see Lancaster 1971, Nicosia 1974) are defined as 'those objectively measurable, technical properties of goods that are relevant to consumer choice' (Lancaster 1971, pp. 114-115). All differences in perceptions are assumed to be captured in the individual preference functions. B is identical for all consumers.

Lancaster's approach allows one to define the economic concept of generic goods in terms of characteristics. Products belong to the same generic good if: (1) they produce a common set of characteristics and no other ones, and (2) no characteristics in the common set of characteristics is possessed by any other good.[22] If these conditions are satisfied, the generic good is said to be fully

[21] These conditions only apply if all characteristics are quantifiable.

[22] See Nicosia (1974) for the public policy implications of the Lancaster conceptualization of generic goods. Archibald and Rosenbluth (1975) applied Lancaster's definition to the theory of monopolistic competition. As was already noted in paragraph 3.2, a major problem in the theory of monopolistic competition is the concept of 'group'. Which goods/firms belong to the same group? Archibald and Rosenbluth showed that Lancaster's conceptualization of generic goods presents a clear solution to this problem.

separable from other goods. The choice between products in this group is then independent of the choice between products in any other group. Lancaster (1971, pp. 132-139) showed that for practical purposes it is sufficient to approximate full separability. This means that a generic group can also be analyzed separately if only a small portion of the characteristics of the generic good in question is provided by the other goods and vice versa.
The consumer is assumed to maximize utility derived from the characteristics, subject to the budget restriction. x and z are assumed to be non-negative and each characteristic has a non-negative marginal utility. Thus, the consumer's choice problem can be formulated as:

(3.13) $\max U(z)$

subject to:
(3.14) $p'x \leq K$
with:
(3.12) $z = Bx$
(3.15) $x,z \geq 0$

where U(z) is an ordinal utility function for characteristics, p is the (n x 1) vector of prices of products, K is the consumer's budget, and B, x, and z are defined in equation (3.12).

Optimization
The consumer choice problem is solved in two steps, both rich in analytical detail. First, the efficiency frontier is constructed. The efficiency frontier gives the maximum combinations of characteristics that can be obtained from a given budget. The efficiency frontier is independent of consumer preferences. A utility-maximizing consumer will only choose between the products (i.e., bundles of characteristics) situated on the efficiency frontier because (combinations of) these efficient products completely dominate the products inside the efficiency frontier. This implies that there is a maximum price at which a product can sell, independent of consumer preferences. If the product is very expensive, it is located inside the efficiency frontier and, thus, will never be chosen. In the second step, the consumer chooses according to his/her preferences for different combinations of characteristics, which of the efficient bundles of characteristics s/he will buy. S/he chooses the bundle of characteristics (and hence the product or combination of products) at the point of the efficiency frontier where his/her indifference curve is tangent to the efficiency frontier.
It is possible to buy fractional amounts of products. Therefore, Lancaster's model mainly applies to goods that are available in highly divisible units. Most of these highly divisible goods are frequently purchased consumer nondurables such as foods.
In Lancaster's model quality is simply defined as the amount of characteristics per unit of a product.[23] Quality change is a change in the amount of character-

[23] In principle, this definition does not make sense if the product is infinitely divisible because in that case the concept 'unit of a product' has little meaning. This problem can be solved by using the same

istics provided per unit of the product (Lancaster 1971). Horizontal quality change denotes the situation in which the amount of some characteristics is increased and the content of other characteristics is decreased. (Note that Lancaster's definition of horizontal quality change differs from the one used by Abbott, cf. Section 3.2; however, in both cases the effect of horizontal quality change on consumer preferences is uncertain.) If the amount of some characteristics is increased or decreased and the amount of the other characteristics is kept constant, one can speak of vertical quality change (cf. Abbott 1955; see also Lancaster 1966b, 1979).
Lancaster's model allows the analysis of the effects of horizontal and vertical quality changes of a product, and of price changes on consumer choices (see, for instance, Steenkamp and Van Trijp 1988a).

Limitations
The Lancaster model suffers from a number of limitations. It is possible that some characteristics have negative marginal utilities. The consumption technology relating goods to characteristics may not be linear. Utility may depend on the distribution of characteristics among products (i.e., it could matter to the consumer whether the characteristics are produced by product A or product B). These issues have been addressed by Lancaster (1971), Hendler (1975), Lucas (1975), Ladd and Zober (1977), and Ratchford (1979).
The first problem can be solved to a large extent by rescaling negative characteristics (Lancaster 1971, pp. 94-98, Hendler 1975, Ratchford 1979).
Nonlinearity in consumption technology has been considered by Lancaster for the case of discrete characteristics (Lancaster 1971, pp. 107-110). The linearity assumption seems only appropriate if products are divisible and can be consumed in any quantities (e.g., Lancaster 1979, Ratchford 1979).
Lancaster's analysis breaks down if utility depends on the distribution of characteristics among products because it is assumed that the consumer only values characteristics. The identity of the products is of no importance. In fact, the utility function has been called '... the weakest aspect of Lancaster's consumer theory' (Lucas 1975, p. 178). The utility functions of Houthakker-Theil and Rosen (see Section 3.4) are more general. However, this generality is achieved at the cost of assuming a continuum of product alternatives within each commodity, a continuum of consumers, and by assuming that each consumer chooses only one product alternative within a commodity (Lucas 1975).
Another limitation of the Lancaster model is that it is formulated in objectively measurable characteristics. Consumers are assumed to value only these objective characteristics. Sociopsychological aspects, which sometimes have no direct relationship with the physical characteristics, are not taken into account. However, they can be of considerable importance to consumers (e.g., Hauser and Simmie 1981, Wierenga 1984, Steenkamp 1987a). Apart from the sociopsychological aspects, some other characteristics are not objectively measurable either. A case in point is the characteristic taste. Taste is a very

unit of measurement for the different products of the generic good. For instance, this procedure is followed in the official tables of the Dutch Consumer Food Education Bureau. In these tables the different foods and beverages are made comparable by specifying the characteristic content per 100 grams of the product.

important quality characteristic of foods (e.g., Wierenga 1984, Bonner and Nelson 1985, Steenkamp 1987a). Deleting such a variable from analyses because it cannot be objectively measured greatly limits the applicability of the Lancaster model.[24]
The assumption that consumers are perfectly informed about the characteristics content of products is unrealistic. Consumers' perceptions often differ from reality (see Section 3.5). Lancaster does not deny the existence of perceptions but he confounds perceptions with preferences (see above).
Further, the model, like most microeconomic models, is deterministic. The consumer will, ceteris paribus, always choose the same product(s). For many goods (especially for foods and beverages) this is an unlikely situation. Variety-seeking behavior plays an important role in consumer behavior (McAlister and Pessemier 1982). This has been shown very convincingly within the framework of Lancaster's model by Wierenga (1984). He has investigated consumer choices with respect to fresh vegetables empirically, and concluded that 'it is clear that variety seeking is much more important than the utility obtained from the characteristics' (Wierenga 1984, p. 290).

3.4. The hedonic approach

The hedonic approach has a more or less unique place in economic theory on quality because it originates in empirical research (Waugh 1928, Court 1939). Since the studies of Waugh and Court numerous empirical hedonic studies have analyzed quality in relation to price in areas such as automobiles (Dhrymes 1967, Triplett 1969, Griliches 1971, Cowlin and Cubbin 1971, Hogarty 1975, Ohta and Griliches 1975, 1986, Agarwal and Ratchford 1980), housing (King 1975, Witte et al. 1979, McMillan et al. 1980, Kristensen 1984), other consumer durables (Dhrymes 1967, Gavett 1967), services (Goldman and Grossman 1978), and industrial goods (Fettig 1963, Chow 1967, Cowling and Rayner 1970, Kravis and Lipsey 1971).
In the hedonic approach, quality is simply defined as the vector of the total amount of objectively measurable characteristics possessed by a given brand (Dhrymes 1967, Griliches 1971, Kristensen 1984). Basically the hedonic approach consists of fitting a regression relationship on cross-sections of brands or models of the form:

$$(3.16) \quad p_j = p(z_{1j},\ldots\ldots,z_{nj})$$

where p_j is the price of the j-th brand and $z_{1j},\ldots\ldots,z_{nj}$ are amounts of objectively measurable characteristics 1,.....,n contained in the j-th brand. The regression coefficients provide information about the consumer's marginal valuation of quality improvement of a brand with respect to each individual characteristic

[24] It could be argued that instead of taste, the physicochemical properties that create a sensory sensation should be included in the model. Lancaster (1971, pp. 114-115) argues in this spirit. However, this can hardly be considered as a realistic solution to the problem because little is known about the relationships between physicochemical properties and sensory sensations for complex products (cf. Steenkamp and Van Trijp 1988a,c). The same argument goes for sociopsychological aspects (e.g., Hauser and Simmie 1981, Holbrook and Moore 1981b, Holbrook et al. 1985).

(see also below). This basic approach can be extended in a number of ways, for instance by combining cross-sections for several years or by adding manufacturer dummy variables.
Rosen (1974) developed a theoretical model of competitive equilibrium that provides an explanation for the relationship between prices and characteristics as given in equation (3.16). Rosen considers a class of goods that is described by n characteristics. The characteristics are assumed to be objectively measured and positively valued by consumers.
Brands in the class are completely described by numerical values of $z_1,\ldots\ldots,z_n$ and offer consumers distinct packages of characteristics. The good is assumed to be indivisible (one cannot buy fractional amounts of any particular brand). A critical assumption in his model is that the choice between combinations of characteristics is continuous, i.e., alternative brands of a good are available for a continuous range of characteristics. This assumption allowed Rosen to frame the consumer's and producer's problems directly in terms of characteristics of the good without reference to alternative brands.
Each brand has a market price and can be defined by a fixed value of the characteristics vector z. This means that the structure of prices and characteristics in the market implicitly reveals a function $p(z) = p(z_1,\ldots\ldots,z_n)$. This function relates prices and characteristics, and is the equivalent of the hedonic price regression function (Rosen 1974, p. 37). It is assumed that producers and consumers treat p(z) as a parameter in their optimizing decisions.

The consumption decision
The consumer is assumed to be rational and fully informed. S/he purchases only one unit of the good at a time. The consumer wants to maximize the total utility derived from the good in question and all other goods subject to the budget limitation. The consumer's maximization problem may be stated as:

(3.17) $\max U(x, z_1,\ldots\ldots,z_n)$

subject to:

(3.18) $y = x + p(z_1,\ldots\ldots,z_n)$

where $U(x, z_1,\ldots\ldots,z_n)$ is the consumer's utility function, $p(z_1,\ldots\ldots,z_n)$ is the market price of each alternative bundle of characteristics of the good in question, x is the aggregate of all other goods consumed measured in dollars, and y is the consumer's income. The price of x is set at one dollar and y is measured in units of x.
Maximization of utility, subject to the budget constraint, requires that the consumer purchases that brand for which the ratios between the marginal utilities of any pair of characteristics are equal to the ratios between their marginal prices. The marginal prices define the additional amount the consumer has to pay for an additional unit of the characteristic in question. In formula:

(3.19) $$\frac{\partial U}{\partial z_i} \Big/ \frac{\partial U}{\partial z_j} = \frac{\partial p(z)}{\partial z_i} \Big/ \frac{\partial p(z)}{\partial z_j}$$

Based on equations (3.17) and (3.18), Rosen developed bid functions. A bid function, θ, shows the price the consumer is willing to pay for alternative bundles of characteristics, or brands, at a given level of utility and income:

$$(3.20) \quad \theta = \theta(z_1,.....,z_n, U, y)$$

The bid function resembles an indifference curve. All the bundles of characteristics lying on a given bid function provide the same utility. The bid function is assumed to increase with an increase in any characteristic, but at a decreasing rate.[25]

The production decision

It is assumed that there are no production indivisibilities and that marginal costs of producing more units of a given characteristics bundle are positive and increasing. Marginal costs of quality improvement are positive and nondecreasing with respect to each characteristic. Firms maximize their profits. The firm's maximization problem may be stated as:

$$(3.21) \quad \max \pi = Mp(z_1,.....,z_n) - C(M, z_1,.....,z_n)$$

where π is profit, M is number of units produced of characteristics bundle $z_1,.....,z_n$, and $C(M, z_1,.....,z_n)$ is total costs. To maximize profits, each firm has to choose M and $(z_1,.....,z_n)$ optimally. Firms can have different cost structure characteristics, denoted by the vector β, because of differences in factor prices and technology, among other things.

Optimal production is obtained if price equals marginal cost, evaluated at the optimum bundle of characteristics. The optimum bundle of characteristics is chosen by the producer in such a way that the marginal price of each characteristic is equal to the unit cost of incorporating a marginal amount of that characteristic into the good (Agarwal and Ratchford 1980). Based on equation (3.21), Rosen developed offer functions. An offer function, ϕ, indicates the price the firm is willing to accept for alternative bundles of characteristics at a given level of profit when quantities produced of each bundle are optimally chosen:

$$(3.22) \quad \phi = \phi(z_1,.....,z_n, \pi, \beta)$$

The firm is indifferent between the alternative bundles of characteristics lying on the same offer function because they all generate the same profit. The offer function is assumed to be progressively increasing with an increase in the amount of characteristics offered.[26]

Market equilibrium

The simultaneous and independent decisions of consumers and producers about which quality (i.e., which characteristics bundles) to buy and to sell

[25] See Rosen (1974, p. 38) for mathematical specifications of the first- and second-order conditions.
[26] See for details Rosen (1974, pp. 41-43).

determine an equilibrium value of the hedonic relation between prices and characteristics, i.e., between prices and quality. Equilibrium requires that the value of an additional unit of a characteristic to the consumer is equal to its marginal price, which, in turn, must be equal to the marginal cost to the producer of providing an additional unit of this characteristic (Agarwal and Ratchford 1980). Because of diversity in consumer utility functions and producer cost conditions, more than one equilibrium can exist in the market. The hedonic function $p(z_1,.....,z_n)$ traces out the occurrence of these multiple equilibria and is obtained by connecting the tangencies of the different offer and bid functions. In this, hedonic theory extends traditional economic theory in which only one offer function and one bid function are assumed. In traditional economics, equilibrium results in one market price instead of the price function of the hedonic approach.

Equilibrium in the Rosen model is graphically illustrated in Figure 3.2 for a good which contains only one characteristic. This allows a two-dimensional graph. The bid functions θ_1 and θ_2 represent the highest attainable utility level for consumers 1 and 2, given their utility functions and income. These consumers would like to get more quality for the same price but this is not possible, given current market conditions Producers are not willing to provide more characteristics at that price, given their cost structures. The offer functions (ϕ) are plotted for two producers, corresponding to their highest attainable profit level, given their cost structures. They cannot provide fewer units of z at the hedonic price in question, given current market conditions.

As stated above, market equilibrium is obtained by the tangency of the offer and bid functions. Producer 1 (2) produces brand B_1 (B_2) at quality level z(1) (z(2)) and sells it to consumer 1 (2). Their production and consumption choices correspond to the equality of marginal quality valuations, marginal prices, and marginal quality costs described above.

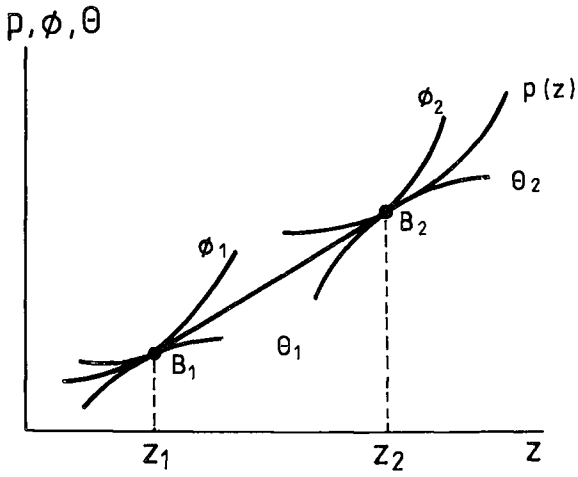

Figure 3.2. Market equilibrium in the Rosen model for a good containing one characteristic.

Source: Rosen (1974)

There is no theoretical guidance as to the choice of the proper hedonic functional form (Rosen 1974, Kristensen 1984). The linear, semi-log and double-log specifications are the most popular forms (e.g., Triplett 1969, Griliches 1971, Goodman 1978). Researchers have recently started to investigate the hedonic functional form systematically, using a general statistical methodology, the Box-Cox methodology, which covers numerous functional forms (Goodman 1978, Bender et al. 1980, Palmquist 1980, Halvorsen and Pollakowski 1981, Kristensen 1984). This methodology offers great promise for future studies based on the hedonic approach. At this moment, however, the empirical results are contradictory so that no conclusions can be drawn concerning the relationship between price and quality except that it is often nonlinear.

An important analytical concept in hedonic theory is the concept of implicit price (e.g., Triplett 1975). Implicit prices show the value consumers and producers implicitly attach to marginal amounts of individual quality characteristics of a product. The implicit price of a characteristic i can be derived from the first-order partial derivative of the hedonic function with respect to that characteristic i: $\partial p(z)/\partial z_i$. If the hedonic function is linear, the regression coefficient b_i of characteristic i directly represents the implicit price. In the case of nonlinear functions such as semi-log and double-log specifications, the implicit price is dependent upon the actual quality purchased.

It is important to recognize that, in general, the hedonic function does not provide information about a consumer's overall evaluation of various levels of product quality. It only shows the marginal valuations of quality improvement of the brand actually bought. This means that the hedonic price cannot be used as a one-dimensional index of quality. An exception is when consumers have homogeneous preferences. Then the common bid function is identical with the hedonic price function (Rosen 1974). Consumers are indifferent about their choice among brands lying on the hedonic function. Price differences between the brands directly reflect quality differences and the hedonic price can be used as an index of quality. Thus, the hedonic approach is especially attractive with respect to the analysis of product quality if consumers are reasonably homogeneous in their preferences.

In many respects, Rosen's model closely resembles Lancaster's model. However, some important differences are apparent. Lancaster focuses on consumer behavior whereas Rosen is more concerned with market equilibrium. Lancaster assumes divisibility of products whereas in Rosen's model the products are indivisible. This makes Lancaster's model better applicable to frequently purchased nondurable goods and Rosen's model to infrequently purchased durables. Further, in Lancaster's model, owing to the divisibility assumption, the hedonic price function $p(z_1,\ldots\ldots,z_n)$ is linear and the efficiency frontier can be represented in terms of characteristics per dollar. Rosen needs a separate price dimension and must define characteristics of goods in terms of their absolute rather than dollar levels. (See Ratchford (1975, 1979) for a more detailed comparison of the models of Lancaster and Rosen.)

Limitations

The hedonic approach suffers from some limitations that restrict its usefulness for studying the role quality plays in the marketplace. The underlying assump-

tions are very stringent. For example, markets often are not perfectly competitive, consumers may differ in their perceptions of products, and many attributes are not objectively measurable (e.g., design, taste). Violations of these assumptions may weaken the core concept of the hedonic approach, i.e., price and quality are closely related (see also Chapter 12).
A main focus of the hedonic approach is the consumer's marginal valuation of quality improvement. Thus, quality is confounded with value. Further, the hedonic price function, if evaluated at the actual characteristics bundle purchased, only reflects the consumer's marginal valuation of the various quality characteristics. In many cases, however, the main point of interest is the overall evaluation of products of different quality. The hedonic approach also requires that the number of brands significantly exceeds the number of product characteristics. Otherwise, regression coeficients will be unstable due to the small number of degrees of freedom.

3.5. Quality and the imperfectly informed consumer

3.5.1. Introduction

The traditional economic theory of consumer choice, including the models reviewed above, assumes that consumers possess perfect knowledge of their environment, including all different products, their qualities and their prices. Under this assumption there is no need to study consumer information acquisition. In the past decades, however, this assumption has been increasingly criticized as being unrealistic. A large volume of empirical research has shown that the consumer is imperfectly informed. Consumer knowledge of prices is often modest (Shamir 1985), and small differences in prices are often not perceived (Monroe 1971, 1973, Müller 1981). Consumers not only do not possess perfect knowledge of prices but also are imperfectly informed about the quality characteristics of the product. For example, Wierenga (1984) found that perceived vitamin C content is better predicted by true vitamin A content than by true vitamin C content and that perceived carbohydrate content is better predicted by true protein content than by true carbohydrate content. Steenkamp and Meulenberg (1986) reported that butter is perceived to be much fatter than margarine. In another study, it was found that 45% of the respondents think that whole milk contains over 10% fat (Fallows and Gosden 1985).
Quality information about products is often not used by consumers as is evidenced by studies concerning nutritional information (Asam and Bucklin 1973, Lenahan et al. 1973, Daly 1976, Jacoby et al. 1977b, Rudell 1979), quality grading (Miller et al. 1976), energy labels (McNeill and Wilkie 1979, Anderson and Claxton 1982), open dating (Day 1976), furniture labels (Julander 1978), unit pricing (Kilbourne 1974, Day 1976), and truth in lending (Day and Brandt 1974).
Consumers can even receive too much information about products. Too much information can result in information overload so that consumers become confused and make poorer decisions (Jacoby et al. 1974a, b, Jacoby 1975, Scammon 1977, Malhotra 1982, Berndt 1984).[27]
In short, consumers must solve their problems of choice within the limitations

of available information, cognitive skills, memory capacity, and time.
Scitovsky, Chamberlin, and Simon were among the first economists to recognize that consumers are usually imperfectly informed about prices and quality.[28] Scitovsky (1945, p. 100) stated:

'The average consumer of today has become a layman not only when it comes to buying a motorcar or a wireless set but also with respect to prime necessities and household implements. Few of us can appraise the qualities of an electric iron or of toothpaste, and the frequent introduction of new models and improvements prevents us from relying an experience. Since the discovery of vitamins we dare not rely entirely on our palate even for judging the quality of food.'

Chamberlin (1953) discussed the 'highly realistic assumption of imperfect knowledge' (p. 4). Simon (1955, 1957) developed the concept of a choosing man of limited knowledge and information processing capacity. An individual can only conduct rational behavior 'that is compatible with the access to information and the computational capacities that are actually possessed by organisms, including man' (Simon 1955, p. 99).
Subsequently, the interest in economic theory for the imperfectly informed consumer has increased rapidly. Below, this large body of literature is reviewed to an extent considered relevant to the present study.

3.5.2. Search and experience as quality information acquisition strategies

Stigler
In 1961 the influential article of Stigler, *The economics of information*, was published. Stigler developed an economic model of the behavior of an imperfectly informed consumer interested in purchasing a homogeneous good. Stigler does not deal with quality. However, his model provided the basis for other models of search behavior that did include quality (e.g., Nelson 1970, 1974).
Stigler assumed that the product is offered in different stores at different prices. The consumer is assumed to know the distribution of the prices but not the particular price at each store. The aim of the consumer is to buy at the lowest price s/he knows of. The more stores are visited by the consumer, the lower will be the expected minimum price. However, the marginal decrease in expected minimum price decreases with the number of stores visited. Since search activities also involve cost, the consumer limits the number of stores s/he visits. Stigler argued that the consumer will visit an a priori fixed number of stores and then buy from the store with the lowest price. The optimum number of stores is determined by the cost-benefit rule that the consumer will keep on visiting stores until the marginal expected cost of search activity becomes greater than its marginal expected return.

[27] The empirical procedures employed by Jacoby and his associates have been criticized by Russo (1974), Summers (1974), Wilkie (1974), Malhotra et al. (1982), and by Jacoby himself (Jacoby 1975, Jacoby et al. 1975). However, agreement exists with respect to the notion that consumers can be overloaded (Jacoby 1984, Malhotra 1984).
[28] Early references are Mitchell (1912) and Clark (1918a, b). At that time, however, the notion that consumers are not fully informed had little impact.

Since consumers attach different values to the costs of, and returns from, sales, some buyers will become more informed about the prices than others. The existence of less informed consumers allows some sellers to charge higher prices, and this results in a dispersion of prices.
Stigler's model has been revised in a number of ways. McCall (1965, 1970), for instance, showed that a sequential decision rule is better in terms of expected total costs than a fixed sample size rule. However, his basic idea that consumers trade off costs and benefits of information search is still valid (cf., Goldman and Johansson 1978, Urbany 1986). This is incorporated in integral consumer models such as the ones developed by Bettman (1979) and Engel et al. (1986).

Nelson
Nelson (1970) extended Stigler's economics of information approach by considering consumer acquisition of information on quality as well as prices. He made the following observation: 'Not only do consumers lack full information about the prices of goods, but their information is probably even poorer about the quality variation of products simply because the latter information is more difficult to obtain' (Nelson 1970, p. 311).[29]
The problem for the consumer is to evaluate the utility of each product alternative or brand. Nelson distinguished two methods for evaluating the utility of a brand: search and experience. Search refers to the actual inspection of the brand prior to purchase to evaluate its utility. A person can search for quality as well as price. For many products, however, search is not possible or too expensive. It is often much easier to buy and consume a couple of brands and determine subsequently which brand provides the highest utility. Such an evaluation procedure is quite sensible for goods such as cheap prepackaged foods. Nelson called this method of evaluating the utility of a good 'experience'. The consumer will acquire information through search or experience, whichever entails lower costs. Nelson categorized goods as either search goods or experience goods depending on which method is preferred by consumers.
According to Nelson, the Stigler-McCall approach can be used in case of search goods, but it is not appropriate for experience goods. Nelson developed a new approach for understanding consumer behavior with respect to experience goods. He assumed that (p. 313): 'consumer either sample at random from among all brands or from among those brands in the price range the consumer deems appropriate for himself'. Further, it is assumed that after buying and consuming some brands, the consumer can determine with certainty which brand s/he prefers, and this preference is stable in time. Thus, Nelson studies a static market in which the set of brands is given.
The decision situation facing the consumer in case of experience goods is analagous to the case of search goods. The consumer should purchase different brands until the marginal cost of information acquisition through experience exceeds its marginal return.
The marginal cost of buying another brand is the loss of utility from consuming a

[29] An early reference is Chamberlin (1953, p. 4) who stated: 'It is relatively easy for a buyer to know the *price* of a product; but as to its *qualities* and their significance to him, perfect ignorance would often be a better assumption than perfect knowledge'.

brand selected at random rather than terminating the information search and using the best brand that one has already discovered in the set of (i-1) different brands experienced. In formula:

$$(3.23) \quad MC_i = E(U_{i-1}) - u$$

where MC_i = the expected marginal cost for the i-th sample, $E(U_{i-1})$ = the utility the consumer expects if s/he uses the best brand already available based on (i-1) random samples, u = the expected utility if s/he continues to sample at random (u is the mean of the utility distribution), and $i > 1$.
The marginal return is the difference between the expected present value of the utility of the best of i brands minus this expected value for (i-1) brands. In formula:

$$(3.24) \quad MR_i = [E(U_i) - E(U_{i-1})] \sum_{y=1}^{ft-i+1} \frac{1}{(1+s)^y}$$

where MR_i = the expected marginal return for the i-th sample, f = the number of times per year the product is purchased, t = the number of years over which purchases will occur, and s = the interest rate over the period of one purchase: $s = (1+a)^{1/f}-1$, with a = the annual interest rate.
The consumer will continue sampling brands until marginal cost exceeds marginal return. In formula, after simplifying equation (3.24):

$$(3.25) \quad E(U_{i-1}) - u \leq [E(U_i) - E(U_{i-1})] \frac{1}{s} \left[1 - \frac{(1+s)^i}{(1+s)^{ft+1}}\right]$$

The solution to equation (3.25) depends on the shape of the utility distribution. Nelson showed that the optimal number of samples increases with the frequency of purchase of the product. This conclusion holds regardless of the utility distribution. Further, a consumer samples more brands in case of search goods than in case of experience goods.
An interesting implication of Nelson's approach is that the seemingly 'irrational' brand-switching behavior of some consumers can in fact be a very rational and effective information acquisition strategy. A related implication concerns brand loyalty. It must be expected that in the aggregate market, brand loyalty is the strongest for search goods because there will always be some consumers who are in the information acquisition phase with respect to experience goods.
Another implication is that distribution of free samples can be a very effective way of stimulating the sales of an experience brand. By distributing free samples the producer ensures that his product belongs to the set of brands experienced by the consumer, and this enhances the repeat purchase probability. Such a strategy would presumably be less profitable for search goods. For search goods the sample size is greater and, by definition, the consumer need not consume the product to assess its quality.
Based on his model, Nelson developed a number of testable hypotheses. Within the scope of the present work one of these hypotheses is particularly interesting. This hypothesis concerns the relationship between guided sampling and the

type of good (experience versus search, durable versus nondurable). Nelson noted that his initial assumption that consumers sample at random (i.e., unguided sampling) is often not realistic. Consumers can use recommendations from friends, consumer magazines, advertising, etc. to guide them in sampling products.[30] Nelson argued that guided sampling will not be used if unguided sampling is cheap. Further, unguided sampling tends to be cheaper for search goods than for experience goods. Unguided sampling is also cheaper for nondurables than for durables because the former category of goods are purchased frequently, and the latter category infrequently. Therefore, he hypothesized that there is more guidance for experience goods than for search goods and that there is more guidance for durables than for nondurables.[31]

Nelson tested this hypothesis by investigating how articles published in *Consumer Reports* in the period 1963-1964 were distributed over search and experience goods, and over durables and nondurables. The hypothesis was supported for both product categorizations: there were significantly more articles about experience goods and significantly more articles about durables.

Nelson's approach has been extended by Darby and Karni (1973) who argued that for some goods a consumer cannot even evaluate its quality after consumption. An example could be most services of a doctor. They called this third type of goods 'credence goods'.

Criticism on Nelson

Nelson's approach has been criticized by Wilde (1980a) who noted that Nelson concentrates on products per se and not on the product as a bundle of characteristics.[32] Not many products can be regarded as pure search or pure experience goods. Most products contain search as well as experience characteristics. This is the most clear in the case of experience goods. Price is usually observed before purchase but, by definition, this cannot influence the purchase decision of experience goods. That is the reason why Nelson assumed that consumers either sample at random or from brands within the appropriate price range. This assumption requires the further assumption that consumer either ignore price or already possess information on prices before they start sampling. Wilde (1980a, p. 147) gave the following comment on these assumptions: 'Neither of these assumptions seems justifiable, and certainly they would lead to different kinds of behavior. Moreover, other attributes besides price are generally observed prior to purchase and the same problem arises with them'.

Wilde argued that Nelson's approach should be extended. Information acquisition must be analyzed in relation to search, experience, and credence attributes. This issue has been addressed by Ratchford (1980) and Hey and McKenna (1981), among others.

[30] Price and advertising as forms of guided sampling will be discussed in Sections 3.5.3 and 3.5.4.

[31] Nelson based this hypothesis on a detailed theory of guidance that was not reported in his article because of space limitations.

[32] In his article of 1974, Nelson initially defined search and experience qualities instead of search and experience goods. However, in the continuation of his article, he did not make explicit use of the distinction between qualities and goods and focused mainly on goods instead of characteristics.
In a comment on Wilde's paper, Nelson (1980) acknowledged that Wilde's criticism is justified, but pointed out that his propositions remain intact, even if goods have search as well as experience attributes (for empirical evidence see Nelson 1978).

Ratchford

Ratchford (1980) developed a normative model of search behavior prior to purchase for a given good with variable prices and characteristics. The consumer is assumed to know the distribution of the prices and characteristics but to have no advance information on the prices and characteristics of each individual brand. Further, it is assumed that the consumer maximizes expected utility and selects a priori a fixed number of searches.[33] Each search consists of gathering information about the price and characteristics of one brand. Thus, Ratchford's model only applies to search attributes. However, because it treats products as bundles of characteristics, Ratchford's model is an extension of previous product-based approaches (Stigler, Nelson). His model is closely related to the hedonic approach.

The model estimates the incremental gain (in dollars) of various numbers of searches in relation to the consumer's preference function. Ratchford applied his model to gains to be expected from information search with respect to appliances. He found that a comparison of three brands will be sufficient to ensure a near-optimal purchase for a representative consumer, i.e., a consumer whose preference function is identical to the hedonic price function. For a consumer whose goal is to buy at the lowest price, regardless of quality, it is not worthwhile to compare more than five brands. The number of searches will even be smaller if the cost of information search is taken into account or if the consumer has prior information about prices and characteristics of individual brands.

A major contribution of Ratchford's model is that it quantifies the benefits of information acquisition. In his study, Ratchford showed that extensive search for quality information frequently is not worth the effort since the monetary gains are often very small.

Hey and McKenna

Ratchford did not consider the situation in which some product characteristics are observable prior to purchase whereas other characteristics are not observable. This problem has been taken up by Hey and McKenna (1981) who considered the case in which the price of the brand can be observed prior to purchase but its quality is observable only on purchase and experience.[34] Quality enters their model as the money value of the brand's quality per period. The brand yields the same quality for each period. Price and quality are assumed to be positively correlated. The consumer knows the joint distribution of price and quality over all brands. It is assumed that the consumer makes independent random selections from the joint distribution of price and quality. Each search involves the same cost. The price is immediately observed. Quality is revealed only after purchase and experience. The consumer faces a two-stage problem. In the first stage s/he must decide what prices are acceptable and search (at constant cost per search) until an acceptably priced brand is obtained. The second stage relates to quality. After experiencing the brand the consumer must

[33] Ratchford acknowledged that a sequential decision rule is more optimal but that he adopted Stigler's fixed sample size rule because this rule leads to more easily interpretable results.

[34] A similar model has been developed by Wilde (1980b).

decide whether its quality is sufficiently good to retain it. If not, the brand is disposed and the consumer returns to stage one. If the brand is retained the consumer must decide whether to continue buying it thereafter. If not, the consumer returns to stage one at the end of the lifetime of the brand.
Hey and McKenna showed that the optimum strategy for the consumer, in terms of maximizing the expected present value of the purchases, critically depends on the relationship between quality and price. Depending on this relationship 'buy cheap', 'buy expensive', 'buy medium', or various combinations of these can all be optimum buying strategies. For instance, they showed that in cases where there is a weak (strong) positive relationship between quality and price a 'buy cheap' ('buy expensive') policy would be optimal. These results accord with intuition.
Under certain conditions a particularly interesting result can be obtained.[35] Under those conditions, an optimizing consumer should search until either a very cheap or a very expensive brand is obtained. A very expensive brand is attractive because the probability of getting a brand of high quality is then sufficiently high to outweigh the possible 'lemon' effect (in their model a lemon refers to a brand whose quality is so low that it pays to dispose of it within its lifetime and to start searching again). A very cheap brand is also attractive despite its associated high probability of getting low quality because of the small loss involved in disposing of a lemon. Intermediately priced brands are not attractive because their quality is not high enough to compensate for the possibility of getting a lemon and not low enough to involve only a small monetary loss.

It has already been argued by Nelson (1970) that information acquisition need not be performed at random. Imperfectly informed consumers can use information from personal sources, consumer magazines, etc., and from signals in the market to guide them in their information acquisition behavior. Traditionally, economic theory has devoted most attention to the information content conveyed by the market signals price and advertising. The central question in these studies is whether price and/or advertising convey accurate information about the quality of brands. Sections 3.5.3 and 3.5.4 elaborate the economic theory concerning the information content of price and advertising, and the way consumers can use these market signals in choosing between brands of different quality.

3.5.3 Price as quality information

Economic theory in general assumes that there is a positive relationship between price and quality. The rationale for this reasoning is simple. In a competitive situation a higher price reflects higher unit cost of production. If this would not be the case abnormal profits would be earned. This would attract the entry of new firms. Entry of new firms would cause abnormal profits to disappear.

[35] These conditions are that there is a positive probability of getting a 'lemon' and that net utility (i.e., quality minus price) increases with price. However, if these conditions are satisfied, the result described above presents only one of the two possibilities (Hey and McKenna 1981, Figure 2).

Under the assumption of efficient production, unit cost of production is higher with higher quality (better materials, more ingredients, etc.). Thus, higher quality should be accompanied by higher prices.[36] Therefore, it is not surprising to see that in a number of economic models on quality competition, quality is operationalized as unit cost (e.g., Abbott 1955, Schwartz and Wilde 1985).
The positive relationship between price and quality is also perfectly logical if consumers are rational and completely informed about prices and product characteristics. In such a market situation brand A, which is offered at a higher price than brand B but has a lower quality than B, will disappear from the market because nobody would buy A. On the other hand, if all consumers are perfectly informed there is no need for them to use price as a source of quality information.

Miscellaneous authors
Most economic models on the imperfectly informed consumer assume that price and quality are positively correlated. An early source is Chamberlin (1953, p. 6): 'In general, it is elementary common sense that there will be a rough correlation between the quality of the product and its price'. Nelson (1975, p. 229) stated: 'The consumer quite properly assumes that there tends to be a positive relationship between price and quality'. Hey and McKenna (1981, p. 62) considered the possibility that quality is negatively correlated with price and stated: 'This is highly unlikely in practice. A more realistic case is to assume that quality generally increases with price'. Schwartz and Wilde (1985) assumed that in a competitive equilibrium low-quality brands sell for a lower price than high-quality brands.
Scitovsky (1945, pp. 100) and, later, Salop and Stiglitz (1977) pointed out that the reliance of imperfectly informed consumers on price as an indicator of quality is perfectly justifiable if there are relatively large numbers of well-informed consumers in the market. Well-informed consumers will 'discipline' the market so that price differences will reflect true quality differences. In this way poorly informed consumers can benefit indirectly from the information held by others.
Scitovsky (1945, pp. 100-101) feared, however, that if only few consumers are well-informed about the quality of the product alternatives, this may wreak havoc on the whole economic theory of choice:

'The situation becomes paradoxical when price is the index by which the average buyer judges quality. In a market where this happens price ceases to be governed by competition and becomes instead an instrument wherewith the seller can influence his customers' opinions of the quality of his wares. A commodity offered at a lower price than competing commodities will be both more attractive to the consumer on account of its greater cheapness and less attractive on account of its suspected inferior quality. If all consumers would judge quality by price alone, these two factors would counterbalance each other exactly and price competition would become impossible.'

[36] Note that the positive relationship between quality and costs assumed in economic theory is, in general, not supported by studies using the PIMS data base (see Chapter 1 for references).

Klein and Leffler

Scitovsky's conclusion has been contested by Klein and Leffler (1981) who argued that 'cheating' on quality may not at all be profitable to firms if repeat purchases are taken into account. If the quality of the product is less than expected (less than implied by its price) consumers will cease to purchase from that firm. Klein and Leffler demonstrated theoretically that a firm will produce high quality if it is able to charge a price premium on top of the production cost of high-quality output. The price premium is necessary as compensation for the profit the firm forgoes by refraining from following a hit-and-run strategy. In the hit-and-run strategy the firm would earn high profits for a short time by cheating on consumers through selling a low-quality brand for a high price. Klein and Leffler (1981, p. 623) concluded: 'Under very general cost conditions a price premium will exist that motivates competitive firms to honor high quality promises because the value of satisfied customers exceeds the cost savings of cheating them'. Thus, according to Klein and Leffler, (1) price and quality are positively correlated even if most consumers are imperfectly informed, and (2) consumers can successfully use price as an indicator of quality. The same conclusions were reached by Shapiro (1983). High-quality brands sell at a premium above cost, and price can justifiably be used by consumers as quality information.

Thus, the incentive to cheat is counterbalanced by the profit potential offered by repeat purchases. An interesting implication of the studies of Klein and Leffler, and Shapiro, is that a higher price premium for maintaining a high quality level is required for types of products that generate few repeat purchases than for types of products that generate many repeat purchases. Few repeat purchases reduce the counterbalancing influence of repeat sales vis-à-vis cheating. This would mean that the relative price premium is higher for high-quality consumer durables than for high-quality consumer nondurables. Some evidence for this proposition can be found in Phillips et al. (1983) who reported that product quality has a larger effect on the prices of consumer nondurables than on the prices of consumer durables.[37]

Gabor and Granger

Scitovsky's notion that price plays a dual role in the decision process of the imperfectly informed consumer has been elaborated by Stoetzel (1954), Adam (1958), and Gabor and Granger (1966).

Gabor and Granger's approach is based on the assumption that each potential buyer of a given product has two price limits in mind: an upper limit beyond which s/he would find the brand too expensive (price as a cost factor) and a lower limit below which the quality of the brand would be suspect (price as quality indicator). Generally, a consumer would only consider buying the brand if the price falls between his/her limits. Gabor and Granger developed an approach to analyze the consumer's buying behavior in relation to the dual role of price. Three functions were developed: $L_g(P)$, $H_g(P)$, and $B_g(P)$. $L_g(P)$

[37] Phillips et al. specified a linear relationship between product quality and price. A large price premium for high-quality consumer durables tends to weaken the linear effect of product quality on price.

denotes the probability that a randomly chosen consumer of g will find the brand too cheap if it is priced at P. $H_g(P)$ refers to the probability that a consumer of g, chosen at random, will find the brand too expensive at price P. $L_g(P)$ is monotonically decreasing with P and $H_g(P)$ is monotonically increasing with P. The third function, $B_g(P)$ is called the buy-response function. It shows the probability that a randomly chosen consumer of g will purchase the brand at price P; $B_g(P) = 1 - L_g(P) - H_g(P)$.
The approach of Gabor and Granger has been frequently applied in empirical research (see Gabor 1977 for references). Steenkamp and Van Trijp (1988a) have extended this approach by applying it to a multiple-product situation in which the products (i.e. meat cuts) differ in quality. An implication of the Gabor and Granger approach is that it is unlikely that the use of price as quality indicator tears the economic theory of choice to shreds. Not only the lower limit but also the upper limit is important to consumers. Consumers will only consider buying the brand if it is not too expensive.

Conclusion
Economic theory generally assumes that there exists a positive relationship between price and quality although this relationship need not be perfect. This implies that imperfectly informed consumers can use price as an indicator of quality. In Chapter 12, the validity of this assumption will be examined empirically.

3.5.4. Advertising as quality information

Advertising can provide the consumer with information about the quality of a brand in at least two ways. First, an advertisement (may) convey information about the quality characteristics of the brand, its price, etc. Second, the bare fact that the brand is advertised is relevant. Chamberlin (1953) was among the first economists to recognize the informational importance that a brand is advertised at all. He argued: 'It is also true that advertising and quality are often positively correlated, and it is a familiar maxim that "it doesn't pay to advertise a poor product"' (Chamberlin 1953, p. 7).

Nelson
The above two ways in which advertising may provide quality information have been examined by Nelson (1974). Nelson argued that consumers prefer advertisements that provide direct information about the characteristics of the brand if they can have enough confidence that this information is trustworthy. He posed that consumers can have this confidence in case of search goods. Deceptive advertising for search goods is not advantageous to firms since the consumer can easily verify the advertising claims prior to purchase. Moreover, deceptive advertising may damage a firm's reputation. Thus, Nelson concluded that advertisements for search goods provide predominantly direct information based on valid product claims.
This is not the case for experience goods. Direct information about the quality characteristics cannot be checked prior to purchase. Firms may be induced to make exaggerated or even false product claims in advertising experience goods

since this might trigger trial purchases. Thus, advertising usually does not provide direct information that is of much help to the consumer. Recognizing this, does advertising convey any information about the quality of a brand at all? Nelson answered this question with a definite: yes. Quality information is provided by the level of advertising, or, as Nelson put it (1974, p. 745): 'The primary information content of advertisements for experience goods is the information that the brand advertises'. To support this contention, Nelson argued that high-quality brands elicit more repeat purchases, *ceteris paribus*, than low-quality brands. Producers of high-quality brands have thus more incentive to advertise than producers of low-quality brands. This generates a positive relationship between the level of advertising and product quality, regardless of the actual content of the advertisements.

According to Nelson, if an imperfectly informed consumer wants to purchase a high-quality experience good, s/he should limit his/her sampling to heavily advertised brands. These brands are also the best buys.

Nelson hypothesized that experience goods are more heavily advertised than search goods.[38] This is an elaboration of his hypothesis that guided sampling is more important for experience goods (see Section 3.5.2). The hypothesis is supported by empirical evidence (Nelson 1974), even if it is assumed that brands contain search as well as experience attributes (Nelson 1978).

Comanor and Wilson

Nelson's conclusion that for experience goods there is a positive relationship between the level of advertising and product quality has been contested by Comanor and Wilson (1979). They argued that low-quality products generate fewer repeat purchases and therefore must compensate this disadvantage by attracting more trial purchases. This means that producers of low-quality products have more incentive to advertise than producers of high-quality products. This will result in a negative relationship between level of advertising and product quality. Following Comanor and Wilson's argument, the imperfectly informed consumer looking for a high-quality experience product, should purchase a brand that is hardly advertised.

Schmalensee

The resolution of the Nelson/Comanor and Wilson controversy requires a formal model in which the different incentives for advertising are mathematically specified. Such a model is developed by Schmalensee (1978). Schmalensee's model constitutes an important contribution of economic theory to the veridicality of advertising as quality information, and hence will be discussed in some detail.

Schmalensee considered a market in which there are N sellers and Q buyers, where all buyers behave identically, and each buyer demands only one unit of the good over each time period. Firms are assumed to maximize a discounted stream of profits. Buyers do not optimize their behavior and can only obtain

[38] See Nelson (1974, pp. 735-738) for a mathematical derivation of this hypothesis. Intuitively the hypothesis makes sense since more effort is needed to increase the reputability of a brand than to provide 'hard facts' about the search attributes.

direct information about the quality of a brand by purchasing and consuming the brand. Further, the model assumes that all firms charge the same price, P. The unit cost of production, $c(\beta)$, for a brand with quality level β is assumed to be equal for all firms and can be formulated as:

$$(3.26) \quad c(\beta) = P(1 - k/\beta^{\gamma})$$

where $\beta \geq 1$, $0 < k < 1$ and $\gamma \geq 0$; k is a constant and γ is a measure of the cost advantage of producing low-quality brands. The larger γ, the greater the cost advantage of producing low-quality brands. Given P, this means that, *ceteris paribus*, producing low-quality brands is more profitable than producing high-quality brands because of a higher margin. However, the probability that a consumer will be satisfied after consuming a low-quality brand is less than the probability of being satisfied after consuming a high-quality brand. Suppose a consumer purchases brand j in period t. Then, it is assumed that with probability $(1 - 1/\beta_j)$ the buyer will be satisfied with brand j and purchase it again in period $(t + 1)$. With probability $1/\beta_j$, the buyer will be dissatisfied with j and will consider switching brands in period $(t + 1)$.[39]

At this point, advertising enters the model. In Schmalensee's model, advertising is an attempt to lure dissatisfied customers from other firms. Following Nelson, only advertising expenditures, not the content, is important. Let $A_i(t)$ denote the advertising expenditure of firm i in period t and $a_i(t)$ the conditional probability that a consumer who becomes dissatisfied with any brand in t will switch to brand i in $(t + 1)$. Schmalensee assumed that $a_i(t)$ is given by:

$$(3.27) \quad a_i(t) = A_i^e(t) \Big/ \sum_{j=1}^{N} A_j^e(t) \qquad i = 1,\ldots\ldots,N$$

where e is the measure of advertising effectiveness $(e \geq 0)$.[40] It is a measure of the confidence dissatisfied consumers have in (Nelson's) notion that advertising expenditure levels are positively related to the quality of brands. If $e = 0$, advertising is completely ignored by dissatisfied consumers. If $0 < e < 1$, advertising has some but a less than proportional effect. If $e = 1$, dissatisfied consumers can be thought of as buying the brand for which they are first exposed to an advertisement. If $e > 1$, the most heavily advertised brand gets a disproportionately high share of the currently dissatisfied consumers (i.e., has a disproportionately large a_i). Schmalensee combined $a_i(t)$ with the probability of satisfaction/dissatisfaction to model the probability, T_{ij}, that a consumer who purchases brand j in period t will switch to brand i in period $(t + 1)$. For fixed values of the a_i and β_i, the switch probabilities can be described by a first-order stationary Markov chain:

[39] This means that the product considered by Schmalensee possesses at least some credence attibutes. By definition, if the product were a pure experience good, the consumer would be either satisfied or dissatisfied after experiencing the product.

[40] In the terminology of Smallwood and Conlisk (1979) consumers in Schmalensee's model can only be weakly dissatisfied since there is a non-zero probability that they repurchase a brand of unsatisfactory quality. According to Schmalensee, the case of strongly dissatisfied consumers was completely intractable. Smallwood and Conlisk also concluded that the case of strongly dissatisfied consumers is very difficult to analyze.

$$(3.28)\quad T_{ij} = (1 - 1/\beta_j)\,\delta_{ij} + a_i(t)(1/\beta_j) \qquad i,j = 1,\ldots\ldots,N$$

where δ_{ij} is the Kroneker delta (i.e., $\delta_{ij} = 1$ if $i = j$ and zero otherwise). If the $A_i(t)$ are fixed at A_i over time, standard Markov chain theory establishes that in equilibrium the market share q_i of a firm i is given by:

$$(3.29)\quad q_i = \beta_i A_i^{\varepsilon} \Big/ \sum_{j=1}^{N} \beta_j A_j^{\varepsilon} \qquad i = 1,\ldots\ldots,N$$

Implications of Schmalensee's model

Now we are able to address the question whether the level of advertising expenditure correlates positively with product quality as is argued by Nelson or whether the relationship is negative as is contended by Comanor and Wilson. The answer depends on e and γ. Schmalensee showed that advertising expenditure will be inversely related to product quality if $e\gamma \geq 1$ and $\gamma > 0$.[41] These conditions imply that if advertising is very effective (e is large) and there is a large cost advantage in producing low-quality brands (γ is large), it is profitable to producers of low-quality brands to advertise more than producers of high-quality brands. Thus, Schmalensee concluded that the nature of the relationship between advertising expenditure and product quality is an empirical question.

Paradoxically, Schmalensee's model implies that Nelson would probably prove to be wrong if consumers would indeed believe Nelson's contention that advertising expenditure is positively related to quality. In that case, e would be large and $e\gamma$ is more likely to be greater than one. In equilibrium, this results in a negative relationship between advertising and quality (assuming $\gamma > 0$). The same argument goes for Comanor and Wilson if everybody would accept their hypothesis.

It is important to realize that Schmalensee's conclusion concerning the relationship between advertising expenditure and quality also depends on the necessary condition that higher quality entails higher unit cost of production (i.e., $\gamma > 0$). In his model (as in Nelson's model), advertising of high-quality products is more profitable, *ceteris paribus*, than advertising of low-quality products because of higher repeat purchase probabilities. This positive relation between quality and profitability is offset in Schmalensee's model by the negative relation between quality and profit per unit sold because price is fixed in his model. However, Wilde (1980a) pointed out that the basic assumption that a high-quality product commands a lower absolute markup on top of unit cost is not realistic.[42] Wilde's position is supported by empirical studies of Phillips et al. (1983), Day (1984), and Luchs (1986), among others. Thus, it appears that for many products the counterbalancing factor employed in the Schmalensee model, a lower markup for higher-quality brands, does not exist.

[41] These results apply only if $e > 0$ and the number of firms N is two or buyer adjustment to changes in advertising levels, D, is very rapid (i.e., $D = 1$). The necessary and sufficient conditions could not be derived if $N > 2$ and $D < 1$.

[42] Other criticism of Schmalensee's model includes (1) not all consumers are affected by advertising, (2) not all affected consumers need to be dissatisfied, and (3) the modeling of consumer behavior by Markov chains is of limited reality (Haines 1980).

This leads to the conclusion that Nelson's assertion that advertising expenditure and product quality are positively correlated mostly is correct. This conclusion is also reached by Telser (1978), Klein and Leffler (1981), and Shapiro (1983) who regarded advertising as a capital investment that is lost if the firm cheats on its assurance of high quality (i.e., advertising is a sunk cost).

Wiggins and Lane

Wiggins and Lane (1983) argued that previous models (Nelson, Schmalensee) have ignored quality *risk* as a factor affecting the decisions of consumers. Consumers are not only concerned with expected product quality but also with the extent of quality variation that exists in the market. Since consumers are imperfectly informed, quality variation entails quality risk. In Wiggins and Lane's model a consumer can obtain quality information by search and advertising. It is assumed that all advertised brands are sold at the same price, P_a, regardless of quality. The unadvertised brands are all sold at price P_u. P_a and P_u are set exogenously and are assumed to be related to each other by the following equation:

$$(3.30) \quad P_a = P_u + \alpha$$

where α is the cost of advertising per unit. It is assumed that consumers are risk averse, maximize utility, and know the exact distribution of available qualities. Firms maximize profits given the behavior of consumers.

The consumer faces the simultaneous decision how many searches to conduct and whether to buy advertised or unadvertised brands, in order to maximize the following utility function:

$$(3.31) \quad \max V(h,m) = (\mu_{h,m} - P_h)n - \lambda m - r\,\phi(h,m;n)$$

where h = u,a denotes unadvertised (u) and advertised (a) brands respectively, n = the number of units purchased, $\mu_{h,m}$ and $\phi(h,m;n)$ respectively denote the ex ante mean and riskiness of quality obtained by searching m times before purchasing an (un)advertised brand, λ = the cost of one search, and r = the level of risk aversion. The term $(\mu_{h,m} - P_h)n$ is the expected consumer's surplus, λm is the cost of search, and $r\,\phi(h,m;n)$ is the premium the consumer is willing to pay to reduce risk. An increase in expected consumer's surplus, and a reduction in cost of search and risk increases utility.

Given equation (3.31), the consumer can follow a variety of information acquisition strategies: s/he can acquire direct quality information through search, s/he can rely on the implicit quality signals contained in advertising, or both, or s/he can purchase at random.

A firm's decision variables are its quality, q^i, and its decision whether to advertise or not, h. These variables, which determine output X^i_h, are set to maximize the following profit function:

$$(3.32) \quad \max \pi^i_h = (P_h - \tau q^i_h - \delta_h \alpha)X^i_h - (F + \delta_h F_a)$$

where τ = the marginal cost of increasing quality ($\tau > 0$), F = fixed cost of

entry, F_a = fixed cost of advertising, and $\delta_h = 1$ if h = a and $\delta_h = 0$ if h = u.
In Wiggins and Lane's model, high-quality brands generate more sales than low-quality brands (note that price does not vary with quality). Firms must trade off between the increased sales generated by higher quality and the associated higher cost.
It is shown that there are only two types of equilibrium in which both advertised and unadvertised brands exist. Either advertised products have a higher mean surplus and higher quality risk (i.e., more quality variation) or advertised brands have a lower surplus and lower risk than unadvertised brands. In other equilibria, either advertised or unadvertised brands are driven out of the market. For example, if advertised brands have a higher mean surplus and a lower risk they dominate unadvertised brands completely. Wiggins and Lane argued that the mean surplus of advertised brands is usually lower than the mean surplus of unadvertised brands because advertised brands sell at higher prices. Therefore, the most likely situation is that advertised goods will offer lower expected surplus, but also lower risk. This proposition is supported by the results of a simulation study: 'Thus, for all examples we have constructed, the implicit quality information that is signaled by advertising is lower risk' (Wiggins and Lane 1983, p. 891).
It is important to note that Wiggins and Lane did not suggest that advertising and quality are negatively correlated. The quality of advertised brands can be higher, even if the mean surplus of advertised brands is lower than the mean surplus of unadvertised brands. However, the higher quality is more than 'compensated' for by the higher price.
Wiggins and Lane's model suffers from a number of limitations. For instance, the assumption that prices are independent of quality is unrealistic (see above). Another limitation is that repeat purchases and income are not taken into account. As argued by Nelson, what is the use of heavily advertising low-quality brands, especially if the cost of advertising is incorporated in the price? Advertising can induce consumers to try a low-quality brand, but if they are dissatisfied they will not purchase it again. Therefore, repeat purchase behavior drives heavy-advertised, high-priced, low-quality brands out of the market, or at least reduces their market shares significantly. This will increase the positive correlation between advertising and product quality, reduce quality risk (because quality variation decreases), increase the average quality level and the mean expected surplus of advertised brands. Thus, if repeat purchases are considered, it seems that unadvertised brands would be eliminated (this result can also be obtained in the Wiggins and Lane model; see above). However, at this point, income should be taken into account. Even if advertised brands provide a higher expected surplus and lower risk, not all consumers are willing (or able) to pay the higher price attached to the more attractive advertised brands.[43] Consumers differ in their willingness to pay more for higher-quality brands. Thus, unadvertised and advertised brands can both exist in the market even though advertised brands provide a higher surplus and are less risky.
Despite these limitations, some implications of the Wiggins and Lane model are very interesting. One of their propositions is that risk-averse consumers who

[43] One would also suspect that the surplus varies between consumers.

purchase few units of the product tend to purchase advertised brands. Further, they draw attention to the importance of quality risk in consumer behavior. Advertising expenditures could be used by consumers (1) as quality indicator, and (2) for quality risk assessment.

Empirical research on the relationship between advertising and quality

Several researchers have investigated the relationship between advertising expenditures and quality empirically. In their studies no distinction is made between search goods and experience goods. Obviously, that would have been very difficult since most products contain both search and experience (and credence) attributes.

In an early study (1933) conducted by the (American) Federal Trade Commission it was found that the chance of purchasing canned vegetables and fruit of high quality was greater for advertised brands than for unadvertised brands (study cited in Woodside and Taylor 1978).

Beem and Ewing (1954), Marquardt and McGann (1975), Rotfeld and Rotzoll (1976), and Archibald et al. (1983) all used quality ratings as reported by a consumer magazine to analyze the advertising-quality relationship. In an extensive study involving 131 product categories covering a wide range of consumer durables and nondurables, Marquardt and McGann (1975) found that brands produced by heavy advertisers score a significantly higher number of high quality ratings than brands manufactured by firms that do not advertise heavily. The authors concluded that heavy advertising is strongly associated with high-quality brands. This conclusion is consistent with a previous study conducted by Beem and Ewing (1954).

Rotfeld and Rotzoll (1976) conducted a more limited study, involving only 12 product categories. They partially confirmed the results of previous studies. In most product categories significant positive correlations were found between product quality and amount of advertising when both nationally and non-nationally advertised brands are considered. However, among the brands which are advertised nationally little or no correlation was found between quality and advertising.

Archibald et al. (1983) conducted an interesting study in which the impact of the publication of quality ratings by a consumer magazine on the advertising-quality relationship with respect to running shoes was examined. They found that quality and advertising were much more strongly correlated in the presence of quality ratings than in their absence (rank correlations of .608 and .203, respectively, on the basis of individual brands; both correlations were significant at $p = .01$). Archibald et al. (1983, pp. 351-352) concluded:

'The publication of ratings has a major impact on the advertising behavior of firms, which makes misleading advertising much less likely. In fact, this effect is so strong in our sample of data on running shoes that, after the ratings' publication, advertising levels are not only good indicators of high quality products, but also good indicators of good buys'.

Using the PIMS data base, Phillips et al. (1983) reported that relative product quality and relative advertising/promotion expenditures were correlated significantly for consumer durables, capital goods, and supply goods (Pearson's correlations of .39, .19, and .18, respectively). No significant correlations were

found for consumer nondurables, raw and semifinished materials, and components.
On the basis of empirical evidence, the most that can be concluded is that for many products advertising expenditure and product quality are positively correlated. However, given that for a substantial number of products no such a relation is found and that the correlation is mostly well below 1, it is clear that advertising expenditure provides at best imperfect information about the quality of a brand.

3.5.5. Quality grading and minimum quality standards

In this section two issues related to quality and the economic theory of the imperfectly informed consumer will be briefly discussed: quality grading, and the effects of the imposition of minimum quality standards. Quality grading can assist imperfectly informed consumers in their decision process by structuring the information environment. Minimum quality standards protect the individual against hazardous purchases. Both types of market regulation would not be necessary if consumers would possess complete knowledge of the market.

Quality grading
Quality grading can be advantageous to consumers because it reduces uncertainty in the decision process. It might also be profitable to producers because it allows for product differentiation with its accompanying monopolistic gains.
Zusman (1967) developed a model to determine a grading scheme that maximizes the profit of the firm.[44] It is assumed that different grades will get different market prices. Grades are defined in terms of continuous quality characteristics $a_1,\ldots\ldots,a_n$ of the product. The development of an optimal grading scheme means the specification of cutoff points with respect to amounts of characteristics $a_1,\ldots\ldots,a_n$. For example, consider the product apples. Assume that only one quality characteristic, size, is important. One could apply a grading scheme that assigns all apples with a diameter less than 7.5 cm to grade A, all apples between 7.5 and 10 cm to grade B, etc. However, other grade boundaries are also possible. The question is: which grading scheme will be most profitable to the seller?
Zusman solved this question by introducing the individual quality valuation function (IQVF). The IQVF shows how much a consumer values an additional unit of a product with quality characteristics $a_1,\ldots\ldots,a_n$ relative to the utility derived from spending an additional dollar on the composite of all other goods. Each consumer has his/her own IQVF. The IQVF depends on the consumer's equilibrium bundle of goods, and therefore on market prices and the consumer's income. If sorting costs are ignored, Zusman showed that in a competitive market, where the firm possesses full information on the IQVF's, optimal grade boundaries coincide with the intersections of the IQVF's that are located on the

[44] A grading scheme is defined as a set of quality criteria defining a mutually exclusive and exhaustive set of grades. The separation of the heterogeneous product in accordance with a given grading scheme is called sorting (Zusman 1967, p. 90).

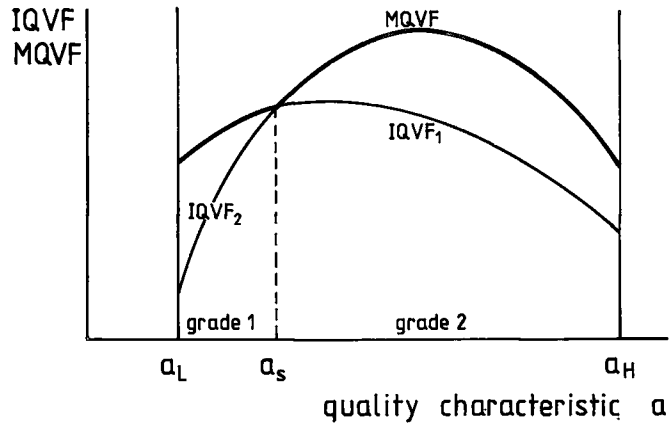

Figure 3.3 Determination of an optimal grading scheme for two consumers and one quality characteristic.
Source: Zusman (1967)

upper envelope curve of the IQVF's. This upper envelope curve is called the market quality valuation function (MQVF). In Figure 3.3 Zusman's approach is graphically illustrated for two consumers and one quality characteristic. a_L and a_H denote the lower and the upper boundary of the quality characteristic, respectively. a_s denotes the grade boundary.
Since the grading scheme is only dependent upon the IQVF's, it is the same for all sellers, whatever the composition of their product. If the cost of sorting is taken into account the profit maximizing scheme may consist of fewer grades. The exact impact of sorting cost on the optimal grading scheme is not analyzed by Zusman.
The most obvious limitation of Zusman's approach is the requirement that the firm has perfect knowledge about the IQVF's. Besides, the procedure becomes tedious if the grading scheme is based on more than one quality characteristic.

Minimum-quality standards
Bockstael (1984) analyzed the effects of the imposition of minimum-quality standards on social welfare.[45] Minimum-quality standards may be advantageous to producers because they will lead to a higher average quality and thus presumably to a higher average price and higher profits. Further, the imposition of minimum-quality standards by the government or by commodity boards may protect the imperfectly informed consumers against deplorable quality decisions of firms. The results of Bockstael's theoretical analysis show that the wisdom of minimum-quality standards can be doubted (except, of course, in the case of products such as drugs where low quality could present unacceptable dangers to consumers). Her conclusions depend on the way quality standards are defined. According to Bockstael, if standards are based on product charac-

[45] Other relevant work on this subject includes a theoretical study of Price (1967) and an empirical study of Shafer (1968). These studies suffer from the limitation that minimum quality standards have not been explicitly integrated in the supply and demand analysis (Bockstael 1984).

teristics that are relevant to consumers and can be perceived by them before purchase, the imposition of minimum-quality standards leads to social losses. Minimum standards can be profitable to producers but only at the expense of consumers. The net benefits for producers fall short to compensate for the losses incurred by consumers. As Bockstael concluded (p. 469): 'society is unambiguously worse off after standards'. The net benefits for society are also negative if minimum-quality standards are based on characteristics that are irrelevant to consumers. Producers could profit in this situation but consumers will certainly be hurted more. A third possibility distinguished by Bockstael is that minimum-quality standards are based on relevant characteristics that cannot be observed by consumers before purchase. She did not analyze this alternative, but Leland (1979) did.

Leland assumed that the consumer does not know the quality of the product prior to purchase (i.e., he considered experience goods and credence goods). Implicit in his analysis is that the minimum-quality standard is based on relevant characteristics because consumers are willing to pay for better quality. He concluded that minimum-quality standards tend to increase social welfare in markets with high demand sensitivity to quality variations, low price elasticity of demand, low marginal cost of providing quality, and/or low willingness to pay for brands of the lowest quality level. These findings intuitively make sense. (Note the correspondence in findings between Leland and Dorfman and Steiner; see Section 3.2.)

A limitation of the models developed by Bockstael and Leland is that the possible effects of the imposition of minimum-quality standards on consumer uncertainty are not considered. It seems plausible that quality standards reduce consumer uncertainty in the choice process even when the standards are based on observable product characteristics, since it is unlikely that even in this case consumers are completely certain in their perceptions. Uncertainty reduction is an immaterial benefit accruing to consumers. Especially if uncertainty is high this benefit could be considerable. It is likely that Bockstael and Leland underestimate the total societal benefits of minimum-quality standards.

3.6. Conclusions

In this chapter, the economic approach to product quality was reviewed. We have discussed the role of quality as a competitive weapon of the firm, the hedonic approach, and the economic theory on consumer behavior in respect to quality, both when the consumer is perfectly informed about quality and when s/he is imperfectly informed. The effects of quality competition between firms were analyzed. The impact of horizontal and vertical quality changes on consumer choices was investigated. The marginal valuations of quality improvement were studied. The economic theory on consumer search behavior with respect to quality was reviewed and the difficulties in information acquisition highlighted. The validity of price and advertising expenditure as quality indicators was investigated theoretically and empirically (for advertising). The effects of minimum-quality standards and quality grading were reviewed.

In each area, several models were described, none of which can claim general acceptance. In all of these models, elements can be found that contribute to our

understanding of the role of product quality as an economic variable.
Conclusions were drawn on the basis of these theoretical models which may serve as research hypotheses in empirical studies. For instance, one could examine whether a price increase in a competitive market where prices are regulated leads to quality improvement, whether aggressive vertical quality competition leads to a higher level of quality in the market, and whether it is true that the greater the sensitivity of consumers to quality variation and the lower the sensitivity to price variation, the higher the general level of quality in the market tends to be.
The limitations of specific models have already been discussed, and need not be repeated here. In this section, some final attention will be given to the concept of quality as it is seen by economists, and to the role of assumptions in economic models of quality in general, with special reference to the economic theory on quality and the demand side of the market.

The concept of product quality
There appears to emerge growing consensus in economic theory that quality should be defined as the amount of the different characteristics per unit of the product, a development that is primarily due to the work of Lancaster. This definition of quality has been adopted by Houthakker, Theil, Abbott, Leffler, Leland, and Rosen, among others. Studies on quality as a competitive weapon link this conceptualization of quality to unit cost, higher quality resulting in higher unit cost. Studies on quality and the demand side of the market link it with utility, higher quality generating more utility. The hedonic approach uses this definition in developing a market equilibrium in which both the supply and the demand side of the market are fully taken into account.
This conceptualization of quality can be enriched by considering different types of quality characteristics. If one acknowledges that consumers are imperfectly informed about the quality of the product, it is useful to distinguish between search, experience, and credence characteristics/attributes, since these entail different types of search behavior, quality risk, etc. While the distinction between search, experience, and credence attributes enhances the insight into the concept of product quality, as will be shown in the rest of this work, Nelson's original distinction between search, experience, and credence products is of limited value since most products possess all three types of attributes.

Some final reflections on the role of assumptions in economic models on quality
As evidenced by the studies reviewed in this chapter, considerable progress has been made in economic theory on quality since Chamberlin's *The Theory of Monopolistic Competition* was published in 1933. A major strength of economic models is their conceptual clarity and elegance. Given a number of explicitly stated assumptions, conclusions are drawn on the basis of a clearly formulated model. Other economists can extend this research by relaxing one or more of these assumptions. In this way, the economic theory on quality expands steadily as is clear from the body of literature discussed above.
While clearly formulated assumptions assist the economist in developing models of quality, these assumptions constitute, at the same time, also the main weakness of the economic theory on quality. The assumptions of the models are

often unrealistic. Economic theory has difficulty in developing models that are realistic in the sense that they reflect actual behavior in the market. It has been argued (cf. Frazer and Boland 1983) that it is not relevant whether the model is descriptively realistic or not. The relevant question to ask is whether the assumptions are sufficiently good approximations to reality. In this view, a model is adequate if it makes accurate predictions. One can wonder, however, whether the assumptions of many economic models do approximate reality at all. Further, if one wants to obtain fundamental insight into the role product quality plays in the marketplace, descriptively realistic assumptions are a prerequisite. This calls for the development of 'managerial' models of quality competition which include other marketing variables, other company objectives than profit maximization, and behavioral elements. Some attempts have already been made in this matter (see, for example, Section 3.2).

In particular, economic theory is not very successful in developing a consumer-based quality concept that is realistic in that it accords with the way product quality is used by consumers in their decisions. This issue is especially relevant to the rest of this work. The assumptions underlying economic models concerning quality and the demand side of the market are mostly unrealistic. With respect to the development of more realistic assumptions, economists can benefit from the body of knowledge developed by consumer researchers.

In short, three major problems plague (most) economic studies on quality and the demand side of the market.

1. The measurement problem: many product characteristics which are relevant to consumers cannot be measured objectively.
2. The integration problem: quality judgments are usually based on several characteristics. This poses the question about the way the ratings of a product on these characteristics must be integrated in order to arrive at an overall quality judgment. Economists have usually avoided this issue by defining quality as the amount of different characteristics but this operationalization is insufficient for studying consumer behavior with respect to quality.
3. The perception problem: even if all product characteristics can in principle be measured objectively, consumers' perceptions of the ratings of a product on those characteristics can differ from the true scores. How are these perceptions formed and what is their role in the formation of quality judgments? Even in studies in which it is assumed that consumers are imperfectly informed the quality perception problem is not clearly addressed.

In order to study the way consumers evaluate quality and use quality in their decision processes, these problems have to be considered. Behavioral elements should be taken into account. The 'perceived quality' approach, which will be discussed in Chapter 4, meets these demands.

4. THE PERCEIVED QUALITY APPROACH

4.1. Introduction

There is a distinct consumer trend to become more demanding with regard to quality (e.g., Leonard and Sasser 1982, Takeuchi and Quelch 1983, Sloan et al. 1984, Berry et al. 1985, Folkers 1986). It has been argued that the search for quality is the most important consumer trend of the 1980s (Parasuraman et al. 1985). However, there is evidence that many consumers are unhappy with the quality they are receiving (Grainer et al. 1979, Stanley and Robinson 1980). Morgan (1985) argued that there is a 'quality perception gap' between manufacturers and consumers. For example, a *Fortune* survey among chief executive officers (CEOs) of the largest U.S. companies revealed that 60% of the CEOs believed 'quality is better today' whereas only 13% believed that quality was declining. On the other hand, a large-scale consumer survey conducted during the same time period revealed that 49% of the respondents believed quality was declining and 59% believed it would continue to decline in the next five years. The quality perception gap observed by Morgan underlines the necessity to study quality from the point of view of the consumer as ultimately *the consumer* decides which product to buy. This approach has been called the 'behavioral' or 'perceived quality' approach and is generally adopted in marketing and consumer behavior research. Researchers in the 'perceived quality' approach use the term 'perceived quality' instead of 'quality' to stress that quality, in their opinion, 'lies in the eyes of the beholder' (Garvin 1984a). They argue that quality is neither absolute nor objective. Quality is a subjective concept since it is dependent on the perceptions, needs, and goals of the individual consumer. Although there exists a considerable body of literature on perceived quality, surprisingly few authors have conceptually defined the concept before exploring it. Most authors seem to assume that there is consensus among researchers with respect to the meaning of perceived quality. A number of writers, however, have proposed a definition of perceived quality.

The best known and most widely adopted definition of perceived quality is simply 'perceived quality is fitness for use' or some variant thereof. For example, Wimmer (1975) and Genth (1981) adopted the definition 'fitness for use'. Box (1984, p. 179) defined perceived quality as 'the degree to which a product fulfills its functions, given the needs of the consumer', and Kotler (1984, p. 479) speaks of 'the rated ability of the brand to perform its functions as perceived by consumers'. Kawlath (1969, p. 50) defined perceived quality as 'the fitness for certain goals'.

Maynes (1976b, pp. 51-52) proposed the following definition: 'The quality of a

specimen (a product/brand/seller/combination) consists of the extent to which the specimen provides the service characteristics that the individual consumer desires'. A similar definition is suggested by Monroe and Krishnan: (1985, p. 212): 'Perceived product quality is the perceived ability of a product to provide satisfaction relative to the available alternatives'. Kuehn and Day (1962) stated that the quality of a product depends on how well it fits in with patterns of consumer preferences.

Kupsch et al. (1978, p. 4) regarded perceived quality as a bundle of need-satisfying attributes. A similar position was taken by Oxenfeldt (1950). Böckenhoff and Hamm (1983) defined perceived quality as the composite of all product attributes irrespective of whether these attributes are in reality existent in the product and objectively measurable, and whether consumers are correct in their evaluations.

Thurston (1985, p. 31) suggested: 'Quality is the index that reflects the extent to which the customer feels that his need, the product, and his expectations for that product overlap.' He concluded that the relevant measure of quality does not reside in the product but in the customer. A similar position is taken by Wolff (1986) who argued that quality should be measured from the customer's perspective: 'If the customer says it's good, it's good; if he says it's bad, it's bad' (Wolff 1986, p. 9).

Trenkle (1983) distinguished three manifestations of perceived quality:

1. neutral concept (i.e., 'much quality' - 'not much quality'), defined as the nature of a product, given by the whole of all the attributes which discriminates the product from the other products in the same category;
2. evaluative concept ('good quality' - 'bad quality'), defined as the fitness for use of a product, given by the whole of all the attributes that are relevant to the evaluation of the product;
3. positive judgment ('quality products'), defined as superior or excellent with respect to all attributes.

Some researchers have followed Wittgenstein's (1953) linguistic approach that 'the meaning of a word is its use in the language' and explored the word quality in terms of everyday use of the term. For instance, quality often means reliability, general approval, or general excellence in the eyes of consumers (Holbrook and Corfman 1983). With respect to foods, Steenkamp et al. (1986a) found that quality is associated with keepability (29.0% of the subjects mentioned this aspect), wholesomeness (11.8%), appearance (11.7%), well-known brands (11.0%), taste (9.2%), price (6.9%), and nutritional value (6.1%). The ordinary language approach, however, does not get one very far conceptually with respect to the meaning of perceived quality. Definitions vary across products (e.g., nutritional value is associated with quality in case of foods but not for consumer durables), and the meaning of perceived quality may change with time. A definition should be dynamic in its implications but not in its formulation.

4.2. Cue effects on perceived quality

Of all the issues regarding perceived quality, consumer behavior researchers have been interested the most in how consumers *evaluate* quality. On what basis

does a consumer form an impression about the perceived quality of refrigerators, cars, soft drinks, cereals, and so on? It is generally recognized that consumers' perceptions of quality are based on one or more cues (e.g., Cox 1967a, Olson 1972, 1977, Monroe 1973, Monroe and Krishnan 1985). A cue is defined as any informational stimulus about or relating to the product (Cox 1967a, Olson 1977, Monroe and Krishnan 1985). Engel et al. (1972) used the terms cue and stimulus interchangeably. They emphasized that cues serve to direct consumer responses and behavior in general. A cue is a very broad concept, encompassing such various product-related aspects as price, brand name, advertising, friends' opinions, color, and so on. From an information processing perspective a product can be conceived as an array of cues (Cox 1967a, Olson 1977). A consumer faces the task to use cues (information) from the array as a basis to evaluate the quality of products.
Much research effort has been devoted to the cue or cues consumers use in their quality judgments. These studies will be reviewed below. In this review a cue effect will be considered significant when its p-value does not exceed .05.

4.2.1. Single-cue studies

Scent

To the best of our knowledge, Laird (1932) has published the first empirical study concerned with the way consumers form quality evaluations. He conducted an experiment in which housewives were asked to examine and evaluate four pairs of silk stockings. The stockings were visually identical in manufacture but differed in scent. The scents were so faint that only six of the 250 housewives noticed them. However, 50% of the housewives selected the pair of stockings with the narcissus scent as being the best quality, on the basis of such attributes as texture, weave, feel, wearing qualities, lack of sheen, and weight. The 'natural' (i.e., unscented) stockings were judged best by only 8%. Laird attributed this result to subconscious sensory impressions.

Price

Scitovsky's seminal paper (see Sections 3.5.1 and 3.5.3) generated considerable research on price as quality cue. In an early and influential paper, Leavitt (1954) reported the results of an investigation into the effects of price and perceived heterogeneity in quality on consumer choices. On the basis of a pretest, he chose four products which varied in degree of perceived quality differences between the brands. Perceived quality differences were relatively large for razor blades and floor wax, and relatively small for moth flakes and cooking sherry. In a simulated purchase situation subjects were confronted with two unnamed 'brands' (A and B) at two different prices. The only difference between the 'brands' was the price. There were four pairs of prices which differed in range in the following way: $ 0.68 - $ 0.72; $ 0.66 - $ 0.74; $ 0.62 - $ 0.78; $ 0.52 - $ 0.88. Price ranges were systematically varied across products by a special Latin-square design. Each subject chose one 'brand' (A or B) for each product and indicated the degree of satisfaction with his/her choice. Subjects tended to be less satisfied when they had selected lower-priced brands. When the products were perceived to be heterogeneous with respect to quality,

subjects tended to choose higher-priced brands.
Tull et al. (1964) replicated Leavitt's experiment with liquid shampoo and floor wax as products exhibiting relatively large quality differences, and table salt and aspirin as products with relatively small quality differences. In line with Leavitt, they found that subjects tended to choose the higher-priced brands of products for which relatively large quality differences were perceived. About one-quarter of the subjects chose a higher-priced brand of aspirin and table salt whereas nearly 50% chose a higher-priced brand of floor wax and liquid shampoo.
It should be noted that Leavitt and Tull et al. provided at best only indirect evidence on the relationship between price and perceived quality since the task involved choice instead of quality evaluation.
McConnell (1968a, b, c) examined the relationship between price and perceived quality for a frequently purchased consumer product, beer. Subjects were confronted with three bottles of identical beer labeled L, M, and P. P was sold at $ 0.99 a six-pack, L at $ 1.20, and M at $ 1.30. Subjects were asked to select one of the three 'brands'. Monetary compensation was given when the subject selected the lower-priced brand ($ 0.05 per bottle or $ 0.30 per six-pack) or the medium-priced brand ($ 0.02 per bottle). This procedure was carried out three times a week for eight consecutive weeks. Subjects were visited at their homes and could consume the beer at any time they liked but before making their next choice. After completion of their twenty-fourth and last trial, subjects rated the quality of the three brands of beer on a five-point scale, among other tasks. Based on these results McConnell constructed a contingency table. The χ^2 test indicated that price was significantly and positively related to perceived quality ($p < .005$).
McConnell's study has been widely cited as providing strong evidence of consumers' willingness to use price as a cue for quality. Unfortunately, he made a computational error which was found only twelve years later (Riesz 1980). The probability level proved to be $p = .18$ instead of $p < .005$. Therefore, it must be concluded that McConnell's study did not support the hypothesis that consumers infer product quality from price.
Shapiro (1973) investigated the relationship between price and perceived quality for stockings, cologne, carpeting, sweaters, and reclining chairs. Thus, the products in his study were mostly consumer durables whereas previous studies used consumer nondurables. Six hundred women were interviewed. Shapiro found that, in general, price acted as a cue to quality. However, price reliance varied among consumers. Price reliance was stronger (1) for subjects who perceived high risk in the purchase situation, (2) for subjects interested in convenience and shopping speed, (3) for subjects who perceived considerable quality differences among brands, and (4) for subjects who had trust in price maker's competence and honesty.
Peterson (1970), Deering and Jacoby (1972), Woodside (1974), Woodside and Sims (1974), and Petroshius and Monroe (1987) also reported that consumers use price as a quality cue.

The relationship between price and perceived quality in conjunction with perceived quality differences and product experience
Obermiller and Wheatley (1985) found that the relationship between price and

perceived quality was moderated by perceived quality differences among brands in the product category. If quality differences were perceived to be small (large), price had no (a significant) effect on perceived quality. Their results were in line with the studies of Leavitt, Tull et al., and Shapiro.

Brooker et al. (1986) studied the effect of price on perceived quality in combination with (1) product experience, and (2) information about quality differences between brands in the product category. The products chosen were orange juice and potato chips. Price was manipulated at the levels higher and lower (actual prices employed were not reported in the paper). Two information conditions were specified: either information was provided that no essential differences between the brands of the product existed, or no information was given about brand differences. Product experience was also manipulated at two levels: either the higher-priced and the lower-priced brand were tasted, or subjects were not allowed to taste the brands. Actually, the brands were physically identical (i.e., they only differed in price). Price was a within-subjects factor, and information and product experience were between-subjects factors. Product experience and information about quality differences did not influence quality perceptions. Price had a significant influence on quality perceptions of potato chips (for orange juice the price effect was significant at $p = .068$). The interactions between price and information about quality differences, and between price and product experience were not tested. Therefore, the study of Brooker et al. provides no information about the moderating effect of quality differences and product experience on the relationship between price and perceived quality.

Brand name

Bellizzi et al. (1981) and Rosen (1984) explored brand name as a cue to perceived quality. Consumer perceptions of national brands, private brands, and generic brands (i.e., unnamed brands) were collected for a variety of grocery products. National brands rated the highest on perceived quality, and generic brands rated the lowest. Further, Rosen found that the low overall quality rating for generic brands was unrelated to consumers' familiarity with the generic brand for almost half of the product categories studied.

Note that in these studies the effect of brand name on perceived quality was confounded with price (generic brands are relatively cheap, and national brands are relatively expensive), and with the 'physical product' cue (it is not likely that national, private, and generic brands are physically identical). These studies nevertheless provide some evidence that brand name can act as a quality cue.

Other cues

Gaedeke (1973) studied the relationship between country of origin and perceived quality. He found that subjects use country of origin as quality cue when it is the only information available.

The effect of physical characteristics of the product (the 'physical product' cue) was investigated by Woodside and Taylor (1978). The product chosen was peanut butter. Their results showed that quality perceptions were significantly affected by the 'physical product' cue. Further, a strong link between perceived

quality and (national) advertising was found. Subjects associated high quality with a high level of national advertising.

Price in choice behavior
Lambert (1970, 1972) explored the role of price in choice behavior. Seven products were chosen: toothpaste, battery-powered tape recorder, luggage, tennis racket, portable stereo phonograph, instant coffee, and suntan lotion. These products were familiar to the subjects (200 undergraduate students), and covered a relatively wide range in price, risk, and technical complexity. The subjects were given descriptions of three fictitious brands of each product, identified by letters. The 'brands' were identical except for price. They carried low, medium, and high prices. The subject was instructed to select for each product the brand s/he would purchase from among the three available. Thus, Lambert did not study quality evaluation directly. However, a number of his results yield insight into the quality perception process. He found that, generally, subjects who chose the high-priced 'brand': (1) perceived large variation in quality within the product category, (2) perceived the consequences of a poor choice as being particularly undesirable, (3) had confidence in price as a quality indicator and, rather surprisingly, (4) regarded themselves as good judges of product quality, and (5) had an often high perceived experience in purchasing the product. In line with the studies of Leavitt, Tull et al., and Lambert, Obermiller and Wheatley (1984, 1985) reported a strong tendency among subjects to choose the higher-priced alternative when perceived quality differences between brands of the product were large.

Summary of the empirical results of the single-cue studies
Table 4.1 summarizes the research dealing with the effect of a simple cue on perceived quality. Only those studies that deal directly with perceived quality are included in the table. The review covers the period from 1932 (or the first major single-cue study) up to and including 1987.
The results of a meta-analysis of the studies listed in Table 4.1 are reported in Section 4.2.3.

4.2.2. Multiple-cue studies

Single-cue studies have been criticized for their lack of realism. When subjects are provided with information about a single cue only, they naturally use that cue to evaluate quality. Stafford and Enis (1969, p. 456) put it in the following way: 'It appears obvious to us that if price data provide the only clue to product quality, then perceived quality should be expected to vary directly with price'. Their criticism applies to other cues as well. In real purchase situations, consumers usually have information about a number of quality cues, such as price, brand name, and place of purchase. Further, in single-cue studies it is implicitly assumed that cues do not interact in the quality perception process since cue effects are studied in isolation. Single-cue experiments are not valid when the effect of a specific cue on perceived quality is dependent on other cues.

Table 4.1. Summary of the single-cue studies dealing with cue effects on perceived quality

Reference	Product(s)	Quality cue/ Other variables	Main effect	Interaction
Laird (1932)	stockings	scent	yes[a]	-
McConnell (1968a,b,c)	beer	price	no	-
Gardner (1970)	suits;	price;	yes	no
	shirts;	product type	yes	
	toothpaste			
Peterson (1970)	soft drink concentrate	price	yes	-
Deering &	gasoline;	price level;	yes	yes
Jacoby (1972)	slacks;	price range	yes	
	shoes			
Gaedeke (1973)	products in general; electronic items; textiles	country of origin	yes	-
Shapiro (1973)	stockings; cologne; carpeting; sweater; reclining chair	price	yes	-
Woodside (1974), Woodside & Sims (1974)	electric lunch box	price	yes	-
Woodside & Taylor	peanut	physical		
(1978)	butter	product	yes	-
Bellizzi et al. (1981)	grocery products	branding	yes	-
Rosen (1984)	grocery products	branding	yes	-
Obermiller &	margarine	price;	not tested	yes
Wheatley (1985)		perceived quality differences	not tested	
Brooker et al. (1986)	potato chips (PC); orange juice (OJ)	price; information about quality differences; product experience	only for OJ no no	no
Petroshius & Monroe (1987)	calculator (C); typewriter (T)	price range (PR); price differential (PD); price position (PP)	only for C no yes	only for C: PR x PD, PR x PP

[a] Laird did not report the significance value of his results. Calculations by the present author revealed that the effect of the scent cue was significant at p = .001.

Price and store name

To overcome the limitations of the single-cue studies, Stafford and Enis (1969) investigated the simultaneous effect of two quality cues, price and store name/ image, on the perceived quality of carpet.[1] Four identical samples of carpet were presented to each of the study's 178 subjects. The subjects were told that the samples were of similar color, texture, and weave, but were from two different stores and were priced at two different levels. Each subject received all four combinations (high or low price, and high- or low-prestige store). They were asked to rate each sample on a five-point scale ranging from very low quality (=1) to very high quality (=5). Price was found to exert a significant main effect on perceived quality. The main effect of store name was not significant. Further, the price x store name interaction was significant. High-priced carpet obtained from a high-prestige store received an extra high quality evaluation. The interaction between price and store name found by Stafford and Enis underlines the relevance of studying the effects of several cues on perceived quality simultaneously.

Price and brand name

Gardner (1971) explored whether there is a generalized price-quality relationship across products if brand name is also available. He chose three products, toothpaste, shirts, and suits. According to Gardner, these products represent the extremes and the midpoint with regard to frequency of purchase and search time continuum, and stand for different shopping patterns and price ranges. Five prices and a sixth nonprice condition were distinguished for each product. The brand name cue was manipulated at two levels (present or absent). The three products comprised the third factor of the experimental design. For each of the three products, subjects were presented with a card describing its selling points, the particular price, and either the brand name or not. The product profiles were evaluated on quality and other dependent variables.

Gardner found significant main effects of product and brand name on perceived quality and, in addition, a significant interaction between the two. No significant effects of price were found. He concluded that the existence of a generalized price-quality relationship, as implicitly assumed by Gabor and Granger, among others, can be seriously questioned. It is interesting to note that in an earlier study, involving the same three products and price but not brand name, Gardner (1970) found a significant main effect of price (see Table 4.1). Comparison of these two studies suggests that the importance of price as a quality cue is seriously reduced when brand name information is available to subjects. Gardner's studies indicate that brand name is a more powerful quality cue than price.

Price, brand name familiarity, and store name

Andrews and Valenzi (1971) investigated the role that price, brand name familiarity, and store name play in the quality perception process. The products

[1] In the Stafford and Enis study, as well as in other studies involving the store name cue, the terms 'store name' and 'store image' are used interchangeably since the effect of store name was usually measured by store image.

chosen were sweaters and shoes. Each cue was varied on three levels. Cue levels were combined to produce 3 x 3 x 3 = 27 hypothetical sweaters (or shoes). Subjects rated each sweater and shoe profile on a nine-point quality scale ranging from poor quality (=1) to excellent quality (=9). The results for both products were highly similar. All three cues had a significant main effect on perceived quality. Further, the price x brand name familiarity interaction and the price x brand name familiarity x store name interaction were significant. The results indicate that the lower the price, the greater the influence of brand name. However, price was clearly the dominant quality cue. A somewhat similar result was obtained by Render and O'Connor (1976) in whose study price was the most important quality cue. Store name was of small and brand name was of negligible importance.

Studies involving the physical product as quality cue

Jacoby et al. (1971) examined the relative effects of price (present-absent), brand name (present-absent), and physical differences across product samples (present-absent) on quality perceptions for three samples (brands) of beer. Price, brand name, and physical differences were between-subjects factors. The samples of beer were a within-subjects factor. Subjects tasted each of the three beer samples and evaluated its overall quality on a graphical rating scale with endpoints labeled as 'worst beer' and 'best beer'. It was found that only the main effect of the product sample factor was significant. Price did not exert a significant effect on quality perceptions, except when it was the only cue provided to subjects. Thus, the results of the price-only condition supported the findings of most single-cue studies involving price. Brand name affects perceptions of quality only when the actual products (i.e., beer samples) are physically different (different in taste, aroma, etc.). Other interactions between cues were also found by Jacoby et al., but these were difficult to interpret. Jacoby et al. concluded that cues affect quality evaluations primarily through interactions with other cues.

Szybillo and Jacoby (1974) examined the relative effects of price, store image, and the physical product on the perceived quality of nylon hose. They found that (1) physical differences in product samples had a greater effect on perceived quality than the other cues, and (2) price exerted no significant influence on perceived quality. Cues did not interact in the Szybillo and Jacoby study.

Pincus and Waters (1975) extended the research of Jacoby et al. and Szybillo and Jacoby by varying the availability of the product sample cue through packaging. Three physically different ball-point pens were offered in plastic wrapper or unpackaged. Further, price was manipulated at two levels (absent vs. present). Their study also showed that the physical product had the greatest effect on perceived quality, even if the availability of this cue was limited by packaging. Price had no significant effect.

The physical product was also the most important quality cue in the study of Wheatley et al. (1981). However, the relationship between physical quality and perceived quality was found to be nonlinear. Increasing levels of physical quality had a decreasing marginal positive effect on quality evaluations. This result was explained on the basis of Weber's law which states that the difficulty in perceiving a change in intensity level of a stimulus (e.g., physical quality) is

positively related to the intensity level itself. Wheatley et al. reported a significant and linear relationship between price and perceived quality. The results suggest that the effect of price on perceived quality increases with increasing levels of physical quality.

The relative importance of the physical product cue vis-à-vis other quality cues has also been investigated by Nevid (1981), Jun and Jolibert (1983), and Davis (1985). Davis reported that the physical quality of skirts was more important than their brand name. Nevid found for a rather homogeneous product, carbonated bottled water, neither a main effect for the physical product cue nor for brand name. However, the physical product x brand name interaction was significant. The higher-status beverage rated significantly higher on product quality than the lower-status beverage, but only when brand labels were present. The findings are in line with Jacoby et al. (1971). Branding might be particularly helpful for products like beer and carbonated bottled water where consumers have difficulty in evaluating the quality solely on the basis of physical quality cues.

Jun and Jolibert (1983) hypothesized that the importance of physical quality cues depends on the possibility of sensory observation of quality prior to purchase. If it is difficult for a consumer to evaluate product quality prior to purchase on the basis of the physical product s/he will mainly use nonphysical quality cues such as price. However, if the physical product provides quality cues by itself, other quality cues will be relatively unimportant. Their hypothesis was tested for batteries, envelopes, and electronic lighters. Pretests indicated that batteries are difficult to evaluate by the physical product only, whereas envelopes are mainly judged by the product itself. Electronic lighters lie somewhere in between. In their study three cues were manipulated, each on two levels: price, physical product (i.e., two different physical products), and country of origin, resulting in eight different combinations per product. A subject evaluated one combination for each product. The results supported the authors' hypothesis. The physical product cue had a significant effect on quality ratings of envelopes but not on quality ratings of batteries. The opposite effect was found for price and country of origin. All three cues had a significant main effect on the quality evaluation of electric lighters. No significant interactions between cues were found in their study.

Country of origin and price

Apart from the Jun and Jolibert study (1983), the effects of country of origin and price have been explored by White and Cundiff (1978) and Lambert (1981). White and Cundiff studied the effects of these two cues for lift trucks, dictation systems, and machine tools. Price was manipulated on three levels and country of origin on four levels. Cue levels were combined to construct 12 hypothetical product profiles. Subjects evaluated one profile for each product. A significant main effect for country of origin was found. Neither the main effect of price nor the price x country of origin interaction was significant for any of the three products. Lambert replicated the White and Cundiff study for dictation systems, employing somewhat different cue manipulations. Two groups of subjects were interviewed: experts, i.e., purchase agents, and students. For the students, Lambert reported the same results as White and Cundiff. The experts

yielded somewhat different results. In line with the students and the White and Cundiff study, the main effect of country of origin was much stronger than the main effect of price. However, none of the effects were statistically significant. No clear explanation was put forward for the observed differences between experts and students.

Product information, store image, price, and order of price presentation
Rexeisen (1982) observed that previous pricing studies usually had not reported any randomization of price level presentations. He suggested that either randomization is so basic that it need not be mentioned, or researchers implicitly assume that order of price presentation will not affect quality ratings. He conducted a study to examine the effects of product information, store image, price, and order of price presentation on quality perceptions. The product chosen was carpet. The product information cue consisted of two levels (with or without product information on density, thickness, and composition). Store image was also manipulated on two levels (department store vs. carpet speciality store). Price was manipulated on three levels (no price, $ 7, $ 29 per square yard) and order of price presentation on two levels (no price-$7-$29, no price-$29-$7). Subjects were randomly assigned to one of the four treatment conditions of product information and store image. Within treatment conditions subjects evaluated three physically identical carpet samples, under one of the two levels of order of price presentation levels, on perceived quality and other dependent variables. Multiple measures were taken of each variable. Rexeisen found the main effects of product information, store image, and price on perceived quality to be nonsignificant. Significant effects were obtained only for the main effect of order of price presentation, and for the interactions between order of price presentation and product information, and between order of price presentation and price. Rexeisen concluded that ordering effects, if uncontrolled, may seriously confound the interpretation of cue effects. He suggested that price (and other cue) levels must be randomized in within-subjects designs.

Influence of consumer characteristics on the quality perception process
In several studies the influence on the quality perception process of consumer variables such as nationality, income, and product familiarity have been investigated.
Peterson and Jolibert (1976) studied the relative effects of price and brand name in a cross-national setting. The subjects were American and French students. The product selected was a soft drink concentrate. Nationality accounted for more than 50% of the variance explained in quality evaluations, French subjects tending to rate both brands higher in quality. There was also a significant main effect of brand name. In general, the French brand was perceived to be of higher quality. Price had no significant main effect on quality perceptions. The nationality x brand name and nationality x brand name x price interactions were also significant, but hard to interpret. A weakness of the Peterson and Jolibert study is the operationalization of the brand name cue. They used two unknown brand names from different countries of origin. Thus, brand name was confounded with country of origin. It seems likely that country

of origin was more salient in shaping the effect of the brand name cue than the actual brand names used, since unknown brand names are supposed to generate fewer cognitive and affective responses than illustrious countries such as France and the U.S.A. In sum, it appears to us that Peterson and Jolibert actually tested the effects of price and country of origin across nationalities.

Wheatley and Chiu (1977) investigated the effects of the quality cues price, store image, and color, and the consumer characteristics income and educational level on the quality perception of carpet. Each cue was manipulated on two levels. Carpet samples were presented under one of the eight possible price/store image/color combinations in the 2 x 2 x 2 design. The carpet samples were physically identical except for the color cue. Each subject rated the eight samples on a five-point scale, ranging from low quality (=1) to high quality (=5). It was not feasible to control for income and educational level. The main effects of price, store image, color, income, and educational level were all significant, price being the dominant factor. Income had a positive effect and educational level a negative effect on quality perceptions. Further, complex interactions between quality cues and consumer characteristics were found. Wheatley and Chiu acknowledged that they were not able to explain the results with respect to income and education. However, their results indicate that the marketing mix variables are more important than socioeconomic factors in terms of their impact on consumer perceptions of quality.

Wheatley et al. (1977) examined the influence of prior product experience with the product category, price, and brand name on quality perceptions. They hypothesized that nonusers of the product in question would rely more on the price and brand name cues than users. This hypothesis was partially derived from Scitovsky's (1945) suggestion that consumers who lack experience with a product would be more inclined than users to utilize price in assessing product quality. Skis were chosen to test the hypothesis. Price and brand name were both manipulated on two levels. Each subject evaluated the four hypothetical ski alternatives on a five-point scale ranging from low quality (=1) to highest quality (=5). Half of the subjects were skiers (i.e., had experience with the product category) while the other subjects were non-skiers (i.e., had no experience). The main effects of price and brand name, and the price x brand name interaction were significant. The effect of brand name was greater at the high price than at the low price. No support was found for the hypothesized effect of product experience on cue effects. No significant effects involving product experience were observed. Wheatley et al. concluded that product usage alone apparently does not guarantee a degree of expertness with regard to product quality sufficient to rule out price or brand name as useful cues.

Raju (1977) studied the role of a concept similar to product experience, i.e., familiarity with the product category, in the quality perception process. He conducted two experiments with stereo receivers. In these experiments product familiarity was measured by having subjects rate their own familiarity with stereo receivers on a seven-point scale ranging from not at all familiar (=1) to extremely familiar (=7). In the first experiment he found that: (1) product familiarity did not significantly influence the range of acceptable prices, and (2) product familiarity was related significantly and positively to the degree of confidence in brand selection in a purchase situation. Raju's second experiment

involved the influence of product familiarity, price, and brand name on perceived quality and other dependent variables. He hypothesized that product familiarity would mediate the effects of price and brand name on perceived quality. Nine different price levels were included in the study. Brand name was manipulated on three levels. Subjects rated each brand name-price combination on a 1 (=low quality) to 7 (=high quality) scale. Subjects were divided into a low familiarity group and a high familiarity group, according to their rating on the seven-point familiarity scale (see above). The hypothesized effects were not found. The main effect of product familiarity and the interactions with price and brand name were not significant, whereas the main effects of price and brand name, and the price x brand name interaction were significant. Brand name had a greater effect on perceived quality at higher prices than at lower prices. Thus, Raju (1977) and Wheatley et al. (1977) obtained similar results, although using different products and different operationalizations of consumer expertise (product familiarity vs. product experience).

Stokes (1985) investigated product familiarity at the brand name level. He distinguished between familiarity with the brand under consideration (the 'test' brand) and the familiarity with other brands. The product chosen was rice. Familiarity with the test brand was manipulated by providing the subject either with a familiar brand or with an unfamiliar brand. Familiarity with other brands was manipulated by presenting the test brand together with a familiar or unfamiliar array of competitive brands. Other cues included in the study were price of the test brand and package design of the test brand. Sixteen treatments were constructed, consisting of different combinations of test brand familiarity, familiarity with competitive brands, price, and package design. Each treatment (i.e., the familiar or unfamiliar test brand with a specific price level and packaging against a background of other familiar or unfamiliar competitive brands) was shown on a separate color photo. Each subject evaluated one treatment on perceived quality and other dependent variables. All four cues had a significant main effect on perceived quality. However, test brand familiarity had by far the greatest effect. In this respect, the results of Stokes' study differ from the results obtained by Andrews and Valenzi (1971). The latter researchers found that price was more important than brand name familiarity.

The number of cues used

In the context of multiple-cue studies it is useful to give some attention to the number of cues consumers use in their quality perception process. Olson and Jacoby (1972) and Kupsch et al. (1978) have investigated this issue for several products. Olson and Jacoby reported the following average number of cues used by consumers in evaluating quality: hair dryer 5.97, living room rug 7.17, ground coffee 4.64, shampoo 5.13, and aspirin tablets 4.51. Kupsch et al. found similar results for different products: refrigerator 6.43, TV set 6.09, and washing machine 5.86.

These results suggest that consumers use on an average 4 to 7 cues in the formation of quality perceptions. This accords with studies on the information processing capacity of individuals (Miller 1956, Simon 1974). Further, the findings tentatively suggest that consumers use more cues in the quality perception process with respect to durables than for nondurables.

In our opinion the results of the studies of Olson and Jacoby, and Kupsch et al. should be interpreted with caution. In both studies the data were based upon self-reports rather than actual cue use. Actual cue usage might be lower, and could depend on personal factors (e.g., product experience, perceived quality risk) and situational factors (e.g., time pressure).

Summary of the empirical results of the multiple-cue studies

Table 4.2 provides a summary of the research dealing with the effects of cues (and other variables) on perceived quality. The review covers the period from 1969 (the first major multiple-cue study) up to and including 1987. A final remark on the quality cue 'physical product' seems appropriate. As has already

Table 4.2. Summary of the multiple-cue studies dealing with cue effects on overall quality evaluation

Reference	Product(s)	Quality cues/ Other variables	Main effect	Interaction
Stafford & Enis (1969)	carpet	price (P); store name (SN)	yes no	P x SN
Gardner (1971)	suits; shirts; toothpaste	price (P); brand name (B); product type (PT)	no yes yes	B x PT
Andrews & Valenzi (1971)	sweaters shoes	price (P); brand name familiarity (BF); store name (SN)	yes yes yes	P x BF; P x BF x SN
Jacoby, Olson & Haddock (1971)	beer	price (P); brand name (B); physical product (PP); product samples (PS)	no no no yes	B x PS; PP x PS; P x B x PP x PS
Szybillo & Jacoby (1974)	nylon hose	price (P); store image (S); physical product (PP)	no yes yes	no
Pincus & Waters (1975)	ball point pens	price (P); packaging (PA); physical product (PP)	no no yes	PA x PP
Peterson & Jolibert (1976)	softdrink concentrate	price (P); brand name (B); nationality (N)	no yes yes	P x N; P x B x N
Render & O'Connor (1976)	shirts (H) radios (R) after shave lotion (A)	store name (SN); brand name (B); price (P)	only for A no yes	P x B (only for A)
Wheatley & Chiu (1977)	carpet	price (P); store image (S); color (C); income (I); educational level (E)	yes yes yes yes yes	P x C; P x I; S x I; P x C x E; C x I x E

Table 4.2. Continued

Reference	Product(s)	Quality cues/ Other variables	Main effect	Interaction
Wheatley, Walton & Chiu (1977)	skis	price (P);	yes	no
		brand name (B);	yes	
		product experience (PE)	no	
Raju (1977)	stereo receivers	price (P);	yes	P x B
		brand name (B);	yes	
		product familiarity (PF)	no	
White & Cundiff (1978)	lift truck; dictation system; machine tool	price (P);	no	no
		country of origin (CO)	yes	
Lambert (1981): experts	dictation system	price (P);	no	no
		country of origin (CO)	no	
Lambert (1981): students	dictation system	price (P);	no	no
		country of origin (CO)	yes	
Wheatley, Chiu & Goldman (1981)	carpet	price (P);	yes	no
		physical product (PP)	yes	
Nevid (1981)	carbonated bottled water	brand name (B);	no	B x PP
		physical product (PP)	no	
Rexeisen (1982)	carpet	price (P);	no	P x OP;
		store image (S);	no	PI x OP
		product information (PI);	no	
		order of prices (OP)	yes	
Jun & Jolibert (1983)	electronic lighters (L); batteries (B); envelopes (E)	price (P);	yes (not for E)	no
		country of origin (CO);	yes (not for E)	
		physical product (PP)	yes (not for B)	
Stokes (1985)	rice	price (P);	yes	P x FC;
		packaging (PA);	yes	PA x BF;
		brand name familiarity (BF);	yes	PA x BF x FC
		familiarity with competitive brands (FC)	yes	
Davis (1985)	skirts	brand name (B);	yes	no
		physical product (PP);	yes	
		fashion awareness (FA)	yes	

been mentioned, this cue represents actual physical differences between the brands that can be observed by consumers. Unfortunately, the operationalization of the physical product cue was frequently ambiguous. Brands could differ simultaneously on a number of unidentified physical product cues. Combining these cues into a single cue means that the contribution of separate physical cues cannot be determined.

4.2.3. A meta-analysis of the single-cue and multiple-cue studies

Data

Tables 4.1 and 4.2 present a fairly comprehensive overview of the research concerning the effects of single cues and multiple cues on perceived quality, respectively. A detailed discussion of the methodological aspects of cue studies has been reported elsewhere (Olson 1972, 1977, Monroe and Krishnan 1985) and will not be repeated here. Instead we will focus on the issue whether these studies support a generalized relationship between a certain cue and perceived quality, regardless of subjects, the product chosen, and other conceptual and methodological considerations. This question can be adressed by conducting a meta-analysis on the studies reported in Tables 4.1 and 4.2.

Analysis

Meta-analysis is defined as 'a quantitative approach to the integration of findings from several individual studies of a research question' (Houston et al. 1983, p. 497). Meta-analysis can be applied to determine the degree to which a set of studies collectively supports the hypothesis that there is a relationship between a cue and perceived quality. Several meta-analytic procedures are available.

The simplest procedure is the 'vote-counting method' (Hedges and Olkin 1980, Ryan and Barclay 1983). In the vote-counting method one determines for each observation and for each cue whether or not its effect on perceived quality was statistically significant.[2] If the number of significant effects exceeds the number of nonsignificant effects it is assumed that there is a 'true' relationship between that cue and perceived quality. However, the vote-counting method is of limited value since it does not provide insight into the overall significance of the relationship between a cue and perceived quality. The difference between the number of significant and the number of nonsignificant results might sometimes be very small whereas the overall relationship is highly (in)significant.

A more powerful test of the relationship between a cue and perceived quality is provided by the 'method of adding Zs'. This method belongs to a set of meta-analytic techniques which yield an estimate of the overall probability that the probability levels found in the individual studies could have occurred if the null hypothesis of no relationship between the two variables were true. The method of adding Zs is the most applicable of this set of techniques under the

[2] In the vote-counting method, the studies usually are classified into three categories: studies yielding positive significant results (i.e., supportive of the hypothesis), studies yielding negative significant results, and studies yielding nonsignificant results. However, no results with respect to the second category have been reported in the quality cue studies.

largest range of conditions (see Rosenthal 1978 for an overview of the different techniques and their strengths and weaknesses).
The method of adding Zs requires that the p-values of the cue effects are converted into standard normal deviates, or Zs, associated with these p-values. The p-values must be one-tailed. The Zs are added and the sum is divided by the square root of the number of studies (N) being combined. The new statistic, Z_c, is distributed as Z, and its significance can be tested using the standard normal deviates table. In formula:

$$(4.1) \quad Z_c = \sum_{i=1}^{N} Z_i / N^{1/2}$$

If Z_c is significant it can be concluded that the null hypothesis of no relationship between the cue in question and perceived quality is rejected.
It has been observed that the overall significance of a relationship as calculated on the basis of the studies reviewed might be biased (McNemar 1960, Rosenthal 1979). Studies reporting significant results might have a better chance of being published in the academic literature. Further, not all studies published might be retrieved by the reviewer. To cope with this problem, Rosenthal (1979) developed a formula to estimate the number of other studies (X) reporting a p-value of .50 that must exist in order to reduce the overall significance level to an unacceptable level (usually taken as $p > .05$). Rosenthal's formula is ($p = .05$):

$$(4.2) \quad X = [(\sum_{i=1}^{N} Z_i)^2 / 2.706] - N$$

where Z and N are as defined above.
No firm guidelines exist as to what constitutes an unlikely number of unretrieved or unpublished studies. However, Rosenthal (1979) proposed the following conservative rule: if $X \geq 5N + 10$, then it can be safely assumed that the overall results obtained are resistant to sampling bias.
In order to apply the method of adding Zs the p-values of the effects must be known (about the same goes for the other methods described by Rosenthal 1978). Unfortunately, in a number of cases exact p-values were not reported. Further, the way effects were tested differed considerably between studies, and in some cases the procedure used is questionable (cf. Olson 1977). Therefore, we decided to follow a rather conservative approach. Following Rosenthal (1979) and Monroe and Krishnan (1983) we assumed that (1) reported statistical insignificance without a corresponding p-value was at a p-value of .50[3], and (2) that all statistical significance of less than .01 was equivalent to a p-value of .01. If we still find an overall statistically significant cue effect under these conditions we can be reasonably sure that we are not capitalizing on inaccurately estimated or vaguely reported p-values (cf. Monroe and Krishnan 1983).

[3] When a p-value was only vaguely reported and it exceeded .01, we used the upper limit in the analyses. For example, if it was reported that $p < .25$, we used $p = .25$.

We explored the question whether previous research supports a generalized relationship between a certain cue and perceived quality for the single-cue and the multiple-cue studies separately.[4] This was done because it has been suggested in the literature that demand characteristics might have had a considerable influence on the results obtained in a single-cue study, since many subjects will have guessed the purpose of the study and behaved accordingly (see above). Without separate analyses for both types of cue studies, the probability of incorrectly concluding that a certain cue and perceived quality are significantly related, is increased.

Since we wanted to examine whether a generalized relationship between a certain cue and perceived quality exists, the meta-analysis was conducted on cue main effects.

A meta-analysis was only carried out for a certain cue if at least three observations were available. Thus, a meta-analysis was conducted for price (in case of the single-cue studies), and for price, brand name, store name, country of origin, and the physical product (in case of the multiple-cue studies).[5] In order to have a reasonable number of observations no distinction was made between brand name and brand name familiarity, and between store name and store image.

In the single-cue studies of Shapiro and Brooker et al., and in the multiple-cue studies of Andrews and Valenzi, Render and O'Connor, White and Cundiff, and Jun and Jolibert, cue effects were investigated for each product separately. Each of these products counts as one study. Gardner (1970, 1971) also included several products in his experiments. However, in these studies the results were not analyzed separately for each product. Therefore, each of his studies was counted as a single observation.

Results

The studies reported in Tables 4.1 and 4.2 were meta-analyzed with the vote-counting method as well as with the method of adding Zs.[6]

Vote-counting method. The effect of price was statistically significant at the .05 level for 9 out of 11 single-cue observations. With respect to the multiple-cue studies, most of the main effects reported were significant for all five cues: price

[4] We are not so much interested in differences between specific cue levels, but in the question whether a certain cue affects quality perceptions. For example, we are not interested in the issue whether quality ratings differ significantly between countries of origin A, B, and C, but whether country of origin has any effect on perceived quality at all. Conceptual difficulties arise, however, when theory suggests a certain direction in the effect of the cue levels and empirical findings yield a significant F-statistic but the mean quality ratings of the cue levels are in the wrong direction, e.g., low price rates higher than high price rates. Inspection of the data revealed that this situation was not encountered (see footnote 2, this chapter).

[5] The meta-analysis was carried out for each cue separately. This procedure leads to inflated results if cues are moderately or strongly correlated. However, factorial designs were employe in the studies.

[6] Before conducting the meta-analysis the studies were tested for homogeneity of results. When the p-values differ substantially between studies this indicates that the results may be influenced by factors such as sampling error, measurement error, and the range in cue levels used. The statistical significance test for homogeneity of Zs is: $\Sigma\ (Z_i-\bar{Z})^2$ which is distributed as χ^2 with N-1 degrees of freedom (Monroe and Krishnan 1983). For none of the cues was the χ^2-value significant at $p = .10$. Thus, the studies were relatively homogeneous with respect to the p-value reported for a certain cue effect.

13 out of 25 cases, brand name 8 out of 13, store name 5 out of 9, country of origin 6 out of 8, and physical product 6 out of 9.

Method of adding Zs. Applying formula (4.1) to the studies reviewed in Table 4.1 shows that the generalized effect of price was highly significant in the single-cue studies ($Z_c = 6.77$, $p < .0001$). In multiple-cue studies, Z_c was highly significant ($p < .0001$) for all cues: price $Z_c = 6.34$, brand name $Z_c = 5.75$, store name $Z_c = 4.31$, country of origin $Z_c = 5.39$, and physical product $Z_c = 4.43$. The overall significance of the relationship between a cue and perceived quality was resistant to sampling bias. Applying formula (4.2) to the multiple-cue studies yielded the following number of additional studies (with $p = .50$) required to lower the overall probability level to .05[7]: price 346 studies, brand name 146 studies, store name 53 studies, country of origin 78 studies, and physical product 57 studies. For the single-cue studies concerning price, the number of additional studies needed is 176. For all cues, including price in the single-cue experiments, X exceeded 5N + 10, the only exception being store name. X was almost equal to 5N + 10 for that cue (X = 53, 5N + 10 = 55). Given the conservative procedure followed in establishing p-values (see above), it seems reasonable to posit that the multiple-cue studies involving store name indicate that, overall, store name and perceived quality are significantly related.

Conclusions

It can be concluded that across the set of single-cue and multiple-cue studies reviewed, and across two meta-analytic techniques, considerable support exists for the hypothesis that price, brand name, store name, country of origin, and the physical product influence quality perceptions. The finding that these cues affect quality perceptions does not imply, however, that they will have a significant effect on perceived quality for all products and in all situations. The number of published studies is not large enough to study the mediating role of personal and situational characteristics on cue effects.

4.3. Cue effects on quality attributes

Section 4.2 reviewed studies exploring cue effects on overall perceived quality. In this section we will briefly discuss the empirical research with respect to the effects of quality cues on specific quality aspects or attributes such as taste, durability, and nutritional value. In these studies no clear distinction was made between quality cues and quality attributes. The studies to be discussed were exploratory in character and lacked a theoretical basis. No concepts were tested. One of the purposes of the present study is to distinguish between quality cues and quality attributes conceptually, and to explore the relationships between these concepts theoretically and empirically. (See further Chapter 5.)

Britt (1960) found that the *color* of syrup influenced its perceived thickness. Darker syrup was perceived to be thicker. Cox (1967a) reported the results of

[7] The estimates may actually be somewhat too high since some studies yielded more than one observation.

an experiment on the relationship between the color of ice cream and its perceived richness of flavor. It was found that cream-colored 14% butterfat ice cream was judged to be richer in flavor than white-colored 16% butterfat ice cream.

Brown (1958) reported a significant effect of *packaging* on the perceived freshness of bread. Subjects perceived bread to be fresher when wrapped in cellophane than when wrapped in wax. In fact, the bread samples were of equal freshness. A similar result was obtained by McDaniel and Baker (1977) with respect to potato chips. In their study, identical potato chips, all very fresh, were placed in easy-to-open wax-coated paper bags and hard-to-open polyvinyl bags. Subjects were asked to open each bag and taste the chips. Chips in the polyvinyl bag were perceived as both crisper and tastier. In a blind taste test, however, no significant differences were found in either crispness or taste between the contents of the two types of package. Makens (1965) and Friedman and Dipple (1975) found similar results for *brand name*. Makens, for example, reported that the taste evaluation of (identical samples of) turkey meat was influenced by the brand name.

A number of researchers have investigated the effects of the *physical product* and *price*, or *brand name*, on perceived taste (Allison and Uhl 1964, Andrews and Valenzi 1970, Valenzi and Andrews 1971, Cimbalo and Webdale 1973, Valenzi and Eldridge 1973, Rigaux-Bricmont 1982). All these studies showed that cognitive information about brand name (Allison and Uhl 1964, Rigaux-Bricmont 1982) or price (the other studies mentioned above) exert a significant influence on taste evaluations, even when subjects were not able to distinguish between the product samples in a blind taste test. For example, Allison and Uhl found that subjects could not distinguish the taste difference among ten brands of beer when the bottles were unlabeled. However, when the (correct) brand labels were attached to the bottles, significant differences in taste ratings between brands were observed. The effect of physical product on taste was significant in the studies of Valenzi and Andrews (1971), Cimbalo and Webdale (1973), and Rigaux-Bricmont (1982).

Asam and Bucklin (1973) explored the effects of *nutritional information*, *brand/price*, and *store/location* on ratings of canned peas with respect to taste, tenderness, and wholesomeness, among other evaluations. They felt that these concepts would tap the various dimensions of quality with respect to canned peas. Significant effects were found for all three quality cues. For instance, the results showed that nutritional labeling improved consumer perceptions of canned peas with regard to the quality attributes wholesomeness and tenderness.

Nutritional information was also included in the studies of Peterson (1977) and Rudell (1979). Peterson investigated the effects of color, price, and nutritional information on the perceived nutritional value of the bread and on the perceived percentage of whole wheat contained in the bread. All bread samples were identifical. It was found that nutritional information had a significant effect on the perceived percentage of whole wheat but not on the perceived nutritional value. Color exerted a significant effect on both quality attributes, and price on none of the attributes. Color was by far the most important cue for both attributes. In contradiction to Peterson, Rudell did find a significant effect of nutritional information on perceived nutritional value.

Jun and Jolibert (1983) studied the quality perception process with respect to lighters. *Price* and *country of origin* exerted a significant effect on perceived performance & durability (and on overall quality; see Section 4.2.2). The *physical product* had a significant effect on external appearance, and on performance & durability (and on overall quality). Country of origin effects were also reported by Nagashima (1970) and Bannister and Saunders (1978).
Etgar and Malhotra (1981) conducted an elaborate investigation into the effects of the quality cues *sole*, *color*, *upper*, *price*, and *place of purchase* on overall quality and on three quality attributes (comfort, durability, style) for sneakers. It was found that the relative importance varied substantially across quality attributes.
Table 4.3 provides a summary of the research dealing with the effects of quality cues on quality attributes.[8] A cue effect is considered significant when its p-value does not exceed .05. The studies of Britt (1960) and Cox (1967a) are not included since no significance level was reported and no information was provided about the magnitude of the effect.
A meta-analysis on Table 4.3 is not very insightful. Only for the price-taste and the physical product-taste combination are more than two observations available. The four studies on the impact of price on taste perception all reported a significant result. The overall significance level for these four studies was $p < .0001$. Obviously, given the small number of studies, the conclusion that there exists a generalized relationship between price and taste is tentative. This is also shown by the fact that only 20 additional studies reporting a p-value of .50 are required to lower the overall probability level to .05, a number insufficient to satisfy the requirement that $X \geq 5N + 10$; see Section 4.2.3). For the physical product-taste combination the results are even less conclusive: $p = .003$ and only 10 additional studies reporting a p-value of .50 are required.
Table 4.3 lists some quality attributes for different products. The specific quality attributes are highly dependent on the product or product category in question. It makes sense to consider taste as a possible quality attribute among food products, but taste is meaningless relative to quality assessments of vacuum cleaners. The level of aggregation within a broadly defined product category (e.g., food products) is an important factor. For example, nutritional value is an important quality attribute for food products in general (Steenkamp et al. 1986c), but not for meat products. Another example, exclusiveness is a quality attribute for meat products in general, but it seems unlikely that this attribute is used by consumers to compare the quality of different varieties of bacon. Thus, the product attributes relevant to the formation of quality perceptions are to a large extent product specific. Quality attributes can be identified for different products and at different levels of abstraction.

[8] In some studies, taste and quality are confused (e.g., Valenzi and Andrews 1971, Rigaux-Bricmont 1982). These studies used a hedonic scale but the results were discussed as if a quality scale was used. This would imply that taste and quality are the same concepts, an assumption not supported in the literature (see above). Therefore, these studies are included in Table 4.3 and not in Table 4.2.

Table 4.3. Summary of the research dealing with cue effects on specific quality attributes.

Reference	Product(s)	Quality attribute(s)	Quality cue(s) / Other variable(s)	Main effect	Interaction
Brown (1958)	bread	freshness	packaging	yes	-
Allison & Uhl (1964)	beer	taste	brand name identification; physical product	yes no	not tested
Makens (1965)	turkey meat	taste	brand name	yes	-
Andrews & Valenzi (1970)	margarine/ butter	taste	price; physical product	yes not tested	not tested
Nagashima (1970)	products in general	many attributes	country of origin	yes[a]	-
Valenzi & Andrews (1971)	margarine/ butter	taste	price; physical product	yes yes	yes
Cimbalo & Webdale (1973)	margarine/ butter	taste	price; physical product	yes yes	no
Valenzi & Eldridge (1973)	beer	taste	price; physical product; expertise	yes no no	no
Asam & Bucklin (1973)	canned peas	taste (H); tenderness (I); wholesomeness (J)	brand/price; store/ location; nutritional information	I H, I, J I, J	not tested
Peterson (1977)	bread	nutritional value (H); percentage of whole wheat (I)	price; color; nutritional information	no yes only on I	no
McDaniel & Baker (1977)	potato chips	taste; crispiness	packaging	yes yes	-
Bannister & Saunders (1978)	products in general	reliability; value for money;[b] appearance; availability; workmanship;	country of origin	yes[a,c]	-
Friedman & Dipple (1978)	cigarettes	bland/rich flavor (H); hot/cool taste (I); weak/strong taste (J); harsh/mild (K); unenjoyable/ enjoyable (L)	brand name; sex	J, K I, J, K, L	H, I, J, K, L

Table 4.3. Continued

Reference	Product(s)	Quality attribute(s)	Quality cue(s) / Other variable(s)	Main Effect	Interaction
Rudell (1979)	bread; milk; bacon	nutritional value	nutritional information	yes[a,d]	
Etgar & Malhotra (1981)	sneakers	comfort; durability; style	sole; color; upper; place of purchase; price	not tested;[e] cue effects differed considerably between the attributes	not tested
Rigaux-Bricmont (1982)	coffee	taste	packaging/ brand name identification (PB); physical product (PP); region (R)	yes yes no	PB x PP; PB x PP x R
Jun & Jolibert (1983)	lighters	external appearance (H); performance & durability (I)	price; country of origin; physical product	I I H, I	no

[a] Results suggest a significant main effect. However, this was not tested statistically in the study.
[b] One could doubt whether value for money is a quality attribute as claimed by Bannister and Saunders. However, they did not explicate the way in which they determined the quality attributes.
[c] Various effects of the consumer characteristics age, social class, and sex on the relationship between a specific country of origin and a quality attribute were also found.
[d] Rudell also found an effect of nutritional information on taste evaluation. However, she attributed this result to a halo effect.
[e] Etgar and Malhotra employed nonmetric conjoint analysis to study the effects of quality indicators.

4.4. Perceived quality risk

Only in rare instances, the consumer is able to evaluate the quality of a product alternative with complete certainty. Frequently, relevant cues are missing and/or available cues are poorly understood. This implies that one must consider perceived quality risk as a factor in the quality perception process. Based on Grunert (1978, p. 162), the following definition of perceived quality risk is proposed:

'Perceived quality risk is a state of psychic tension with respect to the quality of the product that is experienced by a consumer in his/her decision process, which results from the fact that the consumer has, on the one hand, a desire to buy a particular product, but, on the other hand, accepts as possible unpleasant, negative consequences from the purchase.'

Starting with Bauer (1960), a considerable body of research on perceived (quality) risk has been developed. This research is reviewed below. Many of these studies deal with perceived risk in general. However, the results of these studies are relevant to our understanding of the role perceived quality risk plays in the formation of quality perceptions since the results usually apply to perceived quality risk as well as to perceived risk in general (cf. Bettman 1973, Wiggins and Lane 1983).

Components of perceived (quality) risk

There are two main studies in the marketing literature that have developed a scheme for specifying the components assumed to comprise overall perceived risk: Cunningham (1967a) and Bettman (1973).

Cunningham conceptualized perceived risk as a two-dimensional structure consisting of: (1) the uncertainty about the *outcome* of the decision, and (2) the extent of *negative consequences* that are possible after the purchase of a particular product. The first dimension involves the probability of making an erroneous choice. The second dimension is related to the eventual consequences of making a wrong choice. For example, a consumer might face the uncertainty whether the quality of a meat cut is less than expected. Further, s/he must take into account what the consequences could be if such a situation should occur. The uncertainty about the outcome is reflected in questions like 'If I buy this meat cut, can I be certain that its quality is acceptable?'. For the consequences component, questions like 'If the quality of the meat cut is not acceptable could some member of the family get very sick?' are relevant (cf. Taylor 1974). The two components are multiplied to arrive at an overall rating of perceived risk. Outcome and consequences are equally weighted because 'an arbitrarily weighted scale would be less defensible than the equally weighted scale used' (Cunningham 1967a, p. 82). A multiplicative integration rule seems the most appropriate since the absence of either uncertainty about the outcome or negative consequences would eliminate risk (Hansen 1972).

Kaplan et al. (1974) identified five types of consequences: performance, financial, social, psychological, and physical consequences. They found that the relevance of each type of consequence differed considerably between products. For example, suits rated much higher in social consequences than razor blades; the opposite was true for physical consequences. (Note that all five types of consequences are also relevant to perceived quality risk since they can be the result of buying a product of disappointing quality.)

Another model of perceived risk has been developed by Bettman (1973), who also conceptualized perceived risk as a two-dimensional structure but employed other components. His two components were: (1) the percentage of brands exceeding a consumer-specific acceptable level of quality, and (2) the importance of making a satisfactory brand choice within the product category. Overall perceived risk is computed by multiplying the components. (Note that Bettman measured risk on the basis of quality.)

In the empirical part of this study, both Cunningham's model and Bettman's model will be used to measure perceived quality risk.

Contrary to his expectations, Cunningham (1967a) found that heavy users tended to perceive more risk in the product. However, the relationship did not reach statistical significance. Further, perceived risk was related to specific self-confidence, i.e., the individual's assessment of his/her confidence in handling a specific task or solving a specific problem, although the results were rather confusing since the nature of the relationship varied between products. Generalized self-confidence and the socioeconomic characteristics level of education and occupation were not related to perceived risk.
Studies of Hisrich (1972) and Locander and Hermann (1979) also showed that specific self-confidence is much more relevant in consumer risk perception than generalized self-confidence. Perceived risk seems to be negatively related to specific self-confidence.
Perceived risk is an important factor in the willingness to try new products. Subjects who perceived higher risk in a new product were less willing to try it (Popielarz 1967, Peter and Ryan 1976). In line with these results, Arndt (1968) reported that low-risk perceivers were more likely to be innovative. Further, perceived risk seems to be negatively related to consumer evaluation: the greater the risk associated with a product, the less favorable the evaluation of that product (Kupsch and Mathes 1977, Bearden and Shimp 1982).
Mathews et al. (1971) found that the willingness to take more risky decisions decreased with age. High-risk takers were also more impulsive and more prone to make decisions based on incomplete information. The economic shopper (i.e., the individual searching for bargains, guarantees, etc.) was less willing to make risky choices than less economically oriented consumers. Pras and Summers (1978) found that consumers were substantially less willing to accept risk in their decision process when one or more product attributes reached an unacceptable value.
Kupsch et al. (1978) studied personal and situational factors that might affect perceived quality risk with respect to three consumer durables (refrigerators, TV sets, and washing machines). They found that perceived quality risk:

- was lower for males than for females;
-

was lower for brand-loyal buyers than for others (brand loyalty serves as an important risk reduction strategy, see below);

- was lower for buyers who did not consider brands other than the brand bought than for buyers who also considered other brands;
- was lower for buyers who did not perceive that technical innovation had occurred in the time period between the previous purchase and the new purchase than for others;
- was lower for buyers who were satisfied with their previous purchase than for dissatisfied buyers.

Some studies have contrasted perceived risk for different products. Cunningham (1967a) investigated perceived risk for three products. The percentage of respondents perceiving high or medium risk in the product were 59.3%, 40.1%, and 24.0% for headache remedies, fabric softener, and dry spaghetti, respectively. This suggests that perceived risk not only varies between consumers, but also between products. Bettman (1973) explored perceived risk for nine con-

sumer nondurables. Toothpaste, beer, instant coffee, aspirin, and margarine rated above average on perceived risk. Paper towels, dry spaghetti, furniture polish, and fabric softener rated below average.
The perceived risk associated with twelve different consumer products was researched by Kaplan et al. (1974). They selected health, recreational, and hygienic products, highly visible and low-profile items, and intimate and nonintimate products, varying in price. Each product was rated by the subjects on overall risk and on specific components of risk (see above). Kaplan et al. found that perceived risk is higher for consumer durables than for consumer nondurables. Further, the overall rank order of perceived risk ratings tended to correspond with the rank order of the prices of the products.
Steenkamp et al. (1985) investigated the perceived quality risk with respect to twenty food products. They found that the percentage of respondents that perceived a relatively high quality risk varied considerably between products. There was a distinct tendency that this percentage was the highest for products that could scarcely be evaluated sensorically prior to purchase (canned soup, canned vegetables, jam, frozen vegetables, eggs).

(Quality) risk reduction strategies
As stated above, consumers perceive a certain degree of risk in their decision processes. Since this is an undesirable state of affairs for (risk averse) consumers, consumers are hypothesized to develop risk reduction strategies in choice situations if perceived risk exceeds tolerable risk (Cox 1967b). A risk reduction strategy can operate on the outcome and/or the consequences component of perceived risk (Locander and Hermann 1979). However, since it is usually difficult for consumers to influence the negative consequences of their choice, most risk reduction strategies involve the outcome component (Kupsch and Hufschmied 1979).
Several strategies aiming at reducing risk perceived by consumers have been explored. Brand loyalty is such a risk reduction strategy. A consumer who tries a certain brand and finds it adequate may continue to purchase it in order to avoid the risk involved in buying a new brand. The relevance of brand loyalty for risk reduction was already suggested by Bauer (1960) and is supported by studies of Arndt (1967), Cunningham (1967b), Sheth and Venkatesan (1968), and Jacoby (1971). Consumers can also buy a more expensive brand, i.e., conduct a price-oriented quality evaluation, (Lambert 1970, 1972, Shapiro 1968, 1973, Diller 1982), or rely on store image (Shapiro 1973). Other risk reduction strategies include loyalty to a certain company (Bauer 1967), reliance on a warranty (Bearden and Shimp 1982), reliance on the manufacturer's reputation (Bearden and Shimp 1982), and reliance on advertising expenditure (Barach 1969, Wiggins and Lane 1983). Wiggins and Lane proposed (but did not test) the hypothesis that risk averse consumers purchasing few units of the product tend to use advertising expenditure as a risk reduction strategy by purchasing advertised brands only (see Section 3.5.4). In sum, it appears that most quality cues can be used by consumers to allay perceived risk.
A risk reduction strategy that has generated much research interest is information search. Information search refers to such various activities as informal discussions with friends and relatives about the product and reading of

test reports published by consumer agencies. In these theoretical and empirical studies, the basic hypothesis was that consumers who perceive high risk in the choice process will seek greater amounts of information.

Recently, *Gemünden* (1985) reviewed the empirical literature on information search as risk reduction strategy. He conducted a meta-analysis of 100 findings drawn from 50 different studies. More than 50% of the findings falsified the hypothesis that higher perceived risk induces more information search. The falsification rate was especially high for routinized decisions. According to Gemünden, the latter might be due to a number of factors. First, he suggested that perceived risk in routinized decisions is below the threshold of tolerated risk, so that there is not enough motivation to engage in active information search. Second, a 'try out some brands' strategy could be a more efficient information acquisition strategy than searching for information prior to purchase. This is in line with Nelson's (1970) contention that 'experience' is often a more efficient strategy to acquire information than 'search' (see Section 3.5.2). Third, since the time intervals between successive purchases are usually rather short for routinized decisions, personal experiences are a valuable information source so that there is less motivation for active information search. This argument is supported by findings that consumer prefer personal experiences with foods to other information sources (Steenkamp et al. 1985).

Roselius (1971) examined consumer preferences for eleven risk reduction strategies vis-à-vis each other, and in relation to four types of risk: physical, psychological, financial, and time risk (closely related to performance risk). The strategies included 'brand loyalty', 'buy a major well-known brand', 'buy the most expensive and elaborate model of the product', and 'buy a brand with a money-back guarantee'. Some strategies (e.g., brand loyalty) refer to the outcome component whereas other strategies (e.g., money-back guarantee) deal with the consequences component of perceived risk. Roselius found that brand loyalty was by far the most preferred risk reduction strategy regardless of the type of risk involved. 'Buy a major brand' was always the second most preferred strategy. Store image, shopping around to compare product features on several brands in several stores, and the use of a free sample of a product before buying were evaluated favorably by the respondents for all types of risk except for physical risk. For the latter type of risk, government testing (i.e., buy the brand that has been tested and approved by the government) rated relatively high. 'Buy the most expensive and elaborate model' was for all types of risk the least preferred method.

Derbaix (1985) studied consumer preferences for nine risk reduction strategies. His nine strategies were similar to those of the Roselius study. Derbaix also distinguished the same types of risk. He extended Roselius' study design by collecting data for nine products separately. Roselius did not specify products. The products covered a wide range of common risky-choice situations. A distinction was made between search goods (dresses, plates) and experience goods (the other seven products). Derbaix found that financial risk is especially high (as compared to the other types of risk) for durable experience goods. Physical risk was high for the nondurable experience goods related to health issues (canned mushrooms, shampoo). Shopping as a risk reduction strategy rated high only in the case of the search goods. This accords with Nelson's

theory. For experience goods shopping is less effective since their quality is (largely) hidden. Derbaix found that for this category of products brand loyalty, store image, and money-back guarantee rated high as risk reduction strategies. Unfortunately, test results of consumer agencies were not included in his study. This type of information-searching activity might be very useful for consumers with respect to experience goods since it provides information about the hidden attributes of a product.

Steenkamp et al. (1986a) investigated consumer preferences with respect to six quality risk reduction strategies for fresh food products and for nonperishable food products. Appearance of the product and open date information were the preferred strategies for fresh food products. Store image was a distant third. For nonperishable food products, information on the package and preservation technique were preferred. Buying a well-known brand ranked third. Price reliance rated very low for both product categories.

Roselius, Derbaix and Steenkamp et al. found that 'buy expensive' rated very low as risk reduction strategy whereas the results of Leavitt (1954), Tull et al. (1964), Lambert (1970, 1972), and Shapiro (1973) suggest that price reliance plays an important role in risk reduction behavior (see for these studies Section 4.2.1). It is not unlikely that the results of the former three studies were influenced by demand bias. Few consumers will be willing to admit that 'buying expensive' is an important risk reduction strategy when they are asked directly. Such behavior would seem 'irrational'. On the other hand, a 'buy expensive' strategy could actually increase total risk, especially financial risk, if the price is high (cf. Bearden and Shimp 1982).

The study of *Peterson and Wilson* (1985) sheds light on this dilemma. They found that subjects used a price reliance scheme in order to reduce risk. (In their study, risk was operationalized as the proportion of product failures, i.e., only performance risk was considered.) However, the strength of price reliance was moderated by the price differential between the higher-priced and the lower-priced product and by the amount of perceived performance risk. Price reliance was strongest if perceived performance risk was high and the price differential was small. The attractiveness of the higher-priced alternative decreased substantially when the price differential was large and performance risk was small. Another interesting result obtained in their study is the negative relationship between price reliance and the absolute price level. Only 68.8 percent of the subjects selected the higher-priced ($ 450) television (the other subjects selected the lower-priced one), while 86.7 percent chose the higher-priced ($ 188) camera. Financial constraints (price as cost factor) might account for this result.

Thus, it appears that consumer preferences for price reliance as a risk reduction strategy are positively related to perceived (performance) risk and negatively related to the price range and the absolute price level.

4.5. Comprehensive models of the quality perception process

So far, we have discussed different definitions of perceived quality, studies concerning the effects of cues on perceived quality and on quality attributes, and the relevance of perceived risk. No attention has hitherto been given to

comprehensive models of the quality perception process, with good reason. Few studies on perceived quality have employed a theoretical framework. Most empirical studies had an exploratory and ad hoc nature. Just a few authors (Olson 1972, Shapiro 1970, Wimmer 1975, Kupsch et al. 1978) have developed a more or less comprehensive model of the quality perception process and based their empirical research on that model.

This section is devoted mainly to Olson's model, for three reasons. First, Olson's model is by far the most widely known and influential. Second, his is the only model that has been empirically tested. The other models mentioned are more descriptive in scope and have not been formally tested. Third, the core concepts of Olson's model, i.e., cue predictive value, cue confidence value, and cue intrinsicness-extrinsicness, are incorporated in our model of the quality perception process (see Chapter 5).

4.5.1. Olson's model

The model

Olson (1972, Olson and Jacoby 1972) conceptualized the formation of quality perceptions as a two-stage process. First, consumers choose cues of product quality from an array of product-related cues. Second, consumers integrate their evaluations of these individual cues into an overall judgment of product quality. Olson's model aims to explain cue selection and cue importance in the quality perception process. His model is a modification and extension of Cox's (1967a) approach.

Olson's point of departure was the proposition that a consumer, given his/her limitations of information-processing capacity and time, will attach the more importance to a cue in the quality perception process, the higher the quality information content of that cue. The 'crucial' question is: how does a consumer determine the information value of a cue? In Olson's model the information value of a cue depends on its predictive value, its confidence value, and whether it is intrinsic or extrinsic to the product.

The predictive value (PV) of a cue is 'the extent to which the consumer perceives or believes that the cue is related to or is indicative of product quality' (Olson 1972, p. 67). This implies that cue PV is assumed to be based on the consumer's perception about the degree of association between cue and product quality. In Olson's model there need not be any logical relationship between a cue and product quality.[9] For instance, many studies have indicated that the relationship between price and objective quality is weak in general (see Chapter 12) whereas price is still an important quality cue for many products (see Section 4.2.3). As another example, consider the study of Wheatley and Chiu (1977; see Section 4.2.2) who found that dark green carpet was perceived to be of better quality than light green carpet although the carpet samples were in fact of identical quality.

The second dimensions of the value of information is the confidence value (CV) of a cue. The confidence value is defined as 'the degree to which a consumer is

[9] In this respect, Olson's conceptualization of PV differs from Brunswik's approach (see Section 5.2.3) in which cue PV is based on the ecological (actual) validity of the cue.

confident in his ability to accurately perceive and judge the cue' (Olson 1972, p. 69).

Cue PV and CV are product-specific concepts. For instance, price may have a high PV with respect to refrigerators but not for canned peas. Further, PV and CV of cues may differ between consumers, depending on previous experiences and beliefs related to the different cues, among other things.

PV and CV are treated as independent dimensions of information value. This implies that, in principle, all combinations of PV and CV are possible. It appears to us, however, that the combination low PV - low CV and cue is nearly a contradiction in terms. The term 'cue' refers to any informational stimulus, and a cue that is low in PV and low in CV conveys hardly any information, and accordingly is no informational stimulus. In any case, low PV-low CV cues should not have much influence in the quality perception process (see also below).

Both PV and CV are hypothesized to exert a positive influence on the probability of cue usage, and on the magnitude of cue effects on quality judgments. Thus, the higher the PV (or CV) of a cue, the more important is that cue in the formation of quality evaluations by consumers. Empirical research of Cox (1967a) and Olson (1972) supported this hypothesis.

Olson hypothesized that cue PV and CV jointly influence cue choice and cue effect (Olson 1972, p. 82). More specifically, he suggested that only when a cue has both high PV and high CV it is likely to be used by consumers and to have a strong effect on quality judgments. In other instances, when either cue PV or cue CV, or both, are low, the probability that the cue is used is low and, if used, the effect will be small. In the empirical part of his study, Olson found partial support for the hypothesized PV x CV interaction. It was weakly supported by the major experimental data but strongly supported by various supplementary data (such as the absence of effects that were inconsistent with the PV x CV interaction). The general shape of the hypothesized PV x CV interaction is shown in Figure 4.1.

The third factor in Olson's model of cue utilization is the intrinsic-extrinsic dimension. Intrinsic cues are cues 'which cannot be changed or experimentally manipulated without also changing the physical characteristics of the product itself' (Olson and Jacoby 1972, p. 169). Extrinsic cues are related to the product but are not part of the physical product. Thus, the relationship to the physical product determines whether a cue is intrinsic or extrinsic. If the physical product changes when the cue is manipulated, the cue is intrinsic. If the physical product does not change, the cue is extrinsic.

Olson's intrinsic-extrinsic (I-E) dimension is dichotomous. The cues used by consumers to judge the quality can be classified as either intrinsic or extrinsic. As opposed to cue PV and cue CV, cue I-E has no direct effect on the process of cue utilization. However, this classification is useful in determining the relative order in which individual cues (from an array of cues) is used by consumers. Olson (Olson and Jacoby 1972, p. 176) postulated: 'Given that both intrinsic and extrinsic quality cues are available to the consumer and are perceived by him, it is predicted that intrinsic cues are used more often and, when used, have a greater effect upon quality perception than do extrinsic cues'.

The use of extrinsic cues is dependent on the PV and CV of the intrinsic cues.

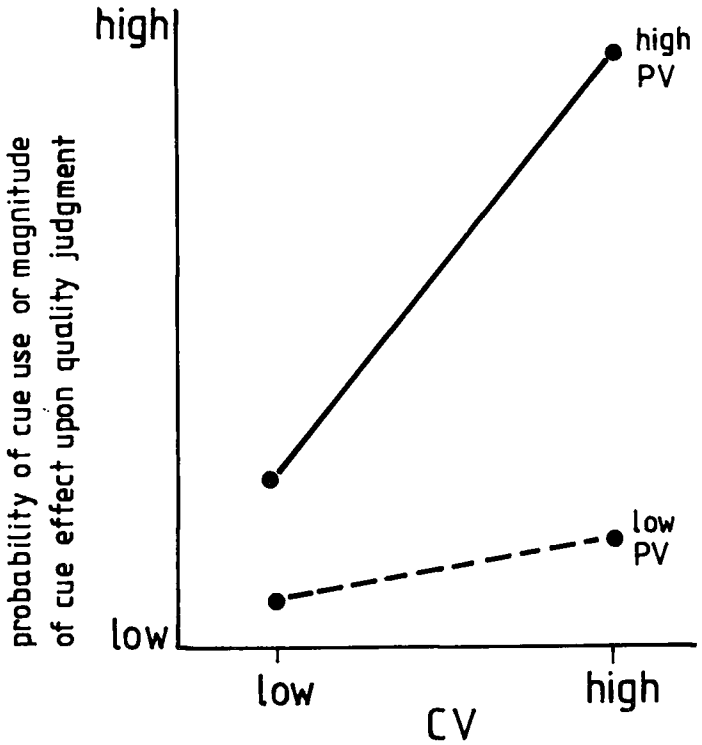

Figure 4.1. Interaction between cue PV and cue CV as hypothesized by Olson. Source: Olson (1972).

Olson predicted that extrinsic cues have a greater tendency to be used when available intrinsic cues have low PV, low CV or both, and a lesser tendency to be used when intrinsic cues have high PV and CV. Thus, when both an extrinsic and an intrinsic quality cue are available, and both have high PV and CV, the intrinsic cue is predicted to have the greatest effect on quality evaluation.

Empirical research on Olson's model

Olson's model has attracted considerable interest. Rudell (1979) and Kupsch et al. (1978) have used the concepts cue PV and CV to predict cue usage by consumers. Rudell (1979) investigated the relationship between a subject's use of a certain source of nutritional information (declaration of ingredients, declaration of vitamins, advertising, and *Consumer Reports*) and the PV and CV of that source of information. She found no significant effect of either PV or CV on the usage of any of the four sources of information.

Kupsch et al. (1978) conducted a similar but more extensive study. They investigated the predictive validity of three different models of cue utilization:

(1) the additive combination: PV + CV;
(2) the multiplicative combination: PV × CV;
(3) the Euclidean distance from the origin to the (PV, CV) coordinates in the two-dimensional (PV, CV) space: $(PV^2 + CV^2)^{1/2}$. The greater the Eu-

clidean distance from a cue to the origin the greater its probability of being used.

Kupsch et al. calculated the correlation between cue usage reported by the subjects and cue usage predicted on the basis of models (1) - (3). This was done for three consumer durables (washing machines, TV sets, and refrigerators) and for a number of cues. The correlations between reported and predicted cue usage were low to moderate but appeared to be significant (no p-values were reported). Further, it was found that the predicted validity did not differ significantly between the three alternative model formulations.

Schellinck (1984) extended previous research on cue usage in relation to cue PV and CV by considering the situational variable time pressure and the personal variable perceived risk. He limited his investigation to situations in which there are no (or not enough) high PV-high CV cues available. The effect of time pressure and perceived risk on consumers' choice of high PV-low CV cues and low PV-high CV cues were explored. The rationale for this study was that high PV-low CV cues take more time to process and entail higher risk since there is more chance of misinterpreting the data (because of the low CV) than low PV-high CV cues. On the other hand, high PV-low CV cues have potentially a greater payoff since the probability of choosing a good brand is higher (because of the high PV) if the information is interpreted correctly. Schellinck tested the relevance of time pressure and perceived risk for predicting cue choice behavior for pagers. The hypothesized effect of time pressure was found. In the high time pressure condition, subjects chose significantly fewer high PV-low CV cues than in the low time pressure condition. The main effect of perceived risk was not significant. However, it exerted some influence on cue choice behavior through a marginally significant ($p = .052$) perceived risk x time pressure interaction. Subjects in the high time pressure-low risk condition used the smallest number of high PV-low CV cues.

In sum, the descriptive potential of the cue PV-CV framework is considerable. However, its potential to predict actual cue usage appears to be moderate. At the present state of knowledge, it is preferable to retain cue PV and CV for further study.

Other studies have concentrated on Olson's intrinsic-extrinsic dichotomy. Researchers have especially been interested in his hypothesis that intrinsic cues have a greater effect on perceived quality than extrinsic cues. Considerable support for this hypothesis can be found in the literature. Szybillo and Jacoby (1974), Pincus and Waters (1975), Wheatley et al. (1981), Jun and Jolibert (1983; with respect to envelopes), and Davis (1985) found that intrinsic quality cues (i.e., the physical product) were more important in the formation of quality perceptions than extrinsic cues. Partial support is provided by Jacoby et al. (1971) and Nevid (1981) who found that the physical product exerted a substantial influence on perceived quality, but only when brand name was available. Olson's hypothesis was not supported by Jun and Jolibert (1983) with respect to lighters and batteries, and by Wheatley and Chiu (1977). However, Wheatley and Chiu's intrinsic cue (color) was rather weak since the carpets were physically identical for the rest. In Jun and Jolibert's study the intrinsic quality cue (i.e., physically different products) for batteries had a very low CV. In conclusion, the relevance of the I-E dichotomy is supported by research

findings. It serves as a framework to interpret and understand results obtained in different studies.

Evaluation of Olson's model

Olson's model is one of few attempts to explain empirical results on the basis of a rigorously defined theoretical framework. Further, it allows empirical testing. However, his model suffers from some limitations. First, the model is primarily useful if cues do not interact in the quality perception process. Interactions between cues imply that the magnitude of the effect of a cue on perceived quality depends on the level of one or more other cues. Such a result cannot be explained by cue PV and CV which are assumed to be independent of the specific cue levels.

Second, consumers might have difficulty in distinguishing between cue PV and CV. Two examples, derived from Rudell's (1979) study, can serve to illustrate this issue (she did not address the issue herself). Rudell found that of ten types of information concerning food products, ingredients rated highest on PV *and* CV. Given the level of nutritional knowledge in the USA (cf. Jacoby et al. 1977b), the high CV rating of ingredients is highly unlikely. Ingredients even rated higher on CV than did price, advertising claims, brand name, and friends' opinions! Further, the correlation between average PV and average CV ratings for the ten types of information was .416 (correlation calculated by the present author). Although this is not significant at $p = .05$, due to the small number of degrees of freedom (eight), it suggests that PV and CV ratings are not as independent as assumed by Olson.

Third, Olson does not consider quality attributes. His model does not enable the researcher to explain *why* a cue has a large PV with respect to perceived quality (see Chapter 5).

Fourth, Olson's model does not consider the mediating role of factors such as product experience, perceived risk, and socioeconomic characteristics in the formation of quality perceptions.

Despite its shortcomings and the fact that empirical support for his model is not unequivocal, Olson's approach remains of considerable heuristic value.

4.5.2. Other models of the quality perception process

Shapiro's model

Shapiro (1970) was the first researcher to develop a model that identifies the basic variables involved in the perception of quality and specifies the relationships between the variables. Further, the model describes the role perceived quality plays in consumer choices. His model is shown in Figure 4.2.

Shapiro's model was based on data collected from 616 housewives who had completed a questionnaire dealing with stockings, sweaters, and chairs. He correlated variables for each product and examined regression analyses concerning relationships between the variables. Based on these results, he constructed his model to fit the data. 'Likelihood of purchase' was the dependent variable of major interest. Consumers trade off 'perceived quality' against 'price attitude' (i.e., the subjective feeling that the price is fair) to arrive at a likelihood of purchase. Quality perceptions are based on tangible, visible

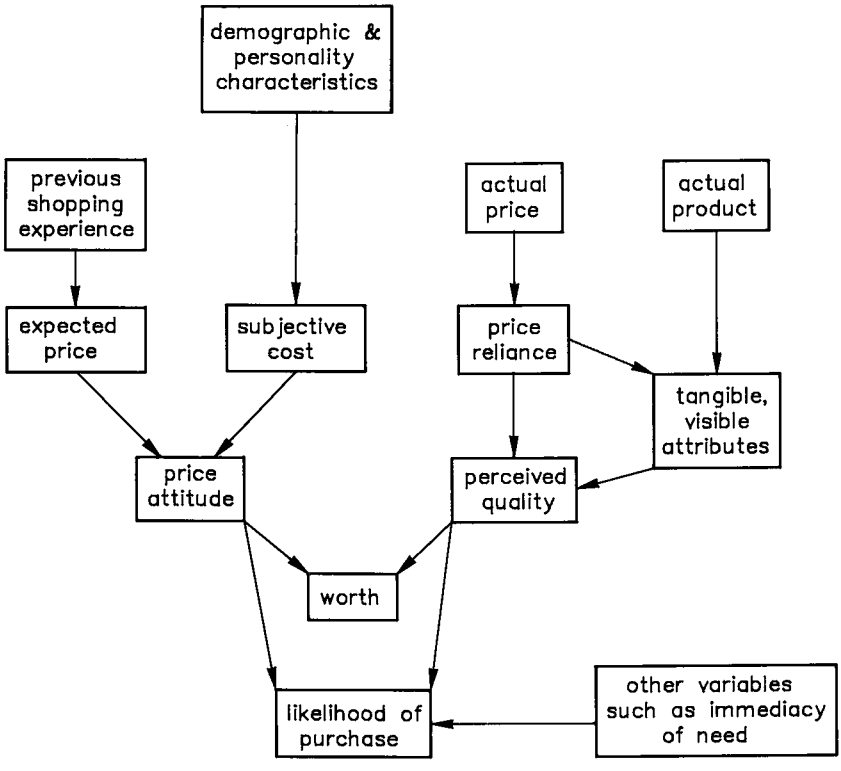

Figure 4.2. Shapiro's model of the variables involved in quality perception and product purchase. Source: Olson (1972)

attributes and price. It seems to us that Shapiro's tangible, visible attributes are similar to Olson's intrinsic quality cues.

Shapiro recognized that the variables in his model were not well thought out conceptually and operationally. For instance, 'actual product' consisted of 'brand name' and 'store-where-purchased'. This is too narrow a conceptualization of the actual product, especially when one takes into account that this implies that brand name and store-where-purchased should the deliver tangible, visible attributes. The effect of price reliance on these attributes is not clear. 'Subjective cost' was discarded as unmeasurable (but see Verhallen and Pieters 1984). A more detailed appraisal of Shapiro's model is not possible since we do not have the working paper in which the model was presented at our disposal, and to the best of our knowledge it has not been used in other studies.[10]

Wimmer's model

Wimmer (1975) presented a model of the quality perception process from an information processing perspective. He hypothesized that quality judgments

[10] Our discussion of Shapiro's model is based on Olson (1972) who briefly discussed the model.

are the result of a cognitive process in which consumers acquire and process quality information and integrate this information with information already stored in their memory. Information acquisition and processing takes place in interaction with motives and attitudes relevant to quality perceptions. For example, health-conscious consumers might acquire relatively much information about the nutritional value of a food product and weight this information heavily in their quality perception process. Wimmer's model is shown in Figure 4.3.

Three sources of quality information were distinguished by Wimmer. He called these sources of quality information: quality attributes, intrinsic quality indicators, and extrinsic quality indicators. His definition of intrinsic and extrinsic quality indicators is different from the one used by Olson and others. Intrinsic quality indicators are aspects of the product that have an established or presumed connection with quality and are not physically related to the product (e.g., price, brand name). Thus, what Wimmer called 'intrinsic' is labeled 'extrinsic' by Olson and others. Wimmer's extrinsic quality indicators are external sources providing information about the quality of the product (e.g., advertising, consumer magazines). His quality attributes resemble Olson's intrinsic cues.

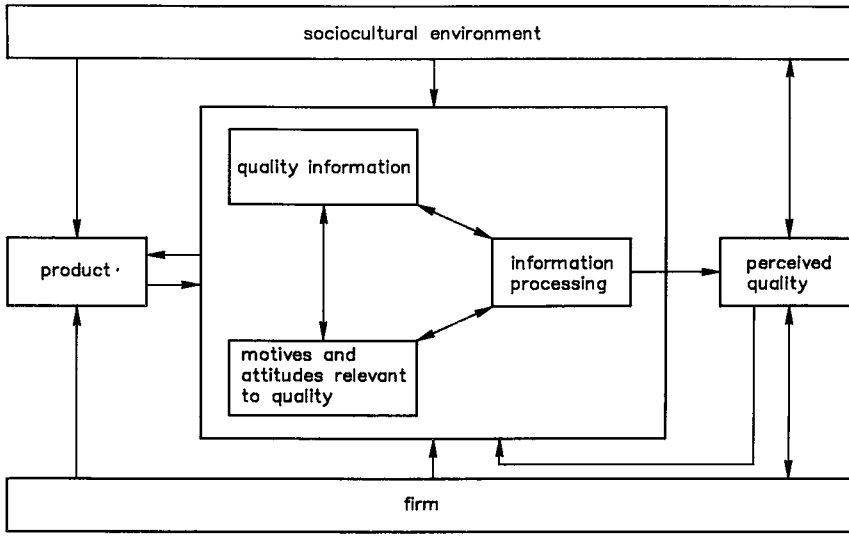

Figure 4.3. Wimmer's model of the quality perception process
Source: Wimmer (1975)

Wimmer's model is formulated at a very general level. In essence, Wimmer's model only states that quality information is processed to arrive at perceived quality judgments and that this judgment is formed in interaction with relevant motives and attitudes. Concepts that might be relevant in the quality perception process are identified but their interrelationships are not clearly specified. The concepts themselves are very general and ill-defined. Thus, his model is difficult to operationalize. It is therefore not surprising that Wimmer has not tested his model.

Kupsch et al.'s model

Kupsch et al. (1978) proposed a comprehensive model of the quality perception process which includes elements of information processing theory and multiattribute models. In their model, the formation of quality judgments starts with the recognition of a problem. This triggers search for information. The result is a certain amount of information stored in the memory of the consumer ('information basis'). It is hypothesized that perceived quality risk exerts a positive effect on the intensity of information search. (Note that this hypothesis is not supported by most of the empirical evidence; cf. Section 4.4.) Certain pieces of information are selected from the information basis to develop evaluative criteria, criteria weights and beliefs. Consumers use such a selection program to avoid information overload. Criteria weights and beliefs constitute the 'information structure'. Kupsch et al. distinguished between intrinsic, extrinsic, and unobservable criteria. The former two types of criteria can be directly observed by the buyer. Product ratings for the unobservable criteria are derived from product ratings for the intrinsic and extrinsic criteria. In the empirical part of their study they explored the importance of extrinsic, intrinsic, and unobservable criteria in purchasing a product, but no clear picture emerged.

The purpose for which the product will be bought ('buying goals') influences the development of the evaluative criteria and criteria weights. Perceived quality risk is also an important variable in this stage of the quality perception process. Criteria weights and beliefs are integrated to form an overall quality judgment. Personal and situational factors are assumed to affect all stages of the quality perception process. Kupsch et al.'s model is depicted in Figure 4.4.

A strength of Kupsch et al.'s model is that perceived quality risk is integrated into the quality perception process. This is not done in any of the other models discussed above. Further, it highlights the influence of personal and situational factors on the formation of quality perceptions. The model is of considerable heuristic value since it enables the researcher to develop hypotheses about specific relationships within the context of a larger theoretical framework.

The most serious shortcoming is that their model is too large and too general in formulation to be empirically testable. This is recognized by the authors (Kupsch et al. 1978, p. 51): 'Eine Ueberprüfung des Gesamtmodells erschien weder möglich, noch war sie beabsichtigt' [An empirical test of the complete model appeared neither possible, nor was it our purpose]. In this respect it resembles the large integrated models of consumer behavior. It is now felt that one needs descriptively realistic but more limited models that are empirically testable (e.g., Meulenberg 1986). Limited models also stand a better chance of being applied outside the academic setting. Further, the model assumes considerable cognitive activity and involvement of the consumer. As acknowledged by Kupsch et al., the model deals with extensive problem solving. Their model was actually developed to study the quality perception process with respect to consumer durables.

4.6. Conclusions

In this chapter, the literature on perceived quality is reviewed. The main conclusions that can be drawn on the basis of this research are summarized below.

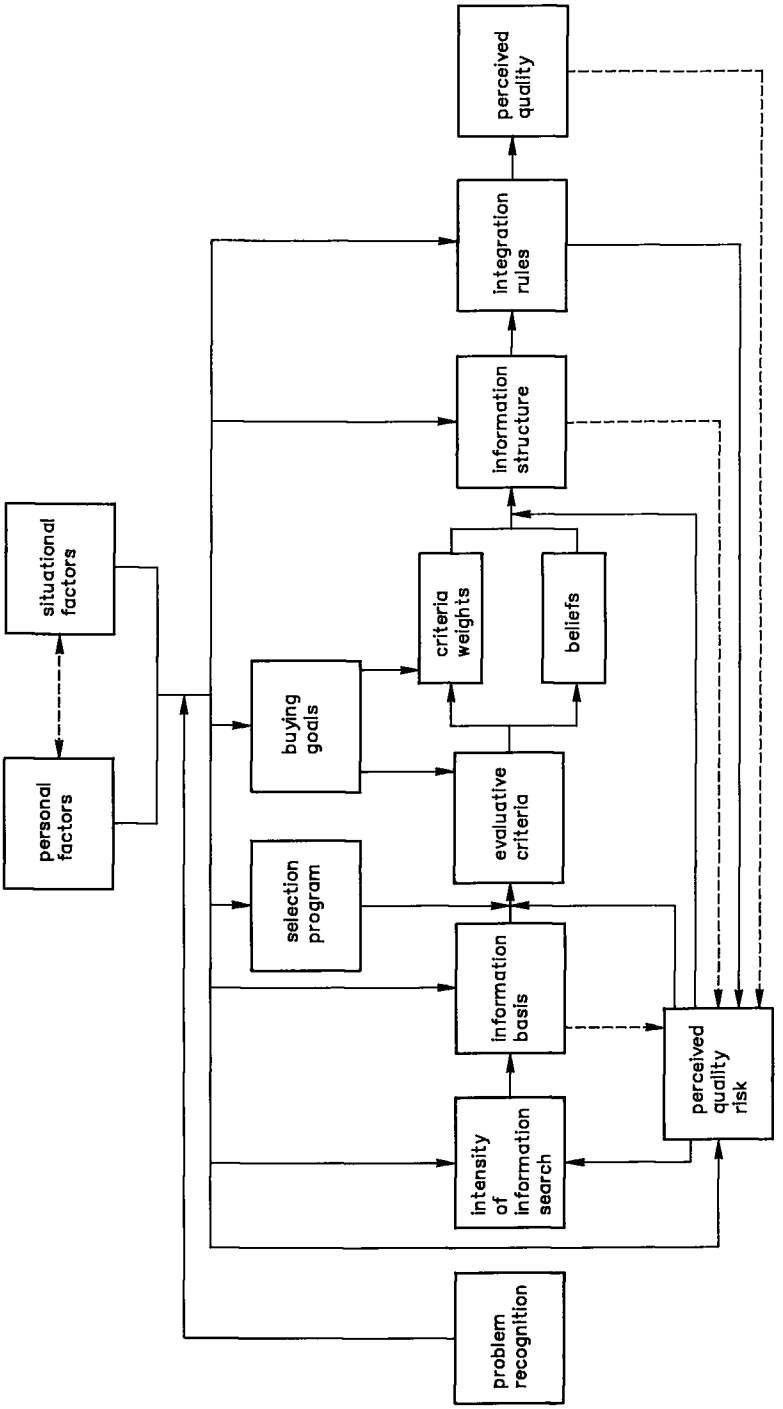

Figure 4.4. Kupsch et al.'s model of the quality perception process
After: Kupsch et al. (1978)

1. Consumers use a limited number of cues in the quality perception process. Actual cue usage depends on the product in question, and on personal and situational factors.
2. Single-cue studies are less appropriate than multiple-cue studies to investigate the effect of quality cues in the quality perception process, since the former type of studies generates strong demand bias.
3. The meta-analysis of the empirical studies on cue effects shows that, in general, price, brand name, store name, country of origin, and the physical product itself affect quality perceptions. This does not imply that they will have a significant effect on perceived quality for all products and in all situations. Not much is known about the mediating role of personal and situational characteristics on cue effects.
4. Cues can affect the perception of a product on quality attributes. The meta-analysis of empirical studies on cue effects on the quality attributes tentatively suggest that there exists a generalized relationship between price and taste.
5. The role perceived quality risk plays in the quality perception process varies across products. It appears that perceived quality risk is higher for consumer durables than for nondurables. Further, perceived quality risk tends to be higher for products that are difficult to evaluate on the basis of intrinsic cues.
6. Consumers use risk reduction strategies if perceived quality risk is high. Strategies related to the brand name cue such as brand loyalty and purchasing a well-known brand rank high among the risk reduction strategies.
7. Cue predictive value (PV), cue confidence value (CV), and cue intrinsicness-extrinsicness (I-E) have a great theoretical potential to explain cue effects in the quality perception process. The relevance of the I-E dichotomy is strongly supported by research findings. Intrinsic cues are in general more important in the quality perception process than extrinsic cues. The empirical support for the relavance of cue PV and cue CV, however, is weak.
8. Few theoretical models of the quality perception process have been proposed. In most empirical studies, no explicitly formulated theory was tested. This is especially true for the empirical studies on cue utilization in the quality perception process. Although meta-analysis of the multiple-cue studies showed that conclusions can be drawn on the basis of this body of empirical research, the marginal revenue of additional exploratory studies (in terms of an increase in insight into the quality perception process) seems small.

As evidenced by the review of the literature presented in this chapter, many empirical studies on the formation of quality perceptions have already been carried out. Most of those studies, however, were of an exploratory nature. Olson (1977, pp. 285-286) rightly stated: 'Future investigations regarding price and other cue effects should be based on explicit theoretical and conceptual notions so that their results may be generalized beyond the immediate product and situation'. Empirical studies should be based upon a clear theoretical model of the quality perception process with which the empirical results are compared. Such a model should include factors that might be expected to moderate cue effects on perceived quality. Only if such an approach is followed, one can expect that results can be generalized to other situations.

Few models of this type have been proposed in the literature on perceived quality. These models have been reviewed in Section 4.5. All the models include useful concepts but also have a number of weaknesses. We aim to develop a model of the quality perception process that avoids, as much as possible, the weaknesses of previous models, and that is empirically testable. Our model is based on the perceived quality approach but incorporates useful concepts from other approaches to quality.

4.7. Some reflections on the relationships between the four approaches to product quality

Chapters 2-4 of this work have been devoted to an extensive treatment of the quality concept. Four different approaches to quality have been reviewed: the metaphysical, production management, economic, and perceived quality approaches. It cannot be said that one approach is 'better' than any other. All four approaches are valuable in their own right since they focus on different facets of quality. The usefulness of a certain approach depends on the issues to be investigated.

The four approaches to product quality have developed rather independent from each other. However, we will conclude this review of the quality concept by giving some consideration to the relationships between the four approaches, an issue that has received little attention in the literature. Figure 4.5 depicts the relationships between the four approaches to quality as we see them.

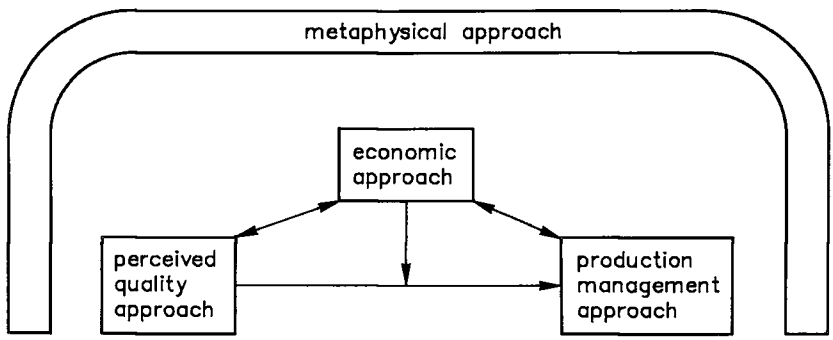

Figure 4.5 Relationships between the four approaches to product quality

Figure 4.5 shows that the perceived quality approach can serve as input to the production management approach. The production management approach explicitly recognizes the consumer's interest in quality. According to the production management approach, the product specifications should be based on the needs of the consumer. This creates a link between the perceived quality approach and the production management approach. First, the quality needs and perceptions of the target segment of consumers should be identified (perceived quality approach). Next, these perceptions must be translated into

physical product characteristics (arrow from perceived quality approach to production management approach). Finally, the firm should develop production and control procedures so that the product will contain these physical characterisics (production management approach).
The link between the perceived quality approach and the production management approach has been called 'quality guidance' (Steenkamp and Van Trijp 1989b). It expresses the link between marketing/marketing research and production/R&D. Quality guidance entails the integration of (1) the psychophysical linkage of physical characteristics to quality attribute perceptions, and (2) the aggregation process of quality attribute perceptions into overall perceived quality. It enables firms to identify the physical product characteristics for which the consumers' tolerance for deviations from the optimal level is the lowest and the ones that should be modified to enhance consumers' perceptions of quality. It is outside the scope of this work to give detailed attention to quality guidance; see further Steenkamp and Van Trijp (1988a, 1989b).
The relationship between the perceived quality approach and the production management approach is modified by the economic approach. The firm will not select the quality level of the product solely on the basis of consumer perceptions. Economic considerations also play an important role. A firm selects the quality level that yields the highest profit or market share (or that is most instrumental in fulfilling some other company objective). Economic theory assists the firm to choose the 'right' quality level by highlighting the short-term and the long-term implications of the decision. This quality level need not always be the level most preferred by the target segment since cost considerations are also important.
The two-headed arrow between the perceived quality approach and the economic approach indicates that each of these approaches is influenced by the other. Behavioral notions are incorporated in the economic approach to quality (cf. Section 3.5). On the other hand, studies on perceived quality have incorporated concepts developed in the economic approach, such as the dual role of price in the consumer decision process.
In developing realistic cost functions, the economic approach could learn much from the production management approach. For example, research on production costs shows that higher quality frequently does not lead to higher costs (cf. Chapter 1 and Section 2.2), whereas the economic approach assumes that quality and costs are positively related. Further, the production management approach shows that quality as a competitive variable is particularly useful to firms if it can be specified in objective terms so that the firm can guarantee a certain quality level to customers. On the other hand, the economic approach might provide guidelines to production managers as to the level of defects allowed that maximizes profits.
The metaphysical approach is the most abstract one of the four approaches. The production management, economic, and perceived quality approaches are rather concrete in that they deal with specific aspects of quality such as quality maintenance, quality competition, and quality cues. The quality concept itself receives less attention. In contradistinction to the other approaches, the metaphysical approach focuses on the being of the quality concept. It provides a bedding in which the other approaches are situated. As such, it is related not

quite directly to the other approaches. Some relationships, however, can be distinguished. The metaphysical approach contributes to the perceived quality approach by drawing attention to the notion that such immaterial aspects as esthetic considerations can be part of quality as it is perceived by the consumer. Further, it suggests that at least some communality exists between consumers with respect to quality judgments. Its focus on quality as a mark of uncompromising standards instead of being satisfied with the fraudulent or sloppy gives philosophical support to what might be called the 'Japanese approach to production management'.

Ideally, a firm should quantify the quality perception process (perceived quality approach), translate these perceptions into technical specifications, select the quality level that yields the highest profit or market share (economic approach), and devise a production management and quality control system that will enable the firm to maintain the quality level selected (production management approach).

Such an 'ideal' system only stands a chance of being developed if thorough knowledge exists of all of its phases. The remaining part of this work is concerned with the first phase: the way consumers form quality perceptions. Further, price-perceived quality tradeoffs are studied. A firm can only select a certain quality level that maximizes profit or market share if it has information about consumers' willingness to pay in relation to the perceived quality of the product.

5. A MODEL OF THE QUALITY PERCEPTION PROCESS[1]

5.1. A definition of perceived product quality

Perceived quality as fitness for use

The best known and most widely adopted definition of perceived quality is 'perceived quality is fitness for use'. The theoretical underpinnings of this definition, however, are not clearly formulated. The definition is not based upon a rigorous examination of the literature and it is not specific enough to serve as a basis for a theoretical model of the quality perception process. More specifically, the *use* of the product takes a central place in this definition whereas other types of consumption, such as possession and appreciation, can also be distinguished. Further, it does not recognize explicitly that perceived quality is an idiosyncratic product evaluation. It also lacks an information processing perspective in that cues are selectively perceived and processed by the individual. No distinction is made between quality cues and quality attributes. The definition 'fitness for use' does not explicate how quality perceptions are formed. It also fails to consider personal and situational variables as factors affecting the formation of quality perceptions.

Therefore, we decided to develop a new definition of perceived quality which is based on the psychological and consumer behavior literature. This definition serves as the basis for the model of the quality perception process that is developed in this chapter.

Perceived quality in the context of value

A theoretical basis for developing a definition of perceived quality can be found within the broader context of value. It has been suggested that the concept of value might serve as the core concept in all the social sciences (Rokeach 1973). Value can be defined as 'a relativistic (comparative, personal, situational) preference characterizing a subject's experience of interaction with some object' (Holbrook and Corfman 1983, p. 23). This definition is formulated in general terms to be relevant to specific types of value such as perceived quality. Holbrook and Corfman distinguished four dimensions of value: preference, subject-object interaction, relativistic, and consumption experience. These dimensions provide a conceptual framework for developing a definition of perceived quality within the context of value:

1. Perceived quality involves preference. Preference denotes any evaluative judgment such as favorable disposition, liking, or affect.

[1] Sections 5.1, 5.2.1, 5.2.2, and 5.3.1 are based on a paper presented at the 13th IAREP annual colloquium (Steenkamp 1988a).

2. Perceived quality is neither completely objective nor wholly subjective. It involves a subject-object interaction in that some product is valued by a subject.
3. Perceived quality is relativistic in at least three ways: (i) perceived quality is comparative in the sense that a product is valued in comparison to other products, (ii) perceived quality is personal in that it differs among subjects, (iii) perceived quality is situational in the sense that it depends on the context in which quality is evaluated.
4. Perceived quality does not reside in the acquisition of the product but in its consumption. A product is not valued for its own sake but because it provides services that are valued by the subject.

We shall develop our definition of perceived quality along each of these dimensions.

Perceived quality as an evaluative judgment

We regard perceived quality as an overall unidimensional evaluative judgment. Thus, it is evaluative. Consumers perceive the quality of products in terms of 'poor' or 'good'. Perceived quality exists on a continuum rather than being a dichotomous variable. The quality of a product can range from very poor to very good.

Further, perceived quality is an overall unidimensional judgment. It is a higher level abstraction instead of a specific product attribute. This aspect of perceived quality will be considered in some detail because of its implications for our theory of the formation of quality perceptions. Perceived quality is an overall judgment that is based on the perception of the product on the quality attributes. These attribute perceptions are integrated to arrive at an overall quality judgment. Quality attribute perceptions are the keystones of quality judgments.

To understand how consumers arrive at quality judgments, it is necessary to consider how consumers form quality attribute perceptions. Empirical evidence shows that consumers use quality cues to obtain insight into the rating of a product on the quality attributes (see Section 4.3 for a review). The question remains: what is the fundamental distinction between cues and attributes?

We define quality cues as 'informational stimuli that are, according to the consumer, related to the quality of the product, and can be ascertained by the consumer through the senses prior to consumption'. Quality cues closely resemble Nelson's (1970, 1974) search attributes.

Quality attributes are the functional and psychosocial benefits provided by the product.[2] They represent what the product is perceived as doing or providing for the consumer. Quality attributes are unobservable prior to consumption.

Thus, it is posited that quality cues can be ascertained through the senses prior to consumption, whereas the rating of a product on the quality attributes cannot directly be determined by the consumer (only through quality cues) before consumption. Quality cues are what the consumer observes, and quality at-

[2] The term 'benefit' is used in a generic way. Dependent upon the way a benefit is described, a high or a low rating is evaluated positively. For example, low in fatness and high in sensory perception usually receive positive evaluations. As an alternative to 'benefit' one could use the term 'consequences'.

tributes are what the consumer wants. Cues are concrete whereas attributes are abstract. Prior to consumption, benefits are unknown, i.e., consumers have no direct way to determine the rating of a product on the quality attributes. They can only ascertain these perceptions by consuming the product. Therefore, at the point of purchase, consumers use cues to form an impression of the perceptions on the quality attributes. Since quality attributes are not observable prior to consumption, consumers, in general, will use quality cues in choosing between product alternatives.[3]

However, a cue is valued because of its perceived relationship(s) with quality attributes. The value a cue has for a consumer in the quality perception process is derived from the benefits it is believed to predict. For example, it is not possible for an individual to obtain direct insight into the taste (quality attribute) of a food product prior to consumption. Therefore, consumers must rely on quality cues such as brand name, price, and physical product cues to form perceptions about the taste of the product in their quality perception process. However, these cues are valued because the consumer thinks they say something about the taste (and possibly about other quality attributes) of the product.

The relationship between quality cues and quality attributes can be conceptualized as means-end chains. In means-end chains, the value of the means is determined by the value of the ends to which they are perceived to lead. Quality cues are important only to the extent that they are perceived to be a *means* to achieve certain *ends* that are valued by the consumer, viz. the benefits or quality attributes.

A distinction is made between intrinsic and extrinsic quality cues. Intrinsic cues are part of the physical product. They cannot be changed without also changing the physical product itself. Extrinsic cues are related to the product, but are, physically, not part of it. In accordance with Olson (1972), the 'physical product' is very narrowly defined. A cue must physically be part of the product to be considered as an intrinsic cue. One can 'test' for a cue's intrinsicness by determining whether the physical product changes if the cue is manipulated. If the physical product changes, the cue is intrinsic, otherwise the cue is extrinsic.

Quality attributes are categorized as either experience or credence attributes (search attributes are not included because they are incorporated in the concept of quality cues, see above). Some quality attributes can be regarded as experience attributes since they can be ascertained on the basis of actual experience with the product. Examples are the taste of a meat cut, fuel consumption of a car, and the cleaning power of a detergent. Other attributes cannot be ascertained even after normal use for a long time and/or without consulting an expert. Examples of such credence attributes are the durability of a car, harmfulness of cigarettes, and the financial security of investments.

[3] Sometimes, a consumer can try out a brand prior to purchase. For example, an individual can make a test drive in a car or try out perfume before buying. This consumption experience yields insight into (some of the) experience attributes but not in credence attributes. Cues are still needed with respect to the latter type of attributes. One might expect that when direct observation of experience attributes is possible, cues will be relatively unimportant in the quality perception process. The relevance of such prepurchase experiences, however, should not be overestimated. The consumer has rarely the opportunity or the motivation to experience the brand prior to purchase (see also the next section).

Thus, the intrinsic-extrinsic dimension and the experience-credence dimension are treated as a dichotomy. This conceptualization is adequate for our model of the quality perception process (see Section 5.3.1). However, extrinsic cues can differ in their degree of extrinsicness. Some cues, such as nutritional information, are more closely related to the physical product than other ones such as price. Further, some attributes are more 'credence' than other ones since they reveal themselves later. For example, a consumer can obtain at least some insight into the reliability of a car after a relatively short period, say one year, whereas the durability of this car will reveal itself only after a number of years. Cues can have different effects on different quality attributes. A cue need not affect the perceptions on a single attribute only. It may contribute to several perceptions in different ways. Further, a single cue is unlikely to be a perfect indicator of a particular quality attribute. Multiple cues must be integrated by the subject to form his/her perception of the product on a certain quality attribute.

It is hypothesized that the effect of a quality cue on a quality attribute is influenced by (1) the predictive value of the cue with respect to the attribute in question, (2) the confidence value of that cue, (3) the intrinsic or extrinsic nature of the cue.

The distinction between quality cues and quality attributes is both of theoretical and managerial importance. For the consumer behavior researcher, it enhances the understanding in the quality perception process, as will be shown in the empirical part of this study. It serves to *explain* why certain cues are more important in the quality process than other cues. Previous studies were not well able to explain the cue effects found.

For the marketing practitioner, the distinction between quality cues and quality attributes is helpful in developing a marketing strategy based on quality. It serves to adress questions such as: Which quality cues predict which benefits (i.e., quality attributes) to consumers? How should the important benefits of the product be communicated in terms of cue-attribute relationships? Which quality cues present possibilities for modification to enhance the quality image of the product or to reduce costs? Which distribution strategy is called for, given the role of the cue 'place of purchase' in the quality perception process? What price level is the most advantageous to the firm?

An issue not yet discussed in detail is the way consumers use quality cues to form perceptions about the quality attributes. Since this topic is rather complex, it will be discussed separately (Section 5.2).

Perceived quality as a subject-object interaction

The second dimension of our framework of perceived quality is perceived quality as a subject-object interaction. The formation of quality judgments entails a subject-object interaction since the quality judgment is formed by an individual consumer with respect to a certain product. By definition, the quality attributes will reveal themselves upon consumption at the earliest (cf. credence attributes). The notion that perceived quality entails a subject-object interaction implies that the quality of a product may differ between subjects. This aspect of quality perceptions is discussed below.

A second position, taken by some other authors, is that perceived quality is

completely subjective, i.e., that it is entirely dependent upon, and relative to, human perception. It entails the belief that the source of perceived quality is within the inner world of the individual (cf. Bond 1983). According to this view, perceived quality is fundamentally descriptive of the experience of the person in question (cf. Holbrook and Corfman 1983). This view is to be rejected because it ignores that quality perceptions are linked to a specific product which is common to the judges in question. Subject and product are both necessary for the formation of quality perceptions.
A third position is that quality is inherent in the product, independent of the individual involved. This view is held by the metaphysical, product management, and economic approaches to quality. Obviously, this position cannot characterize perceived quality since, by definition, subjects are involved.

Perceived quality as a relativistic concept
The third dimension of our framework is that perceived quality is relativistic because it is comparative, personal, and situational. Each of these relativistic components will be discussed below.

The perceived quality of a product alternative may be affected by the *competitive context* of the other product alternatives available. For instance, the perceived quality of brand A relative to brand B could increase if brand C, which is dominated by A but not by B, is introduced into the market (cf. Huber et al. 1982, Huber and Puto 1983, Ratneshwar et al. 1987 who found this effect for preference).
The number of product alternatives in the competitive context influences the evaluation process (Payne 1976, Olshavsky 1979, Lussier and Olshavsky 1979, Kaas 1984). It appears that people change from a single-stage compensatory rule to a two-stage rule if the number of alternatives exceeds four to five. A single-stage compensatory heuristic is usually employed if the number of alternatives is three or four, whereas a two-stage strategy is mostly used when the number of alternatives is six or more. Illustrative is the finding of Lussier and Olshavsky (1979, p. 162): 'The subjects usually reduced the number of brands to three or four, which suggests that three or four brands is about the largest set of brands they could examine with a compensatory comparative approach'.

A second aspect of the relativistic component of perceived quality is that quality judgments might *differ among individuals*. In our opinion, important personal variables are (1) the extent of prior experience with the product category, (2) level of education, (3) perceived quality risk, and (4) quality-consciousness.
(1) *Prior experience*. The extent of prior experience with the product category may influence the quality perception process. Quality judgments are formed in the light of past purchase/consumption experience with the same brand and with competing brands. Experience is especially relevant to the formation of perceptions about the relationships between quality cues and quality attributes. (See the next section for details.)
(2) *Level of education*. The formation of quality perceptions involves, at least to some degree, cognitive processes. In general, higher educated consumers are more skilled in information processing than lower educated consumers, and this

might influence the quality perception process. For example, Steenkamp et al. (1985) found that the former attach more importance to nutritional information, which is a cognitively demanding cue, than the latter.

(3) *Perceived quality risk*. Consumers differ with respect to the degree of quality risk they perceive in the product category, and this may influence the quality perception process (see Section 4.4). Cunningham (1967a) conceptualized perceived risk as a two-dimensional structure, involving the uncertainty about the outcome of the decision, and the extent of possible negative consequences resulting from an erroneous choice. We hypothesize that the uncertainty about the outcome consists of two components: the perceived differences in quality between product alternatives, and the consumer's perceived competence in judging these quality differences (cf. Steenkamp et al. 1985). If a consumer perceives large differences in quality between product alternatives, but is confident in his/her ability to judge these differences, it is not likely that s/he will experience much uncertainty about the outcome. Likewise, if a consumer has difficulty in judging the quality differences between the product alternatives, but on the other hand thinks that the alternatives do not differ much in quality, uncertainty about the outcome will not be great. Thus, it is assumed that perceptions about the uncertainty as to the outcome are based upon a multiplicative integration of perceived quality differences and perceived competence to judge these differences (cf. Section 4.4).

(4) *Quality-consciousness*. It is hypothesized that consumers differ in the degree to which they are 'quality-conscious'. Some consumers give more attention in the decision process to quality-related aspects than others. We define quality-consciousness as 'A mental predisposition to respond in a consistent way to quality-related aspects which is organized through learning and influences behavior.'

The main aspects of the definition are the following. First, it is a mental predisposition in that it is viewed as an underlying, latent variable.

Second, quality-consciousness leads to consistent responses with respect to quality-related aspects, meaning that an individual exhibits approximately the same set of responses in different situations, and for different products. However, we do not regard quality-consciousness as a generalized variable, but as a domain-specific concept. A consumer may be quality-conscious with respect to cars but not with respect to foods. This view on quality-consciousness accords with current sociological and psychological literature suggesting that attitudes, values, and personality variables should be operationalized within a limited domain when the purpose is to use them as predictors of specific behavior (Schuman and Johnson 1976, Verhallen and Van Raay 1986).

Third, the responses concern aspects that are, according to the consumer, related to the quality of the product. These responses might take different forms, such as attaching different importance to specific quality cues (see below), and different levels of elaboration in the quality perception process.

Fourth, quality-consciousness is organized through learning. We do not assume that it is innate. Learning is based on previous experience with the product category, and on information acquired from commercial, neutral, and personal sources. Thus, the predisposition to respond to quality-related aspects in a consistent way is assumed to be the result of learning from information and past

experiences.
Fifth, quality-consciousness influences behavior. The responses to quality-related aspects will express themselves in behavior. It is assumed that quality-consciousness affects the weight of perceived quality in choice behavior. Choice behavior varies according to the perceived quality of the product alternative. It seems plausible that quality-conscious consumers give more weight to perceived quality in price-perceived quality tradeoffs than consumers who are less concerned about quality. However, quality-consciousness need not only express itself through choice behavior. It can also influence the extent of search for, and usage of, quality information in the psychological process preceding purchase. For example, findings reported by Steenkamp (1986) indicate that quality-conscious consumers attach more importance to neutral sources of quality information than consumers who are less quality-conscious.

A third aspect of the relativistic component of perceived quality is that it is influenced by *situational variables*. Situational variables can be defined as 'all those factors particular to a time and place of observation which do not follow from a knowledge of personal (intra-individual) and stimulus (choice alternative) attributes and which have a demonstrable and systematic effect on current behavior' (Belk 1975, p. 158). Situational variables are temporary in nature (Belk 1975). They might affect the formation of quality judgments through their effects on cue choice and cue importance, and on the importance and evaluation of the quality attributes. Knowledge about situational variables enhances our insight into the quality perception process and increases the predictive power of quality perception models.
To our opinion, potentially important situational variables are (1) the usage goal for which the product is purchased, (2) physical surroundings, (3) social surroundings, and (4) time pressure.
(1) *Usage goals*. The quality of the same product can be evaluated differently for different usage goals. The perceived quality of a product depends on the degree to which it fulfills the subject's usage goal(s). In the German literature, this view on perceived quality is called the teleological approach (Kawlath 1969, Wimmer 1975). Wimmer described the teleological approach in the following way:

'The teleological quality concept encompasses more than the object-subject interaction. The attributes of a product are subjectively perceived but need not be related to a specific usage goal. In the teleological approach, one only speaks about quality when attribute ratings are evaluated in relation to specific usage goals. Thus, the teleological quality concept encompasses *two subjective aspects*: the subjective usage goal and the subjective perception and evaluation of the fitness of a product to fulfill this usage goal.' (Wimmer 1975, p.7; translated)

Incorporation of usage goals into the perceived quality theory enables one to make intersubjective quality comparisons based on the degree to which a product fulfills its usage goals for different consumers. If one takes usage goals into account as a factor influencing the outcome of subject-object interactions, it is clear that researchers either have to investigate usage goals in their study or define a specific usage goal a priori. This is rarely done in empirical research. Differences in usage goals and differences in quality perceptions are often

confounded. Consequently, it is impossible to analyze the relative influence of these two aspects in the formation of quality judgments.
The situational variable of usage goal offers interesting opportunities for marketers. Different product varieties can be developed for different usage goals. Companies like Unilever and Procter & Gamble are very successful in this respect. A problem arises, however, when a product is in fact appropriate for several usage goals but, through habit or prejudice, becomes locked in into a single usage goal only. This seriously limits its market potential. One such example is turkey meat, which is predominantly consumed at Christmas.
(2) *Physical surroundings*. The physical surroundings in which quality perceptions are formed can affect these perceptions. For example, butchers often use special lighting in cooled showcases to enhance the apparent quality of meat by creating a favorable impression of the meat's color. The physical environment is especially relevant in respect to the store name cue. The store image a retailer wants to portray should be matched by the store's interior, location, personnel, etc.
(3) *Social surroundings*. The knowledge that the consumption situation will involve other people can influence a consumer in the purchase situation (as well as in the consumption situation). For example, parents will presumably weight quality attributes such as nutritional value and digestibility more heavily when the product is not only consumed by themselves, but also by their children.
(4) *Time pressure*. It is hypothesized that the amount of time a person has available for making quality judgments influences the quality perception process in at least three ways (cf. Wright 1974, Wright and Weitz 1977). First, under time pressure individuals weight negative information more heavily than under more leisurely conditions in order to simplify their evaluation process. Second, under time pressure individuals use fewer quality cues. Third, under time pressure individuals tend to dichotomize quality cues into acceptable and unacceptable categories.

Perceived quality and consumption of the object
The fourth dimension of our framework of perceived quality is that perceived quality resides in the consumption of the product. A product is not valued for its own sake, but for the services it renders upon consumption. 'Consumption' not only refers to actual usage but also to the possession or appreciation of the product (cf. Holbrook and Corfman 1983, Peter and Olson 1987). A person can derive utility from the services a product renders by its merely being available. An example is spare tires. Some products like pieces of art are not consumed in the traditional way but are appreciated.
The type of consumption (e.g., usage or possession) influences the quality perception process. For example, the ability of a tire to keep on pressure might be more important for spare tires than for tires that are actually used. On the other hand, wear-out will probably be less important for spare tires.
A product is valued if the services rendered are valued. Consequently, a certain quality level is valued because of the services it implies. The valuation of these services depends on situational variables (see above).
Perceived quality is relevant in relation to the consumption experience. In its most concise form, we regard perceived quality as fitness for consumption, and

not as fitness for sale. Fitness for sale characterizes the production management approach to quality (Steenkamp 1987f).

A definition of perceived product quality

In this section, a conceptualization of perceived product quality has been developed along the four dimensions of value. As a result, we propose the following definition of perceived product quality:

Perceived product quality is an idiosyncratic value judgment with respect to the fitness for consumption of the product which is based upon the conscious and/or unconscious processing of appropriate and available intrinsic and extrinsic quality cues in relation to relevant experience and credence quality attributes, and formed within the context of prior experience, perceived quality risk, quality-consciousness, usage goals, and other personal and situational variables.

To summarize this section, the main aspects of the definition are the following.
First, perceived quality is an evaluative relativistic judgment, involving a subject-object interaction, and is influenced by personal and situational factors. The same product can be evaluated differently on quality by different consumers.
Second, perceived quality is an unidimensional concept and exists as a continuum rather than as a dichotomous variable.
Third, quality cues are valued because o f their perceived relationship(s) with relevant quality attributes. An individual uses quality cues to form perceptions about the product on the quality attributes.
Fourth, it recognizes that the consumer is imperfectly informed since s/he will only attend to appropriate and available cues. 'Appropriate' refers to the appropriateness of a cue as perceived by the consumer, depending on cue predictive value, cue confidence value, and cue intrinsicness-extrinsicness. The notion of 'availability of quality cues' allows for selective perception. The cue might be physically available but not perceived by the consumer.
Fifth, quality judgments vary within individuals depending on the product, cues, attributes, and situational factors.

5.2. The formation of quality attribute perceptions

A core aspect of the proposed definition of perceived quality is the distinction between quality cues and quality attributes. We posit that quality cues are used by consumers to form perceptions of a product on the quality attributes. For a better understanding of the quality perception process it is necessary to study the psychological mechanisms for establishing relations between quality cues and quality attributes.
Many fundamental psychological studies deal with the way individuals form perceptions about the relationships between different events or variables. Although these studies do not concern quality cues and quality attributes, the concepts developed provide a theoretical foundation for the relationships between quality cues and quality attributes. In Sections 5.2.1, 5.2.2, and 5.2.3 the literature on this subject is reviewed and its relevance for understanding quality perception processes is shown.

5.2.1. Three ways to form perceptions about quality attributes

Descriptive, informational, and inferential belief formation

Quality attribute perceptions can, in principle, be established by descriptive, informational, and inferential belief formation.[4]

By trying out the brand prior to purchase (e.g., tasting a food product before purchase, making a test drive in a car), a consumer can form perceptions about the rating of the brand for the experience quality attributes directly, without using cues. This type of quality attribute beliefs belong to the *descriptive beliefs*. To put it in a more general way, descriptive beliefs are all those beliefs that result from direct observation (via any of the senses) of the characteristics of the product. Following this definition, it is clear that descriptive beliefs can also be formed with respect to quality cues (see below).

If a consumer tries out the brand prior to purchase and this consumption experience provides information on all quality attributes, there is no need to use cues anymore and the formation of quality perceptions is rather simple, analytically. The actual purchase situation, however, is more complex. Experiencing the brand provides no information about the credence attributes. Further, consumers often lack the motivation or the opportunity to try out the brand prior to purchase. Thus, descriptive beliefs with respect to quality attributes are not very relevant in most choice situations. This is the reason why people use cues in the quality perception process.

Acquisition and categorization of cues leads to the formation of descriptive beliefs with respect to quality cues. For instance, a consumer, in evaluating tires can acquire the cue 'country of origin' and categorize the country of origin of a certain tire A as 'France'. As a result, the consumer has formed the descriptive belief that tire A has been made in France. Thus, descriptive beliefs can be formed with respect to quality attributes as well as quality cues. The latter type of descriptive beliefs, however, is more important for understanding quality perception processes, as will be shown below.

Descriptive beliefs about quality cues say nothing about the (unobservable) quality attributes. Processing of descriptive cue beliefs is needed before this kind of information can be used in the quality perception process. This is the process of inferential and informational belief formation.

One can infer beliefs about quality attributes on the basis of the quality cues for which descriptive beliefs are formed. This is the process of *inferential belief* formation. For instance, the descriptive belief 'this car has been made in Germany' may lead to the inferential belief 'this car is reliable'.

Further, beliefs can be formed by accepting information about the quality attributes provided by some outside source such as friends, advertisements, and consumer magazines. This type of beliefs is called *informational beliefs*. For example, the descriptive belief '*Consumer Reports* said that Z rates low in additives' may lead to the informational belief 'Z rates low in additives'. In this case a cue (e.g., certain information provided by *Consumer Reports*) provides direct information about an attribute, which is accepted or not by the consumer. No inference from a cue to an attribute is necessary.

[4] The distinction between descriptive, informational, and inferential beliefs has been developed by Fishbein and Ajzen (1975).

In sum, quality attribute perceptions can be formed by descriptive, inferential, and informational beliefs. Descriptive quality attribute beliefs are usually not available and also provide incomplete information about the quality attributes. The consumer must therefore use cues to evaluate a product on the basis of its quality attributes at the point of purchase. Descriptive cue beliefs are the basis for informational beliefs and inferential beliefs with respect to the quality attributes. Cue-attribute relationships are based on informational and/or inferential beliefs. In order to understand the way consumers use quality cues to form perceptions about the quality attributes, it is necessary to give attention to informational and inferential beliefs.

It should be noted, beforehand, that informational beliefs and inferential beliefs have much in common. Many of the underlying principles are relevant to both types of belief formation (e.g., vividness of information, influence of a priori beliefs, selective search for information). Both types of processes involve quality cues. Further, both types of processes may influence each other. Inferential beliefs can be based on informational beliefs formed in the past and on subsequent observations. Informational beliefs may be affected by existing inferential beliefs with respect to the cue-attribute relationship in question.

Informational beliefs

Crucial questions in determining whether descriptive beliefs as to cue-attribute relationships lead to informational beliefs about these relationships are whether the new information is comprehended and whether it is accepted.[5] From an information processing perspective, it can be posited that both comprehension and acceptance of new information are necessary before it can influence the quality perception process. Traditionally, acceptance has received more attention than comprehension.

Social judgment theory (Sherif and Hovland 1961) suggests that the probability that new information on a cue-attribute relationship is accepted depends on the person's own position and that advocated by the source. The smaller the discrepancy, the more likely it is that the advocated position is accepted by the consumer. Besides discrepancy, other factors may influence probability of acceptance. These factors have been categorized as source, message, and receiver variables (e.g., Fishbein and Ajzen 1975, Aaker and Myers 1987).

The most important source variable is credibility. It is a long-standing principle of persuasion theory that the probability of acceptance of information is higher when it originates from a credible source than from a noncredible source. Expertise and objectivity are the two main components of source credibility (Engel et al. 1986). Other source variables include likability, status, and attractiveness (Fishbein and Ajzen 1975). Source characteristics appear to influence the probability of acceptance through their influence on the consumer's confidence in the information provided by the source.

Receiver variables primarily influence the consumer's confidence in his/her own a priori belief. Receiver variables include general personality factors such as persuasibility, intelligence, and self-esteem, as well as situational and do-

[5] Another determinant factor is attention. Cues have to be attended to if descriptive cue beliefs are to be formed. Thus, attention is a prerequisite for the formation of informational beliefs.

main-specific variables such as involvement, expertise, extremity of own position, and uncertainty. Petty and Cacioppo (1981) stressed the role of involvement, arguing that the probability of acceptance of the information provided by a given source is primarily determined by the discrepancy between the advocated and the consumer's position when involvement is high. When involvement is low, source and message characteristics are more important.
The third type of variables, message characteristics, has been assumed to influence the consumer's confidence in either his/her own belief or in the information provided by the source. Communication researchers have investigated the effects on persuasion of many message characteristics, such as complexity, drawing conclusions, comparative messages, one- versus two-sided messages, fear appeals, humor, and vivid versus abstract information (the role of the vividness of information will be discussed below in the context of inferential belief formation).
Source, receiver, and message characteristics not only influence the probability of acceptance but also the probability of comprehension of the information. For example, sophisticated information will be best understood by consumers possessing much expertise with the product category.

From the discussion above, it is clear that it is not easy for marketers to create informational quality attribute beliefs. Acceptance of information provided by commercial sources is hampered by low source credibility. Information from neutral sources is perceived to be more credible, but is often not attended to because it frequently lacks vividness and comprehensibility (cf. Nisbett and Ross 1980). The disappointing effect of nutritional information on quality perceptions and choice behavior can be explained this way. For example, Peterson (1977) found that the vivid and easily understandable color cue was much more important in consumer perceptions of the nutritional value of bread than probative but also pallid and hardly understandable information about eight ingredients in terms of percentage of daily requirements per slice.
Information originating from personal sources appears to stand the best chance of leading to informational beliefs. However, informational belief formation also depends on perceived expertise of the source, and not all persons will be perceived to be experts. Of the three sources of information, personal sources rate lowest on perceived expertise. Further, few products generate strong word-of-mouth communication.
In sum, informational belief formation will in some situations be of paramount importance in explaining quality attribute perceptions. We believe, however, that the conditions for extensive informational belief formation are not met in most judgment situations. In many cases credible cues are not available, attended to, or comprehended by the consumer. In our opinion, inferential beliefs are usually more relevant to the quality perception process. In assessing quality, consumers have to draw inferences on the basis of product-related cues to form beliefs about the ratings of a brand on the quality attributes. Sections 5.2.2 and 5.2.3 are devoted to inferential belief formation.

5.2.2. Inferential beliefs as a basis for quality attribute perceptions

Inferences involve 'constructing meanings about concepts and relationships that are not explicit in the environmental information' (Peter and Olson 1987, pp. 171-172). Inference processes may occur with or without much conscious analytic thinking (Olson 1978, Pinson 1986). Evidence shows that consumers often engage in inference processes (e.g., Olson 1978, Dover 1982, Pinson 1986). An inferential belief in the quality perception process is based on the perceived relationship between a cue and an attribute. When a consumer perceives a relationship between cue A and attribute X, s/he has a basis to draw inferences from. On the other hand, if s/he regards A and X as being totally unrelated, an inference from A to X is unlikely to be formed.

The most characteristic feature of inferential beliefs is that in addition to the information provided by the stimulus situation, the consumer uses a priori beliefs about the relationship between a cue and an attribute to make inferences. A useful starting point for our discussion is to consider the stimulus situation only as a basis for inferential belief formation with respect to the quality attributes. The most influential conceptualization explaining inferential beliefs on the basis of stimulus information only is Kelley's (1973) *covariation principle*. We will first discuss the covariation principle and subsequently make the picture more realistic by considering the influence of a priori beliefs about cue-attribute relationships in inferential belief formation.

The covariation principle

The covariation principle states that 'An effect is attributed to the one of its possible causes with which, over time, it covaries' (Kelley 1973, p. 108). Although we do not consider cues to be *causes* of attributes (e.g., good taste is not caused by a good store image), this principle is relevant to understanding inferential belief formation from cues to attributes, as will be shown below. Kelley assumed that people follow the covariation principle intuitively, although they need not be aware of this. According to the covariation principle, there are four criteria the consumer supposedly uses to ascertain whether the assessment of the relationship between a certain cue and a particular attribute reflects the inherent properties of the object rather than some environmental influences. These four criteria are (applied to the domain of quality perceptions): (1) *distinctiveness*: the attribute is inferred from the cue if a certain attribute rating uniquely occurs at a certain cue level, and not at other cue levels or with other cues, (2) *consistency over time*: each time the cue level is present, the attribute rating should be about the same, (3) *consistency over modality*: for different situations the same attribute rating should occur if the cue level is present, (4) *consensus*: the relationship between the cue and the attribute is perceived in the same way by other consumers.

An example will illustrate the relevance of these criteria for the formation of cue-attribute relationships.[6] If a consumer named John observes that analgesic brand X (quality cue) does not give him stomach trouble but other brands do, he may form the belief that gentleness to the stomach (quality attribute) uniquely occurs with brand X (distinctiveness). If John also observes that brand X is associated with gentleness to the stomach each time he uses X, his

[6] This example was inspired by Mizerski et al. (1979).

confidence will increase that the initial observation was correct (consistency over time). His confidence will further increase if he observes that X is gentle in different situations such as taking X the morning after a party or to suppress a cold (consistency over modality). Finally, if other consumers also find X gentle to the stomach, John's confidence in the perceived relationship between gentleness and X is enhanced (consensus).
Thus, the covariation principle states that the greater the distinctiveness, the consistency over time and over modality, and the consensus, the stronger will be the perceived covariation between a certain cue and a specific attribute. This is an interesting result since covariation beliefs, in general, refer to beliefs regarding the degree of relationship between two concepts, and inferences are based upon these perceived relationships (Hansen and Zinkhan 1984, Bettman et al. 1986).

A priori beliefs
A limitation of the covariation principle is that it essentially assumes that individuals assess the covariation solely on the basis of the information available in the environment (Alloy and Tabachnik 1984). However, consumers will not usually enter the covariation assessment process with a blank mind. They have a priori beliefs about the degree of covariation between quality cues and quality attributes. Thus, a priori beliefs with respect to relationships between cues and attributes should be considered.
A priori beliefs are based on prior experience with the product category, and/or on general rules, often embedded in the cultural environment, and/or on stereotypes. Examples of a priori beliefs in the context of quality perceptions are 'you get what you pay for' (price as quality cue), 'German cars are reliable' (country of origin as quality cue), and 'Philips television sets are durable' (brand name as quality cue).
Evidence indicates that people deviate from the covariation principle even in situations in which there is sufficient information available to assess the covariation with Kelley's normative criteria (Ross 1977). In judgmental situations, covariance assessments are made on the basis of a priori beliefs with respect to the covariation between two concepts and new information provided by the environment, the former usually being more influential than the latter. Individuals tend to misinterpret new information in line with their a priori beliefs about covariation, especially when these a priori beliefs are strong (see Nisbett and Ross 1980, Crocker 1981, and Alloy and Tabachnik 1984 for reviews). An early reference is the seminal study of Chapman and Chapman (1967) who showed that prior beliefs with regard to relationships between symptoms and psychiatric problems led persons to perceive similar relationships in new situations which had been developed to show no such relationships.
An example of the influence of a priori beliefs in the context of quality perceptions is provided by Van der Poll and Van Trijp (1984) who studied taste perceptions (quality attribute) of four brands (quality cue) of beer in labeled and unlabeled conditions. It was found that for those brands for which a priori beliefs were strong, taste perceptions changed significantly once subjects were given information about the brand name.
Thus, people are reluctant to change their perceptions about relationships once

they have been established. Existing beliefs about relationships often persist even if disconfirming evidence is presented (see Nisbett and Ross 1980, Crocker 1981, and Alloy and Tabacknik 1984 for reviews). This result is important for an understanding of quality perceptions. For example, butter is still perceived to be much fatter than margarine, although much effort has been put into changing this incorrect belief. However, it is often sensible and perfectly justifiable not to change beliefs too quickly since they may be based on considerable prior experience. On the other hand, individuals appear to be far more cautious than is justified by the situation: 'People seem to persist in adhering to their prior beliefs to a point that far exceeds any normatively justifiable criterion of conservatism' (Nisbett and Ross 1980, p. 169).

Perseverance of a priori beliefs

The tenacity of a priori beliefs is caused by several factors. First, individuals tend to regard evidence that confirms the existence of a relationship as more relevant than information that disconfirms the existence of such a relationship (Wason and Johnson-Laird 1972, Einhorn and Hogarth 1978, Snyder and Swann 1978, Snyder and Cantor 1979).

Second, people tend to discredit or ignore disconfirming evidence or treat it as if it were of little consequence (e.g., Lord et al. 1979). The pervasiveness of this tendency is also shown by sayings like 'the exception proves the rule'. Such behavior, for instance, explains why many consumers still use price as a quality cue although evidence (see Chapter 12) shows that these two variables are, on the average, only weakly related (another cause might be the high confidence value of the price cue; see also below).

Third, it has been found that confirming information is better remembered than disconfirming information (Rothbart et al. 1979). For example, one might better remember the cases in which a high-priced product is of better quality than a low-priced product than vice versa.

Fourth, individuals may also persevere in their a priori beliefs simply because they want to, because the beliefs are related to important values (Nisbett and Ross 1980).

Fifth, time constraints and lack of involvement may also lead to perseverance of beliefs. In many situations, people are not able or willing to observe and interpret the new information carefully (Nisbett and Ross 1980).

The foregoing is not meant to imply that a priori beliefs about relationships between concepts can never change. Research shows that massive amounts of disconfirming information, vivid and dramatic information, information that does not differ considerably from previously held beliefs, or information acquired from a highly credible source, among other things, are effective in bringing about changes in a priori beliefs (see Fishbein and Ajzen 1975, and Petty and Cacioppo 1981 for reviews). However, evidence clearly shows that in general: 'there will be less change than would be demanded by logical and normative standards or that changes will occur more slowly than would result from an unbiased view of the accumulated evidence' (Nisbett and Ross 1980, p. 189).

Inaccuracy of inferential beliefs

A corollary of people's reluctance to change beliefs in case of disconfirming

evidence is that existing beliefs with regard to the relationship between concepts is often inaccurate. Obviously, the accuracy of such a belief can only be assessed when the relationship between the concepts can be objectively measured. This condition is usually not met for cue-attribute relationships. However, in the studies of Brown (1958), Britt (1960), Makens (1965), Cox (1967a), and McDaniel and Baker (1977), the objective relationship between the cue and the attribute under investgation was known (see Section 4.3). These studies suggested that individuals may form incorrect perceptions about cue-attribute relationships.

Studies published in the field of social psychology also show that people are quite often poor assessors of the true relationship between two concepts (see Nisbett and Ross 1980, Crocker 1981, and Alloy and Tabachnik for reviews). Several reasons have been put forward to explain why covariation assessments are often incorrect. First, as noted above, people often do not adhere to the normative criteria proposed by Kelley, but instead tend to misinterpret new information in line with their a priori beliefs.

Second, cues may be misperceived. A classic example is the perception of color by color-blind people. Another example is people's comprehension and use of nutritional information (cf. Jacoby et al. 1977b).

Third, the number of observations (i.e., the sample size) may also be too small to allow for an accurate assessment of the covariation. According to the 'law of large numbers' the larger the sample, the more likely it is that the observed covariation is an accurate estimate of the covariation of the population. However, people appear to believe that the law of large numbers applies to small samples as well, i.e., they think that even a very small sample is highly representative of the population (Tversky and Kahneman 1971, Kahneman and Tversky 1972). Crocker (1981, p. 275) concluded: 'In general the evidence on this point suggests that people are often willing to make confident estimates of covariations on the basis of very few observations'.

Fourth, the sample of observations may not only be too small but, more seriously, can also be biased. Obviously, if the sample is biased, generalizations about covariances will often be incorrect. Evidence indicates that people are not sufficiently concerned about the possibility that their sample of observations could be biased (Nisbett and Ross 1980).

Fifth, the time interval between successive observations influences the accuracy of covariation assessments. It is likely that the longer the time interval, the less accurate the covariance assessments will be because of memory decaying processes (cf. Nisbett and Ross 1980).

Sixth, inferences are disproportionately affected by the vividness of prior and new information. Vivid information refers to information that is emotionally interesting, concrete and imagery-provoking, and proximate in a sensory, spatial, or temporal way (Nisbett and Ross 1980, p. 45). Vivid information is more likely to attract one's attention, to be processed and remembered. Consequently, it is disproportionately available for influencing inferences at any time after the information is initially acquired. Evidence shows that individuals often attach disproportionate importance to vivid information and tend to ignore pallid, statistical or abstract information that is frequently more probative but lacks concreteness and fails to arouse emotional interest (Nisbett and Ross

1980, Taylor and Thompson 1982).
In sum, inferential beliefs are frequently inaccurate. This is in accordance with the view on the consumer as an imperfect problem solver. According to Nisbett and Ross (1980, pp. 271-272), however, one can be fairly optimistic about the detrimental effects resulting from inferential shortcomings:

'Despite their lack of 'rigor', intuitive strategies serve people quite well in many contexts. Judgmental heuristics and knowledge structure are often well founded and helpful guides to inference. Ignorance of normative principles may have small costs for many everyday inferential tasks, even if their costs are prohibitively large for more formal scientific judgments. Reliance on very small samples, for instance, is a highly efficient or 'cost-effective' procedure for many familiar tasks.

Conclusion
The studies reviewed above are relevant to the understanding of the stability and dynamics of the relationships between quality cues and quality attributes. At this point, it is useful to relate the theory of inferential belief formation to the concepts 'cue predictive value', 'cue confidence value', and 'cue intrinsicness-extrinsicness' discussed earlier in this work.
Inferential beliefs are based upon cue-attribute relationships. If a cue has a strong perceived relationship with an attribute, it can be said that the cue has a large predictive value (PV) with respect to that attribute. This does not mean that the consumer will actually use that cue in inferring the attribute. Another condition must also be met. The individual must have confidence in his/her ability to interpret the cue correctly, i.e., the cue must have a large confidence value (CV) (Cox 1967a, Pinson 1986). Cue CV can be regarded as the certainty with which the descriptive belief is held.
Given the empirical evidence that intrinsic cues are more important in the quality perception process than extrinsic cues, it seems reasonable to hypothesize that the former are usually more important in inferential belief formation than the latter. The hypothesized influence of cue intrinsicness-extrinsicness (I-E) on inferential belief formation should, however, be considered as tentative since no empirical findings can be found in the literature on this issue.
In general, cue CV will not be dependent upon the inference process in question (Cox 1967a). The same goes for cue I-E. In this respect cue CV and cue I-E differ from cue PV, the latter being specific to a certain cue-attribute relationship.
PV, CV, and I-E are all related to the cue. Some authors have suggested that the importance of the attribute is an additional factor influencing inferential belief formation (Huber and McCann 1982, Hansen and Zinkhan 1984). They argued that the attribute to be inferred must be considered important enough to warrant inferential belief formation at all. For example, cues might have a high PV with respect to that attribute but when the attribute is unimportant, no inferences will occur. However, a review of the literature revealed that inferences may involve unimportant attributes as well (Pinson 1986).

5.2.3. Brunswik's lens model in the context of inferential belief formation with respect to quality attributes

Section 5.2.2 discussed the theory on inferential belief formation and highlighted its relevance to the understanding of the quality perception process. In this section, we supplement this picture by taking a more formal, model-oriented approach. Several theoretical models of inferential belief formation have been developed in the psychological literature (see Slovic and Lichtenstein 1971, and Fishbein and Ajzen 1975 for reviews). The best known of these models is Brunswik's lens model (Brunswik 1943, 1952, 1955, 1956, Postman and Tolman 1959). Slovic and Lichtenstein (1971, pp. 655-656), for example, stated: 'The lens model has proved to be an extremely valuable framework for conceptualizing the judgment process'. Brunswik has been called 'probably ... the most important psychologist of the first half of the 20th century' (Edwards 1971, p. 640).

Brunswik's model will be described in some detail because, in spirit and in scope, it is related to our model of the quality perception process (see Section 5.3.1). The discussion of Brunswik's model is focused as much as possible on quality cues and quality attributes. A more general introduction to Brunswik is provided by Postman and Tolman (1959).

Brunswik studied the individual's (or 'organism's') successes and failures in an uncertain and dynamic environment. His main emphasis was on the adaptive interrelationship between the individual and his/her environment. Brunswik posited that the major way in which an individual adjusts to the environment is through his/her ability to use cues in a compensatory way. This is called the principle of *vicarious functioning*. Vicarious functioning has been described as follows:

> 'Cues can be used interchangeably so that different patterns of cues can lead to equivalent results. Similarly, different motor responses can result in equivalent behavioral achievements. This is the principle of vicarious functioning which is the essential underpinning of adjustment to an environment which remains partly erratic' (Postman and Tolman 1959, p. 553).

Brunswik developed the so-called 'lens model' to formalize the relationships between individual and environmental components of the judgment situation. His basic approach has been refined and extended by Hammond et al. (1964), Hursch et al. (1964), Tucker (1964), and Dudycha and Naylor (1966). Figure 5.1 depicts Dudycha and Naylor's conceptualization of Brunswik's model as we applied it to quality perceptions (cues, true state, and perceived state apply in principle to any concept, including quality attributes and quality cues).

The three basic elements of the model are the quality cues ($X_1,\ldots,X_k$), the true state of the quality attribute, or criterion value (Y_e), and the perceived state of the quality attribute, or subject's inferential response as based upon the available cues (Y_s). The predictive value of cue X_i with respect to the true state Y_e is given by the correlation coefficient r_{ie} between the cue and the attribute for the set of observations considered; r_{ie} is known as the *ecological validity* of the i-th cue. The ecological validity of a given cue is assumed to be less than perfect ($r_{ie} < 1$).

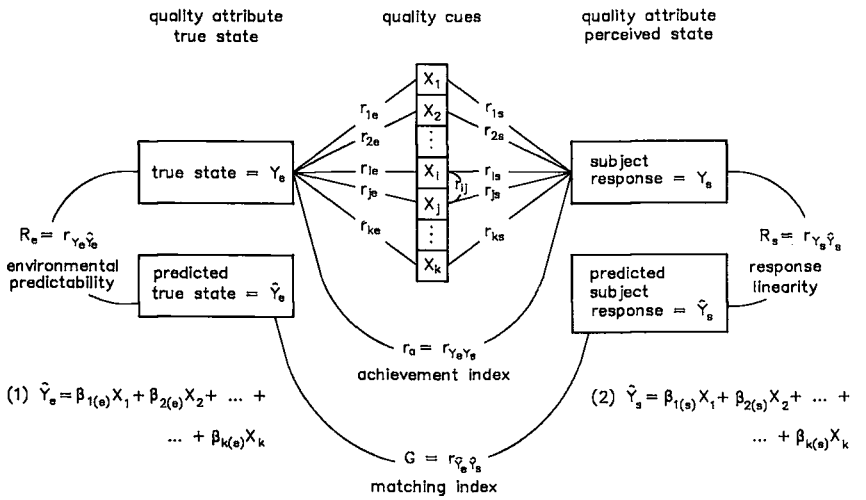

Figure 5.1. The lens model in the context of quality perceptions.
After: Dudycha and Naylor (1966).

The extent to which the inferential quality attribute belief Y_s is (linearly) related to cue X_i can be quantified by r_{is}; r_{is} is called the *utilization coefficient* for the i-th cue. Cue intercorrelations are denoted by r_{ij}.
In Brunswik's model, the true state (here: of a quality attribute) cannot be observed by the individual, but must be inferred through the cues. Since the ecological validity of each cue is less than perfect, the individual must adopt a 'probabilistic strategy', i.e., s/he must combine and weight cues in order to arrive at the most likely inference about the true state.
However, given the uncertainty of the environment (i.e., cue availability and limited cue ecological validity), flexibility in the utilization of cues is essential to adjustment to the environment. Flexibility is achieved by using cues interchangeably, i.e., by vicarious functioning.
The optimum (linear) prediction strategy (in a least-squares sense) for the true state of the quality attribute Y_e is given by the following regression equation:

$$(5.1) \quad \hat{Y}_e = \beta_{1(e)}X_1 + \beta_{2(e)}X_2 + \ldots + \beta_{k(e)}X_k$$

Equation (5.1) indicates that if an individual wants to predict Y_e, the optimal strategy is to weight the quality cues according to their respective $\beta_{i(e)}$'s. Equation (5.1) serves as the normative model for predicting the true state of the quality attribute on the basis of the available cues. The actual inference strategy used by the subject can be compared with the normative model to identify deviations from the optimum strategy. The value of $\beta_{i(e)}$ is a measure of the relative importance of quality cue i in the environment when the effects of the other cues are controlled for. The multiple correlation coefficient R_e is an index of how well the true state of the quality attribute can be predicted from the available quality cues.
The individual's inference strategy is modeled by the following regression equation:

(5.2) $\hat{Y}_s = \beta_{1(s)}X_1 + \beta_{2(s)}X_2 + \ldots + \beta_{k(s)}X_k$

Equation (5.2) describes the way in which the individual weights the cues in forming inferential beliefs about the true state of the quality attribute. The relative importance of cue i in the formation of inferential quality attribute beliefs is indicated by the value of $\beta_{i(s)}$. The multiple correlation coefficient R_s is an index of how well the individual's inferential responses can be predicted on the basis of the k cues. A variant of equation (5.2), including interaction terms, will be used extensively in the empirical part of our study to estimate the inferential relationships between quality cues and quality attributes.

The most important summary measure of the individual's inferential performance is the *achievement index*, $r_a = r_{Y_eY_s}$. The achievement index provides information about the relationship between the individual's inferential response and the true state of the quality attribute. It is a measure of the accuracy with which the individual utilizes cues in order to infer the true state of the quality attribute. The higher r_a, the more accurately a person perceives the relationship between the cues and the true state, and hence the more accurate are his/her inferential beliefs. Maximum achievement is obtained if the individual weights the cues in accordance with their ecological importance as expressed by $\beta_{i(e)}$. Thus, a focal topic of the lens model is to compare what the individual does with what s/he should do.

The above measures all apply to the linearly predictable variance in Y_e and Y_s. Hursch et al. (1964) and Tucker (1964) have extended the basic linear version of the lens model by introducing an index of nonlinearity called C. C is defined as the correlation between the residual variances of Y_e and Y_s which cannot be predicted by the linear model (i.e., $C = r_{Z_eZ_s}$, with $Z_e = Y_e - \hat{Y}_e$ and $Z_s = Y_s - \hat{Y}_s$). C provides no information about the form of the nonlinearity.

An implication of the lens model is that it is very difficult to make a correct inference if the cues upon which the inference is based, have a low ecological validity, i.e., are only weakly related to the true value of the attribute. Another implication involves cue redundancy. Since cues are assumed to be correlated, it is to be expected that not all cues will contribute significantly to the prediction of Y_s (and Y_e). Thus, information search may be limited without a considerable decrease in inferential accuracy.

Brunswik's lens model incorporates concepts, such as the principle of vicarious functioning, that are valuable in the context of quality perceptions. The inferential relationship between quality cues and a quality attribute is explicitly modeled and can be extended to multiple attributes (cf. Castellan 1972, Cooksey and Freebody 1985, 1987). Uncertainty in inferential belief formation is considered. Other researchers have also acknowledged that inferences are usually not made with complete certainty. Pinson (1986, p. 26), for example, observed that: 'The most important feature of the relationship between the uncertain properties of products and the cues available in the consumer environment is its lack of universality. Cues provide only a hint as to the true nature of the unknown attribute.' For this reason people often use more than one cue to form an inferential belief with respect to an attribute. This notion is

formalized by Brunswik in the principle of 'vicarious functioning', and expressed mathematically in equation (5.2).
The greatest limitation of Brunswik's model when applied to quality perception research, however, is the concept of 'true state of the criterion variable'. In most cases it is not possible to assess the extent to which an individual attains a correct inference concerning the value of a quality attribute. Frequently, there even exists no objectively correct response. (Consider, for instance, attributes such as exclusiveness, taste, flavor, and wholesomeness.) Consequently, the applicability of the lens model in the area of quality perception research is largely confined to the cue utilization part of the lens model. The cue utilization part can be applied to explore the way individuals use cues in inferential belief formation, irrespective of whether these beliefs are right or wrong.

5.3. A conceptual model of the quality perception process

5.3.1. The model

The theories and conceptualizations discussed in Sections 5.1 and 5.2 provide the basis for the model of the quality perception process depicted in Figure 5.2. The model describes the way consumers form perceptions about the quality of a product at the point of purchase. (In Chapters 10 and 11 the role of perceived quality in consumer decision-making will be studied.) The model has been refined and extended several times. In its present form, the model integrates concepts developed in the areas of information processing, social and cognitive psychology, and economics.
The quality perception process is hypothesized to consist of three subprocesses.

(1) *Cue acquisition and categorization* (descriptive belief formation with respect to quality cues).
The environment presents the consumer with a large number of quality cues. Due to time pressure, limitations of the information processing capacity, etc., only few of these available cues will be acquired and categorized by the consumer. This means that descriptive beliefs will only be formed with respect to few cues. The other cues are ignored by the individual. Little is known about the process directing cue choice. However, it seems probable that cues having a strong perceived relationship with quality attributes stand a better chance of being acquired. The same applies to vivid cues, to cues that are more easily available (e.g., brand name versus information provided by *Consumer Reports*), and to cues that are more easily acquired and understood (e.g., price versus nutritional information).

(2) *Quality attribute belief formation*
In principle a consumer can form quality attribute beliefs directly, i.e., without using quality cues, by trying out the brand prior to purchase.
However, this kind of information is not available to consumers in most purchase situations (see Section 5.2.1). For this reason, consumers use quality cues in the quality perception process.
Quality cues that are acquired and categorized are used to form beliefs about

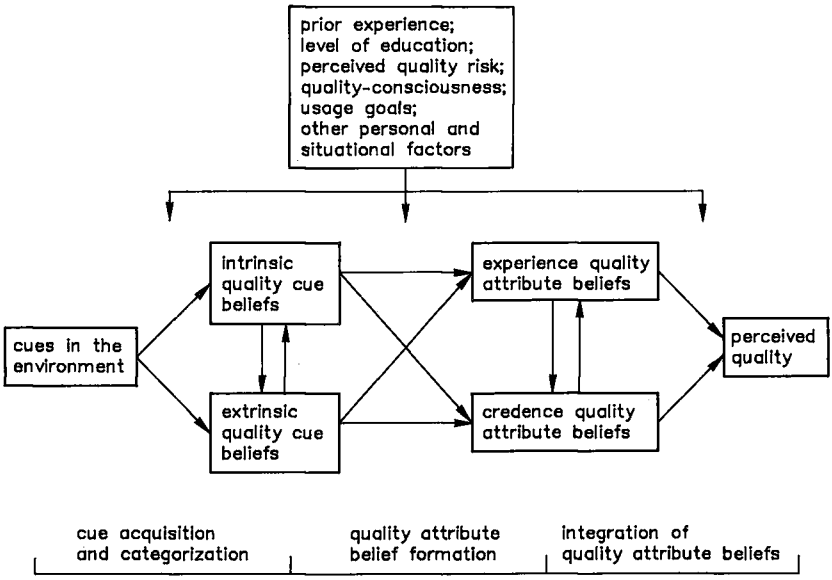

Figure 5.2. A conceptual model of the quality perception process.

the experience and credence quality attributes. The underlying processes of informational and inferential belief formation have been discussed in Section 5.2. Informational beliefs are formed by accepting information about quality attributes provided by some outside source such as friends, salesmen, advertising, or consumer magazines. We argued that many judgment situations do not involve extensive informational belief formation. In our opinion, quality attribute beliefs are mostly based on inferential belief formation.

It is hypothesized that the magnitude of the effect of a certain cue in inferential belief formation with respect to a certain attribute (1) is positively affected by the strength of the perceived relationship between the cue and the attribute in question, i.e., by the predictive value of the cue with respect to that attribute; (2) is positively affected by the confidence an individual has in his/her ability to accurately perceive and categorize the cue, i.e., by the confidence value of the cue, and (3) is usually greater for an intrinsic cue than for an extrinsic cue. Cue confidence value and cue intrinsicness or extrinsicness are independent of the inferred attribute. Further, it is assumed that consumers are homogeneous with respect to their perceptions of a cue's intrinsicness or extrinsicness (cf. Olson 1972).

Note that cue PV and CV are also relevant in informational belief formation, albeit these concepts are called differently in this context. Cue PV is closely related to expertise and credibility. Cue CV strongly resembles the comprehensibility of information as a factor studied in informational belief formation.

A quality cue need not lead to a unique quality attribute belief. It may contribute to several beliefs in different ways. Moreover, any single quality cue is likely to be an imperfect indicator of a particular attribute (cf. Brunswik's lens model). Multiple cues must often be integrated to arrive at an attribute belief. Cues might interact in these processes.

One could speculate about the relationship between the type of belief formation and the type of quality attribute. Informational belief formation might be relatively more important for credence attributes than for experience attributes. The rationale for this hypothesis is that credence attributes cannot be ascertained after consumption, and that therefore a consumer has less opportunity to learn/modify beliefs about the inferential relationships between those attributes and quality cues. Consequently, consumers presumably have a relatively low ability to form perceptions about credence attributes on the basis of the inferential relationships with cues. Therefore, consumers might turn to cues that provide direct information about the credence attributes, i.e., form informational beliefs. We believe, however, that even with respect to credence attributes inferential belief formation is more important than informational belief formation. Informational cues are often not available, not attended to or not comprehended by the consumer (see Section 5.2.1). A case in point is the study of Peterson (1977). He found that perceptions of bread regarding the credence attribute nutritional value were far more heavily based on the inferential belief with respect to color than on the informational belief with respect to nutritional information. It is important to keep in mind, however, that our model of the quality perception process can account for both types of belief formation (as well as for descriptive belief formation with respect to quality attributes).

(3) *Integration of quality attribute beliefs*

The overall quality evaluation is hypothesized to be based upon the perceptions of the product with regard to the quality attributes. Little is known about the way consumers integrate quality attribute beliefs, but some hypotheses can be developed. Due to their generality, these hypotheses also apply to the way consumers integrate quality cues to form quality attribute beliefs. Research reviewed in Section 5.1 suggests that noncompensatory models are more likely to be used when time pressure is high or the number of alternatives is large. Information processing by alternatives (compensatory, conjunctive, disjunctive) is more likely when the alternatives appear sequentially, as is the case in most purchase situations. When attributes are negatively correlated (e.g., top speed and fuel consumption of cars), compensatory models are more likely to be used because explicit tradeoffs are required between these attributes. In such a situation, a simple noncompensatory model such as the lexicographic model will frequently lead to a suboptimal choice. Further, the principle of vicarious functioning suggests that in an uncertain environment people often must use attributes in some compensatory way to arrive at an overall quality judgment.

In some studies the integration process with respect to the quality attributes has been investigated empirically. Troutman and Shanteau (1976) found that quality evaluations with respect to disposable diapers and infant car seats were formed by averaging the quality attribute beliefs. The linear additive model yielded good results in studies of Kupsch et al. (1978), Holbrook and Corfman (1983), Smidts and Wierenga (1983), and Steenkamp et al. (1986b). Troutman and Shanteau, and Steenkamp et al. searched for interactions between quality

attributes but found none. Further, Steenkamp et al. did not find any significant curvilinear effects.

Personal and situational variables influence the formation of perceived quality judgments. Among factors that can be expected to act as mediating variables with respect to the quality perception process are prior experience with the product, level of education, perceived quality risk, quality-consciousness, and usage goals. In Section 5.4 a number of hypotheses are developed with respect to the influence of these variables on certain aspects of the quality perception process.

5.3.2. Measurement methodology for the proposed model of the quality perception process

In this section, attention is given to methodologies that can be used to investigate the proposed model of the quality perception process. We will consider the two major approaches for studying judgment formation, the regression analysis approach and the protocol method, with respect to their applicability to investigations into the quality perception process.

Regression analysis approach

The term 'regression analysis approach' is used for all approaches that use multiple regression analysis to study the use of cues (or attributes) in judgment formation by an individual (cf. Slovic and Lichtenstein 1971). The regression analysis approach to study the way persons use cues (or attributes) in the quality perception process is in line with the Brunswikian tradition. It is assumed that the regression coefficients indicate the relative importance of the cues (or attributes), and reveal the subtle and often unreportable inferential processes of the inferring person.

Within the regression analysis approach, a distinction can be made between the 'correlational approach' and the 'ANOVA approach'. Briefly, the main purpose of the correlational approach is to provide a multiple correlation coefficient between a set of predictor variables (e.g., quality cues or quality attributes) and a given criterion variable (a quality attribute or overall perceived quality). The multiple correlation coefficient serves as an index of fit of the model. It is assumed that a high multiple correlation coefficient evidences that information was actually used by the consumer in the way specified in the regression equation (e.g., linear). Different integration models can be compared on the basis of the multiple correlation coefficient obtained for each model. Usually, data for correlational studies are obtained by asking subjects to rate a number of products on a number of attributes and on some measure of overall evaluation such as perceived quality.

In an ANOVA study, subjects evaluate a number of stimuli, with each alternative being characterized by a unique combination of levels of factors under consideration (e.g., quality cues). Typically, the factors are orthogonal to each other. Overall evaluations are decomposed in the contributions of the factor levels. In ANOVA type studies, interest is usually more focused on the significance of individual terms and their implications for the model used by the

subject, than to obtaining a high correlation coefficient between predicted and input evaluations, although exceptions exist. For example, numerical conjoint measurement, or conjoint analysis as it is called by Green and Srinivasan (1978), is in experimental design an ANOVA type of study but in data analysis correlational in scope. The confusion in terminology is compounded further because different information processing methodologies use ANOVA designs but differ in theoretical background (e.g., axiomatic conjoint measurement, information integration approach).

Informational processing resarchers tend to prefer the ANOVA approach to the correlational approach (e.g., Scott and Wright 1976, Anderson and Shanteau 1977). (See Slovic and Lichtenstein (1971), Anderson and Shanteau (1977), and Bettman (1979) for more information on the correlational and ANOVA approaches.)

The behavioral underpinnings of the regression analysis approach has been clearly formulated by Einhorn et al. (1979). Their point of departure is Brunswik's contention that vicarious functioning is the major way in which a person adjusts to his/her environment. They showed that the regression approach captures the process of vicarious functioning in at least four important ways.[7] First, the linear model usually found in regression analysis studies implies a compensatory rule which is consistent with vicarious functioning. Second, cue (or attribute) tradeoffs as quantified by the beta weights are a function of the specific judgmental environment because the beta weights are estimated on the basis of all cues (or attributes) and their particular levels in the situation. Third, redundancy among cues (or attributes) is included in the model since the beta weights are affected by cue (or attribute) intercorrelations. Further, the indeterminancy of the beta weights when cues (or attributes) are (highly) correlated corresponds to the individual's difficulty in estimating cue importance in judgmental situations. Fourth, the inconsistency and random error found in human judgments (e.g., Goldberg 1970, Dawes 1971, Ebert and Kruse 1978) are explicitly defined and measured in regression analysis.

The regression analysis approach (and especially the correlational approach) is by far the most widely applied method for studying inferential belief formation and the formation of other human judgments. A consistent finding of empirical research using the regression analysis approach is that the linear or additive model accounts for most of the predictable variance in these judgments (see Slovic and Lichtenstein 1971, Slovic et al. 1977, and Holbrook and Moore 1981b for reviews).[8] Incorporation of configural (i.e., interaction) terms or other nonlinear components generally produces only minor improvements in prediction, regardless of whether the correlational approach (Wiggins and Hoffman 1968, Mertz and Doherty 1974, Holbrook 1981, Steenkamp et al.

[7] Einhorn et al.'s discussion of the behavioral underpinnings of the regression analysis approach apply to both the correlational and the ANOVA approach. In their article, however, they are primarily concerned with the correlational approach since this variant of the regression analysis approach has received the strongest criticism. The third way in which regression analysis captures the process of vicarious functioning applies only to the ANOVA approach when factors are correlated (for instance, when unrealistic stimuli are not included in the experimental design).

[8] The terms 'linear model' and 'additive model' are often used interchangeably although, strictly speaking, they are not identical. It suffices to say here that the former term is usually employed in the context of the correlational approach, and the latter one in the ANOVA approach.

1986b) or the ANOVA approach (Hoffman et al. 1968, Slovic 1969, Slovic et al. 1972, Green and Carmone 1974, Anderson and Shanteau 1977, Levin 1985) is employed. Slovic and Lichtenstein (1971, p. 681) concluded: 'This line of research, employing both correlational and ANOVA techniques, can be summarized simply and conclusively... The linear model accounts for all but a small fraction of predictable variance in judgments across a remarkably diverse spectrum of tasks'.

The robustness of the linear model when using the regression analysis approach has worried some researchers. Subjects sometimes indicate that they use their cues/attributes in some nonlinear way although the linear regression model yields an excellent fit (Hoffman 1968, Slovic and Lichtenstein 1971). In response to these and other findings, some researchers (e.g., Van Raay 1977, Bettman 1979) have argued that the regression analysis approach (and especially the correlational approach) is not descriptively realistic. They stated that predictive accuracy of a model does not necessarily prove that the subject did actually use that model (see also Hoffman 1960). According to them process tracing methods such as the protocol method would be better suited to uncover the 'true' model used by subjects.

Protocol method

The protocol method is the most prominent of the 'process tracing' methods. This family of methods have been developed to study the *processes* used by a subject to arrive at a judgment, rather than to concentrate on the relations between observable input and observable output of judgment situations as is done in the regression analysis approach.

In the protocol method, the subject is instructed to give continuous verbal reports, i.e., to think aloud, while s/he performs the task of interest, such as evaluating the quality of a number of brands. All thoughts that occur to him/her should be reported. The verbal record is called a protocol. The researcher can use this protocol to uncover the information processing strategy of the subject. Processing rules can be extracted from the protocol and can be formalized in a series of statements or model that resembles a computer program (Newell and Simon 1972). Such a 'computer model' has several interesting features (Einhorn et al. 1979). First, it is close to the actual judgment process of the subject since it is based on the individual's own protocol. Second, the computer model is a sequential step-by-step set of rules, and, since people generally seem to process information sequentially, it has greater face validity than a regression model. Third, in the computer model the patterns of information processing are conditional to one another which accords to our ideas how we make complex judgments.

Thus, the protocol method provides information that is rich in analytic detail and close to the actual judgment process. The protocol approach also allows one to study the order in which information is acquired.

However, the protocol method has drawbacks as well. It is extremely time-consuming and costly to apply, and is therefore not suited to study the quality perception process for large samples of consumers. The regression analysis approach is more useful for managerial purposes. Further, the degree to which verbal reports accurately reflect cognitive processes has been questioned (Nis-

bett and Wilson 1977), especially in overlearned and routine judgmental situations (Smith and Miller 1978). The protocol approach is also an obtrusive method (Payne et al. 1978), it is sometimes very difficult to develop a model from the data (cf. Acito and Olshavsky 1981) and, in the absence of an error theory, there is a considerable chance that the model capitalizes on irrelevant details or inconsistency in judgments (Einhorn et al. 1979).

Similarity between the regression analysis approach and the protocol method
At first sight the regression analysis approach appears to have little in common with the protocol approach. Einhorn et al. (1979), however, have shown the similarities between the two seemingly opposing methodologies. They contrasted the regression analysis approach to the protocol method, but their argument applies to other process tracing methods as well. Einhorn et al. (1979) argued persuasively that regression analysis procedures and protocol (and other process tracing) methods do not differ with respect to the actual integration process uncovered but rather with respect to each approach's different emphasis and descriptive level of detail. The regression model reflects a more general behavioral schema, based upon the principle of vicarious functioning, which is adapted to the circumstances of a particular judgmental situation. Einhorn et al. (1979, p. 473) underlined the importance of a general schema to organize judgments:

'Such a general schema may be similar to the idea of a metarule, that is a rule on how to generate rules for specific cases. Given a limited memory capacity, it seems unlikely that one has a stored rule for every specific case; however, if one had a metarule, one could literally generate as many specific rules as there are individual cases. Furthermore, Einhorn [1980] has argued that the metarule concept allows one to retain the generality that any rule necessarily implies, yet at the same time it allows for the important effects of context, wording, response mode, and so on.'

This general schema or metarule frequently does not show up in verbal reports because people are often unaware of them (Hayek 1962, Nisbett and Wilson 1977, Smith and Miller 1978, Einhorn et al. 1979).
Thus, regression analysis is particularly well suited to uncover general models. The protocol method, on the other hand, is the most appropriate to study detailed models for a specific person in a particular situation.

Conclusion
Given the strengths and weaknesses of both approaches, we believe that regression and protocol methods provide complementary insight into the way quality perceptions are formed.
The regression analysis approach is better suited to develop insights into the quality perception process at a general level. It can be used to quantify the relationships between quality cues, quality attributes, and overall perceived quality, and to explore the extent to which quality attributes mediate cue effects in the quality perception process. The regression analysis approach is particularly useful to study the fundamental relationships for large samples. It is a powerful methodology to study linear, and possibly configural, models in the formation of quality perceptions. However, it will be difficult to identify with

this approach noncompensatory relations in the quality perception process. Protocol methods are better suited for this purpose.
We believe that the regression analysis approach is the most useful methodology to explore the general framework of the proposed model of the quality perception process. Protocol methods can subsequently be applied, for smaller samples, to solve issues raised by the results of the regression analysis. For example, the protocol method might be used to investigate why the effects of a certain cue in the quality perception process are not significant, for instance because it is not attended to, because its variance is too small, or because the cue has no perceived relationship with any of the quality attributes.

5.4. Hypotheses

The basic proposition of our model of the quality perception process is that quality cues are valued because they predict quality attributes. Quality cues are used to form perceptions with regard to quality attributes, and the quality attribute perceptions in turn are integrated to form perceived quality judgments. Thus, the model predicts that quality attributes act as mediating variables between quality cues and overall perceived quality:

H_1: Quality attributes act as intervening variables, mediating the effects of quality cues on perceived quality judgments.

Two other hypotheses concern the relevance of the distinction between experience and credence attributes.
It is difficult for consumers to make precise judgments about outcomes that are distant in time, since the more distant an outcome is, the greater the chance that environmental factors that are not known yet may influence its likelihood of occurrence. Consequently, individuals will attach more weight to the experience attributes of which the outcomes can be judged at short notice.[9] Further, people show the tendency to attach less importance to distant outcomes, even if they can be judged precisely (Wright and Weitz 1977). Outcomes related to credence attributes are temporally further away, in the sense that they can only be observed after a long time, if at all. Thus, we hypothesize that experience attributes are weighted more heavily than credence attributes in the formation of overall quality evaluations. Thus:

H_2: Experience attributes are weighted more heavily in the formation of perceived quality judgments than are credence attributes.

[9] An exception could be when the outcomes are really hazardous, such as cancer in case of smoking. People may react differently when outcome could be hazardous. Many people stop smoking because of the uncertain long-term health effects. On the other hand, individuals who keep on smoking attach more importance to the immediate outcomes (e.g., the sensory experience of a cigarette) than to long-term health effects. Undoubtedly, many smokers perceive the health effects to be uncertain: not everyone who smokes gets cancer, and there is always a possibility of a breakthrough in cancer treatment before one gets this illness.

Since credence attributes cannot be ascertained after consumption, a consumer has less opportunity to learn/modify beliefs about the relationships between those attributes and quality cues. Consequently, inference processes will be established less strongly, and consumers have a relatively low ability to form perceptions about credence attributes on the basis of the quality cues. More formally:

H_3: Consumers are more able to use quality cues in inference processes with respect to experience attributes than with respect to credence attributes.

Another hypothesis, developed in Section 5.3.1, stating that informational belief formation is relatively more important with respect to credence attributes than with respect to experience attributes could not be tested in this study since none of the cues employed provided direct information about the quality attributes. This hypothesis might be tested in another study.
H_1 deals with the most crucial tenet of our model. H_2 and H_3 are also directly related to the model. These three are the most important hypotheses to be tested in the empirical study of the proposed model of the quality perception process (see Chapter 9).

Besides the three above core hypotheses, six supplementary hypotheses were developed and tested in this study. H_4 deals with the heuristic value of the predictive value (PV)/confidence value (CV)/intrinsicness-extrinsicness (I-E) framework for explaining cue importance in the quality perception process. H_5 to H_9 deal with the influence of consumer characteristics on the quality perception process.
It is hypothesized that the effect of a certain quality cue on a particular quality attribute is positively influenced by the predictive value of that cue with respect to the attribute in question, and by the confidence value of that cue. Further, it is hypothesized that intrinsic cues usually have a larger effect on quality attribute beliefs than extrinsic cues. Cue CV and cue I-E are hypothesized to be independent of the attribute in question. Only cue PV is attribute-specific. Besides considering the relationship between a cue and a particular attribute, one can also investigate the influence of cue PV, cue CV, and cue I-E on the *total* effect of a cue in the formation of quality perceptions. Aggregated over all quality attributes, the effect of a cue in the quality perception process is influenced by cue PV with respect to overall quality (a summary measure of cue PV reflecting cue PV's with respect to the separate quality attributes), cue CV, and cue I-E. It is hypothesized that cue PV with respect to overall quality as well as cue CV have a positive effect on cue importance in the quality perception process (see Sections 4.5.1 and 5.1). The higher the predictive value of a cue with respect to overall quality, the more important that cue is in the formation of quality judgments. The same goes for cue CV. Further, theoretical and empirical evidence suggests that intrinsic cues are more important in the quality perception process than extrinsic cues (see Section 4.5.1).
Thus, the validity of the predictive value/confidence value/intrinsicness-extrinsicness framework can be explored for each quality attribute separately as well as for overall perceived quality. In this study, the framework is only tested

for overall perceived quality (see Section 6.3). Therefore, the hypotheses refer only to overall perceived quality and not to quality attributes:

H_{4a}: The higher the predictive value of a cue, the more important that cue is in the formation of perceived quality judgments.

H_{4b}: The higher the confidence value of a cue, the more important that cue is in the formation of perceived quality judgments.

H_{4c}: Intrinsic cues are more important in the formation of perceived quality judgments than extrinsic cues.

H_4 is based on Olson's model of the quality perception process. Olson also predicted that cue PV, CV, and I-E interact (see Section 4.5.1 for details), but the hypotheses related to these interactions cannot be tested in the present study.

H_5 to H_9 concern the influence of the consumer characteristics product experience, quality-consciousness, perceived quality risk, and level of education on specific aspects of the quality perception process.

Consumers with more product experience are in a better position to establish relationships between cues and attributes than less experienced consumers, since the former group is better able to evaluate the distinctiveness, consistency over time, and consistency over modality of cue-attribute covariation.

Further, it is predicted that quality-conscious consumers tend to make more elaborate quality judgments than consumers who are less quality conscious. Thus, it seems plausible to assume that more elaborate judgments will reveal themselves in the extent of the intervening role of the quality attributes in the quality perception process. Quality-conscious consumers might be more inclined to use cues because these say something about the quality attributes.

Within the limits of information overload, it seems reasonable that consumers who have acquired and used more information in evaluating quality, will experience less quality risk afterwards (cf. Bettman 1973).

Higher-educated consumers are more skilled in processing information than lower-educated consumers. The rationale for this contention is that the former group has had more experience with information processing during their (longer) formal education and probably thereafter as well. When we consider the consequences of this notion for the quality perception process, it appears likely that higher-educated consumers can and will use more cues in the quality perception process than lower-educated consumers. Further, it is predicted that higher educated consumers exhibit more interactions between the cues because interactions are cognitively more demanding than simple main effects (but may also lead to more 'precise' evaluations).

Based on these arguments, the following hypotheses are forwarded:

H_5: The intervening role of quality attributes in the quality perception process is greater for consumers with much experience with the product in question than for less experienced consumers.

H_6: The intervening role of quality attributes in the quality perception process is greater for quality-conscious consumers than for consumers who are less quality-conscious.

H_7: Consumers experiencing high risk in evaluating the quality of the product alternatives have used fewer quality cues in the quality perception process than consumers experiencing low risk.

H_8: Higher-educated consumers use more cues in the quality perception process than lower-educated consumers.

H_9: Cue interactions are more numerous in the quality perception process of higher-educated consumers than in the quality perception process of lower-educated consumers.

Part II

An Empirical Investigation into the Proposed Model of the Quality Perception Process

6. THE METHODOLOGY EMPLOYED IN THE EMPIRICAL INVESTIGATION INTO THE QUALITY PERCEPTION PROCESS

6.1. Introduction

In this chapter, we describe the methodology employed to investigate the model of the quality perception process and the hypotheses developed in the previous chapter.

In the next section the experimental design is described, in Section 6.3 the measures used for the different concepts of the model are discussed, Section 6.4 reports the data collection procedure, and Section 6.5 describes the analytical procedure adopted. Section 6.5 shows how the relationships between the core concepts of our model of the quality perception process, i.e., quality cues, quality attributes, and overall perceived quality, can be quantified in a concrete research setting and for a specific product.

The empirical part of the study involves two meat products, saveloy (a seasoned dry sausage) and gammon. Meat products were chosen because sponsors could be found that were interested in this product category. Since we used real product samples instead of verbal descriptions of product alternatives usually employed in this kind of marketing research, the financial support of sponsors was a prerequisite for conducting this research. The use of real product samples enhances the external validity of the results but also entails far higher research costs.

Within the circumspection of meat products, gammon and saveloy were chosen for several reasons. First, qualitative research indicated that consumers bought gammon and saveloy rather carefully. They do not choose an alternative randomly but give attention to several aspects of the product. A second consideration affecting the choice of the products is the possibiliity to manipulate the quality cues of saveloy and gammon. To quantify cue tradeoffs unambiguously, and to estimate cue effects on quality attributes and on overall perceived quality, it is necessary to manipulate the cues independent of each other. Third, within the domain of meat products, industry experts considered saveloy and gammon prime candidates for (consumer-based) quality improvement.

The empirical study that is reported in Chapters 6 through 9 is based on extensive previous research we have conducted on the formation of quality perceptions of foods in general, and meat products in particular. The following qualitative studies served as input for the present study: (1) two unstructured group interviews (n=10 for each group) concerning quality of meat products and other foods, (2) 30 individual in-depth interviews in the store on the quality of meat products and other foods, (3) four unstructured group interviews (n=8 for each group) concerning gammon, (4) 44 individual in-depth interviews

concerning gammon, saveloy, and other meat products, (5) discussions with experts in the meat products industry.
Previous quantitative research on food quality perception processes was also instrumental for developing and conducting the present study (Steenkamp et al. 1985, 1986a, b, c, Steenkamp and Meulenberg 1986, Steenkamp 1987a, b). For example, the selection of the quality attributes (see Section 6.3) was largely based on the relationships between attributes and perceived quality for meat products in general as reported by Steenkamp et al. (1986b).

6.2. Experimental design

Usage goals
For each meat product two usage goals were specified. For saveloy the usage goals were 'use on sandwiches' and 'use as snack', for gammon they were 'use on sandwiches' and 'use at dinner'. Thus, the experimental design consisted of four product/usage goal combinations. These combinations were developed in cooperation with a committee of experts in the meat products industry.

Quality cues
The selection of the quality cues was based upon qualitative and quantitative research on the formation of quality perceptions of foods in general, and meat products in particular (see above).
The quality cues of saveloy and gammon were experimentally manipulated. Each cue was defined at two levels. Cues and levels are shown in Table 6.1. As the quality cues were specified a priori, cue choice from the environment was not explored in this study.
Four comments should be made on the selection of the quality cues and their levels. First, the range in levels was representative of the market situation in the Netherlands. Second, the texture cue for saveloy referred to the magnitude of the pieces of fat. Saveloy with a fine texture contained small pieces of fat (the fat had been finely ground) whereas saveloy with a coarse texture had large pieces of fat (the fat had been coarsely ground). However, the fat content did not differ between fine and coarse saveloy. Third, packaging was not selected as a cue for gammon since hardly any packaged gammon is sold in the Netherlands. Fourth, one of the quality cues selected for gammon was gloss. The extent of gloss is directly related to the percentage of brine. Different firms inject different percentages of brine into gammon. The percentage of brine is an important cost factor. Brine percentage is inversely related to cost. More brine means less meat per unit of weight. Pretesting among 20 homemakers revealed that people have difficulty in discerning the extent of glossiness on its own. Gloss was still retained in the experimental design, for three reasons. First, gloss might affect the quality perception process in interaction with other cues such as color. Second, insight into the effect of gloss might assist the firm in a product development/cost reduction strategy. Third, subjects also tasted the gammon samples. Gammon with moderate gloss tastes differently from gammon with little gloss, due to the different percentages of brine. It is possible that the sensory experience leads to a considerable shift in consumer choices, thus affecting future behavior.

Table 6.1. Quality cues and levels used in the empirical study

Product/cue	Type	Level	Coding
Saveloy			
Color	intrinsic	deep red	1
		pink	–1
Texture	intrinsic	coarse	1
		fine	–1
Price	extrinsic	Dfl. 2.19 per 100 grams	1
		Dfl. 1.39 per 100 grams	–1
Packaging	extrinsic	unpackaged	1
		vacuum-packaged	–1
Place of purchase	extrinsic	supermarket	1
		butcher's shop	–1
Gammon			
Shape	intrinsic	ovate	1
		rectangular	–1
Color	intrinsic	pink	1
		variegated pink and red	–1
Fat brim	intrinsic	no fat brim	1
		fat brim	–1
Gloss	intrinsic	moderate gloss (30% brine)	1
		little gloss (16% brine)	–1
Price	extrinsic	Dfl. 2.69 per 100 grams	1
		Dfl. 1.89 per 100 grams	–1
Place of purchase	extrinsic	supermarket	1
		butcher's shop	–1

Stimulus construction

A full-factorial design requires 32 product alternatives (saveloy) or 64 alternatives (gammon). A Resolution III Design (Addelman 1962) would reduce the number of alternatives to be evaluated by each person to eight. Such a design allows orthogonal estimation of all main effects. However, it was decided that a Resolution III Design was less appropriate in the present study for two reasons. First, providing data for eight product alternatives was considered to be too burdensome for the subject, given the other tasks she was asked to perform (see below). The data collection procedure already took 1 to 1½ hour. Second, real products were used in the study. Research by Holbrook (Holbrook and Moore 1981b, Holbrook 1983) suggests that one can expect cue interactions in case of visual stimulus presentations.

Therefore, instead of using a Resolution III design, the following procedure was adopted. A master design was developed that permits orthogonal estimation of all main effects and selected two-way interactions (*National Bureau of*

Standards 1957). Higher-order interactions are not considered since they are very hard to interpret, usually of little interest and mostly statistically insignificant (Addelman 1963, Holland and Cravens 1973, Green and Devita 1975, Carmone and Green 1981, Holbrook and Moore 1982, Holbrook 1983). The total number of profiles was subdivided into small sets (or blocks) by means of a blocking procedure. A respondent evaluated the alternatives of a single block only. The blocks were balanced, i.e., each pair of cue levels appears in a block with the frequency given by the product of the relative marginal frequencies of each level and the total number of alternatives in the set (cf. Green et al. 1981).[1] Due to the blocking procedure, several two-way interactions cannot be estimated since they are used as blocking factors and are therefore confounded with the blocking effect. (See Cochran and Cox (1957) for details.)
A master design consisting of 16 alternatives was developed for saveloy. A blocking procedure was employed to split the 16 alternatives into four blocks of four alternatives (*National Bureau of Standards* 1957, plan 2.5.4). Thus, each subject evaluated four saveloy alternatives. Due to the blocking procedure, three interactions could not be estimated. The packaging x price, packaging x color, and price x color interactions were chosen to be confounded with the blocking effects because discussions with experts in the meat industry indicated that these interactions were unlikely to be significant.
The master design for gammon consisted of 32 alternatives, subdivided into eight blocks of four alternatives (*National Bureau of Standards*, 1957, plan 2.6.4). Thus, the subjects evaluating gammon were also presented with four alternatives. The gloss x shape, price x color, and fat brim x place of purchase interactions were used to create the eight blocks. Experts considered these interactions not to be significant.
As has been mentioned above, real products were used in the study. A major meat products company produced the gammon and saveloy alternatives in a special product development laboratory. A panel of experts judged the alternatives, and after some product modifications full agreement was reached that each alternative represented the combination of quality cues it was intended to represent.

6.3. Measures

Quality attributes and perceived quality
The selection of the quality attributes was based upon unstructured group interviews, individual in-depth interviews, discussion with meat industry experts, and previous research concerning quality perception of foods in general and meat products in particular (see Section 6.1).
The following twelve quality attribute statements were developed:
- has a good taste
- contains much fat
- contains coloring agents
- is unwholesome

[1] This is only true for the pairs of cues not used to block the master design.

- is tender
- contains much salt
- keeps for a long time
- contains preservatives
- is natural
- is bad for the figure
- is fresh
- is juicy.

Subjects' perceptions of a gammon or saveloy alternative were measured as to these quality attributes on a seven-point Likert scale ranging from 'completely disagree' (=1) to 'completely agree' (=7).

Two measures of overall perceived quality were developed: a statement, 'Is of good quality', measured on a seven-point Likert scale ranging from 'completely disagree' (=1) to 'completely agree' (=7), and a seven-point semantic differential scale with the poles 'poor quality' (=1) and 'good quality' (=7).

The choice of a version of the Likert scale and the semantic differential scale employed in this study was based upon a pretest of three different scales among a convenience sample of 40 homemakers. The following versions of the Likert scale were pretested: (1) a seven-point scale with polar points labeled only, (2) a seven-point scale with all points labeled, and (3) another seven-point scale with all points labeled using different words. Three versions of the semantic differential scale were also compared: (1) a seven-point scale with polar points labeled only, (2) a nine-point scale with polar points labeled only, and (3) a seven-point scale with all points labeled. The scales were evaluated on their power to discriminate between the product alternatives. The seven-point scale with polar points labeled only discriminated best between product alternatives, both for the Likert scale and for the semantic differential scale.

Cue predictive value and cue confidence value

Olson (1972) measured the predictive value (PV) of a cue with respect to perceived quality by the following question: 'How accurately do you think each of the following factors indicates the overall quality of [vanilla ice cream]?'. The response was rated on a five-point scale ranging from 'not at all accurate' (=1) to 'extremely accurate' (=5). Such a question could also be used to measure cue PV with respect to specific quality attributes.

The confidence value (CV) of a cue was measured by Olson in the following way: 'In this study, how confident were you in your ability to perceive and evaluate differences between [the three ice cream samples] on the following factors?'. The response was again rated on a five-point scale ranging from 'not at all confident' (=1) to 'extremely confident' (=5).

Pretesting of Olson's formulation of the cue PV and cue CV questions indicated that the subjects in our study, homemakers instead of the students sampled by Olson, did not well understand the meaning of the questions. Therefore, we developed more elaborate questions and added 'filler cues' to the quality cues originally specified. Cue PV was measured by the following question (as an example, the statements are given for the experimental condition 'saveloy for use on sandwiches'):

'Consumers often differ in their opinion on the best way to judge the quality of saveloy intended for use on sandwiches. On this sheet, you see a number of different aspects one can use in judging quality. To what extent do you think that each of these factors say something about the quality of saveloy intended for use on sandwiches? When you think that a certain aspect says very little about the quality of saveloy intended for use on sandwiches, you circle number 1, when you think that the aspect says very much about the quality, you circle number 7. When you think your opinion is somewhere in between, you circle the number that is the most congruent with your opinion.'

The following question was used to measure cue CV:

'We have been talking about a number of product aspects. You might be able to interpret some of these aspects very well, with others you may have more difficulty. Could you now, for the same product aspects, indicate how well you can interpret them by yourself?'

The response to the cue CV question was measured on a seven-point scale ranging from 'very bad to evaluate' (=1) to 'very well to evaluate' (=7).
We measured cue PV and cue CV with respect to overall perceived quality, i.e., we measured total PV and CV of a cue in the quality perception process. It would have been preferable to measure cue PV and CV with respect to each quality attribute separately. This procedure was not feasible, however, since it would have entailed 2 (PV, CV) x 5 (quality cues) x 12 (quality attributes) = 120 responses for saveloy, and 2 (PV, CV) x 6 (quality cues) x 12 (quality attributes) = 144 responses for gammon.
The list of quality cues started with two 'filler items', nutritional value and product appearance, to further clarify the task to the subject. The first item is very difficult to interpret but is considered to say much about quality, and the second item is well to interpret and is considered to say much about quality as well (cf. Steenkamp et al. 1986a). These 'extreme' filler items serve as warm-up stimuli. Subjects learn the purpose of the question and get acquainted with the scale (cf. Anderson 1981). One other filler item, amount of preservatives, was inserted halfway down the list, and a fourth filler item, amount of salt, as the penultimate item. The third and the fourth filler items were included as extra clarification. Only one of the four filler items is in fact a quality cue (product appearance). The filler items were developed primarily to clarify the CV question because pretesting had indicated that subjects had much difficulty in understanding this question.

Perceived quality risk
Perceived quality risk with respect to gammon and saveloy was measured in two ways. The first measure of perceived quality risk is based upon the extended Cunningham model (see Sections 4.4 and 5.1), including (1) two outcome components, the perceived differences in quality between product alternatives, and the subject's perceived competence in judging these perceived quality differences, and (2) three types of consequences, viz. financial, physical, and social consequences.
The aspect 'perceived differences in quality' is operationalized through the statement (as an example saveloy is taken): 'I noticed great quality differences between the different saveloy products'. The statement 'I had great difficulty to judge the quality differences between the different saveloy products' was used to measure the perceived competence component. The three types of conse-

quences were operationalized as follows: 'I think that, in general, saveloy is cheap' (financial consequences), 'use of saveloy of poorer quality can be a hazard to health' (physical consequences), and 'if I buy saveloy of disappointing quality, other people (e.g., family members) will say something about it' (social consequences). All five aspects of perceived risk were measured on a five-point Likert scale ranging from 'completely disagree' (=1) to 'completely agree' (=5). The uncertainty rating was computed by multiplying the rating for the perceived quality differences measure by the rating for the perceived competence measure (see Section 5.1 for the rationale for the multiplicative integration rule).

By adding the ratings for the three consequences measures (after the rating for the financial consequences statement had been reversed), an overall perceived consequences rating was obtained. The overall perceived risk score was obtained by multiplying the uncertainty rating by the consequences rating. In formula:

$$(6.1) \quad PR_C = (PD \,.\, PCo) \,.\, (FC + PC + SC)$$

where PR_C is the perceived quality risk rating as computed on the basis of the modified Cunningham model, PD denotes the perceived differences in quality, PCo is the perceived competence in judging these differences, and FC, PC, and SC are the financial, physical, and social consequences, respectively.[2]

The second measure of perceived quality risk is based on Bettman's model of perceived risk (see Section 4.4). The first component is the fraction of product alternatives which are above the standard of quality just acceptable to the subject (Bettman 1973, p. 186). The subject was asked to indicate on the seven-point semantic differential quality scale (see above) the lowest level of quality that would be just acceptable to her if she were going to use the product for the purpose specified in 'her' experimental condition (for example, use as snack). The number of product alternatives above this level was counted and divided by 4 (the total number of product alternatives evaluated by the subject) to obtain the fraction of acceptable product alternatives. The second component of Bettman's model is the importance of making a satisfactory choice. This aspect was operationalized through the statement 'It is very important to me to buy exactly that quality of saveloy (gammon) I want to buy' and was measured on a five-point Likert scale, ranging from 'completely disagree' (=1) to 'completely agree' (=5). Perceived risk is higher, the lower the fraction of acceptable product alternatives and the higher the importance of making a satisfactory choice (Bettman 1975). Therefore, the fraction of acceptable product alternatives was reversed into the fraction of unacceptable product alternatives before the overall perceived risk ratings were calculated. Overall perceived risk scores

[2] In our operationalization of the modified Cunningham model, PD and PCo are multiplied. However, we did not investigate empirically whether this integration rule is correct. An obvious alternative would be the additive integration rule. The quality risk rating was also computed on the basis of adding PD and PCo and multiplying this value by the sum of the ratings for the three consequences. It was found that the kind of integration rule specified did not exert a considerable influence on the results. The ratings of both versions of the modified Cunningham model were strongly correlated: r = .935.

are obtained by multiplying the scores for the two components. In formula:

(6.2) $PR_B = (1 - A/4) \cdot I$

where PR_B is the perceived quality risk rating as computed on the basis of Bettman's model, A is the number of acceptable product alternatives ((1 - A/4) is the fraction of unacceptable alternatives), and I denotes the importance of making a satisfactory choice.[3]

Quality-consciousness

The quality-consciousness of the subject was measured in two ways. First, the following single-item global measure was developed: 'In purchasing saveloy (gammon), I always give careful consideration to quality'. The subject's response to the statement was measured on the five-point Likert scale described before. This measure is product-specific.

Second, a multi-item measure with respect to food products in general was developed. Measurement theory (Nunnally 1978, Churchill 1979) suggests that multi-item measures are typically much better than single-item measures. The approach we adopted, follows Churchill's (1979) suggestions for constructing multi-item measures. This means, among other things, that the measurement instrument was refined on the basis of responses of subjects not included in the main study. Using the data from group discussions, and individual in-depth interviews and findings reported in other studies (e.g., Buchholz 1984, Steenkamp et al. 1986a), a pool of 50 items was generated which covered all aspects of the quality perception process including personal, neutral, and commercial sources of quality information, quality cues, quality attributes, and price-quality tradeoff items, covering cognitive, affective as well as conative aspects. The items referred to the quality perception process of foods. Current sociological and psychological theory suggests that personality variables such as quality-consciousness should be operationalized within a limited domain when the purpose is to use them as predictors of specific behavior (see Section 5.1). The items were formulated in general terms, i.e., they did not refer to the cues and attributes used in the present study. The pool of items was discussed with other researchers with respect to their face validity, clarity, and relevance to the quality-consciousness construct.

A convenience sample of 50 homemakers rated their opinion with respect to each item on a five-point Likert scale. The measure was purified by deleting 25 items which had an item-total correlation of less than .30 (cf. John 1984). Subsequently, a new convenience sample of 50 homemakers (drawn from another city) was obtained. These subjects rated the 25 remaining items and 3 additional items that appeared to be relevant on the basis of the first convenience sample (in that study, other questions were answered as well). Thirteen items were deleted because their item-total correlation was less than .30. On the

[3] In this study, Bettman's operationalization of the number of acceptable alternatives was used. Alternatively, one could define A as the number of alternatives that is equal to or above the minimum acceptable quality level. The two ways to operationalize A lead to similar results. The correlation between the risk scores as computed by the two procedures was .907.

basis of item-total correlations, inter-item correlations, and the value of Cronbach's coefficient alpha (Cronbach 1951) if the item was deleted, the number of items was, after several iterations, reduced to seven. For this seven-item scale, Cronbach's alpha was .68 and three factors had an eigenvalue exceeding one. A five-item solution yielded better results, Cronbach's alpha being .74. One factor had an eigenvalue exceeding one. However, the seven-item measure was used in the main study because (1) the two items not included in the five-item measure performed very well in the first sample of data, (2) the formulation of one of these two items was modified to make the item more easily comprehensible, and (3) observation of the subjects indicated that they had to get acquainted with the type of statements. They used the first couple of items for this purpose, i.e., the first items contained relatively much measurement error. Incidentally, one of the two items that performed relatively badly was the first item to be evaluated in the second pretest.
The final measure of quality-consciousness with respect to food products, which was used in this study, included the following items:

- I usually mean to eat natural food;
- I am willing to pay somewhat more for a product of better quality;
- quality is decisive for me in purchasing foods;
- in choosing food products, on principle I only buy products that do not contain residuals of herbicides and antibiotics;
- I always aim at the best quality;
- I am willing to pay somewhat more for food containing natural ingredients;
- for me, wholesome nutrition begins with purchase of foods of high quality.

Thus, it appears that quality-consciousness is primarily related to the act of buying and the role of quality and quality aspects (most notably health-related aspects) in choice behavior. This notion is supported by another study with the quality-consciousness scale (Steenkamp and Van Trijp 1989a). Using the Gabor and Granger technique, they found that quality-conscious consumers were more willing to pay a higher price for meat cuts than consumers who bothered less about quality.
Three filler items, including two negatively formulated statements, were added to the seven-item measure of quality-consciousness. Two of these items were placed at the beginning of the list to serve as warm-up items. Obviously, the filler items were not included in the calculation of a subject's quality-consciousness score.

6.4. Data collection

Subjects
From the consumer panel of Research International, a large market research agency 600 subjects were sampled. In each of the four experimental conditions (saveloy for sandwiches or snack, gammon for sandwiches or at dinner) 120 subjects participated. The remaining 120 subjects participated in an information integration experiment (see Chapter 11), and performed other tasks which are not relevant to the present study (see Steenkamp 1986). All 600 subjects rated the statements of the quality-consciousness measure.
A questionnaire was mailed to all 2500 members of the consumer panel of

Research International. Questions were asked about the consumption frequency in the household of various meat products including saveloy and gammon, in different usage situations. Of these questionnaires, 1902 were returned. These 1902 households constituted the pool from which the sample of 600 subjects was randomly drawn. The subjects that were sampled were randomly assigned to an experimental situation, under the condition that the household to which the subject belonged used the product in that usage situation at least once a month. This was done to ensure that the subject had some minimum level of experience with the product in that usage situation.
The subjects that were invited to participate in the study were the main purchasers of meat products in the household. All subjects were female. They varied in age from 20 to 68, 44.3% had a paid or unpaid job, and the number of members in the household (including the subject) ranged from one to seven. Subjects varied considerably in level of education, social class, household income, degree of urbanization, region, and other socioeconomic and demographic variables (see Steenkamp 1986 for details).

Procedure
The procedure described below is reported for gammon. A similar procedure was followed for saveloy. Subjects were interviewed at the central test facility of Research International in Rotterdam. The in-store situation was approximated as closely as possible to enhance the validity of the results. The gammon was sliced at the test facility with a commercial slicing machine under the supervision of an expert to ensure that the slices were of equal thickness. The slices were placed on a standard tray that is also used in butcher's shops and meat products departments of supermarkets. On each tray three slices of the same gammon alternative (five slices in the case of saveloy) were placed. Information about price and place of purchase were attached to the tray by means of a small plastic standard that is commonly used in stores. The four gammon alternatives a subject was to evaluate were placed in a cooled showcase. Behind each tray, a piece of gammon was placed. TL-27 fluorescent lamps were used in the test facility because this type of lamps is commonly used in butcher's shops and meat products departments of supermarkets.
The subject looked at the four gammon alternatives as they lay in the cooled showcase. Next, she sat down at a table and the interviewer took the trays with different gammons out of the cooled showcase and placed them on the table in front of the subject. The subject was asked to imagine that she wanted to buy gammon for use on sandwiches (in the other gammon condition, she was asked to imagine that she wanted to buy gammon for dinner). The usage goal was repeated several times during the interview. (Note that, due to the sampling procedure, the subject was familiar with the usage goal.)
The subject first rated each gammon alternative on the seven-point semantic differential quality scale. Next, three trays were taken away and the subject rated the remaining gammon alternative on the quality attributes, perceived quality, and perceived sacrifice (see Chapter 10), using the seven-point Likert scale. The statements measuring perceived quality and perceived sacrifice were placed among the quality attribute statements to counter halo effects. Next, the other three gammon alternatives were rated one by one in the same way.

Subsequently, the four gammon alternatives were again placed before the subject and the subject rated each alternative again on the seven-point semantic differential quality scale. Thus, three quality ratings were obtained for each alternative, using two different scales. In this way, perceived quality is measured more accurately than when only a single quality rating is obtained.
Next, the subject rated the items of the quality-consciousness measure. Subsequently, each gammon alternative was rated on the purchase intention scale (see Chapter 10 for details). Then, the interviewer probed for the reasons why (a) certain gammon alternative(s) received the highest purchase intention rating.
Next, the subject rated the perceived risk items, the global quality-consciousness item, and the predictive value and the confidence value of the cues. She also indicated for each cue which of the two levels denotes better quality. The subject then tasted each gammon alternative, and rated the product on the seven-point Likert scale for six of the quality attributes likely to affect sensory experience. These quality attributes were:
- has a good taste;
- contains much fat;
- is tender;
- contains much salt;
- is fresh;
- is juicy.

The product alternatives were tasted with a time interval of one minute after the subject had rated an alternative on all six attributes. Between samples, subjects were requested to rinse their mouths with water and to use some bread to prevent adaptation (Moskowitz 1983).
Finally, the subject was asked to indicate which gammon alternative she would choose on the basis of the sensory experience. Information about a number of socioeconomic and demographic characteristics was also obtained.
Presentation of the gammon alternatives was randomized within subjects, i.e., the sequence of the alternatives was changed with each part of the data collection procedure. Further, quality attributes were randomized for each alternative.

6.5. Method of analysis

The reliability of the multi-item quality-consciousness was good, Cronbach's coefficient alpha being .83. The set of items was subjected to principal components analysis to explore the dimensionality of the quality-consciousness measure. Both the eigenvalue rule and the scree test (Cattell 1966) suggested that quality-consciousness is a one-dimensional construct. The ratings of a subject on the seven items were summed to provide an overall quality-consciousness score. The distribution of subjects overall scores is presented in Figure 6.1. The distribution is skewed to the left (skewness = -.345). The sample mean score is 27.94 whereas the theoretical mean is 21. This deviation from the theoretical mean is most likely due to the fact that almost all consumers are at least to some extent quality-conscious (cf. *Admedia* 1982).

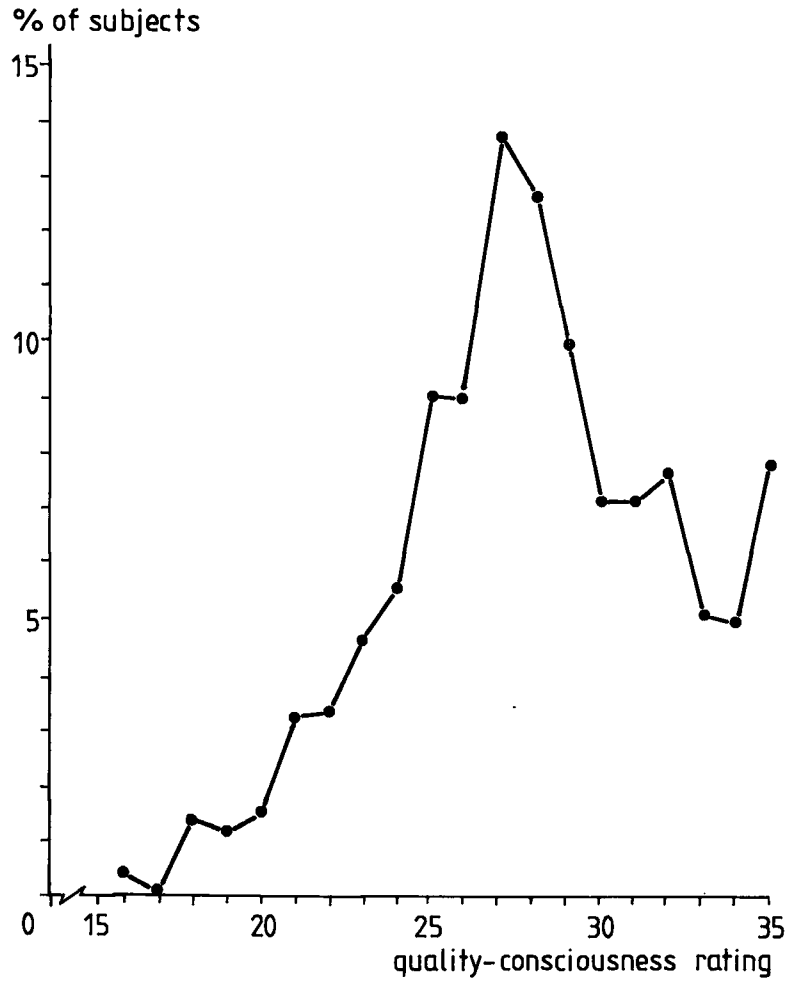

Figure 6.1. Overall distribution of quality-consciousness ratings (n=594)

Ratings for perceived quality and for each quality attribute were normalized across product alternatives within subjects to reduce response-scale bias (Bass and Wilkie 1973). Normalization of ratings also eliminates a potential blocking effect. A blocking effect occurs if the alternatives in one block differ systematically from alternatives in other blocks. However, such a blocking effect was not likely to occur because profiles were balanced within blocks. The absence of blocking effects was supported by statistical analyses. Scheffé's test of multiple comparisons showed that the raw quality ratings did not differ between the blocks for any of the four experimental conditions at $p = .05$. Thus, normalization and pooling of responses across blocks appeared justifiable (Tantiwong and Wilton 1985).

The (normalized) three-item perceived quality measure used in the analyses (see below) was reliable. Cronbach's coefficient alpha ranged from .83 (gammon intended for use at dinner) to .90 (saveloy intended for use on sandwiches).

Principal components analysis with varimax rotation was applied to the (normalized) quality attributes ratings to uncover the underlying quality dimensions. Principal component scores were computed and served as input in subsequent analyses. To emphasize that we have used combinations of quality attributes, the principal components, in the analyses instead of the original attributes, the word *dimension* instead of *attribute* will be used in the empirical part of the study.

Path analysis

Path analysis (Duncan 1966, 1975, Land 1969, Blalock 1971, MacDonald 1977, Pedhazur 1982) was used to estimate the relations between quality cues, quality dimensions, and overall perceived quality. Since the model of the quality perception process proposed in Chapter 5 is fully recursive, it can be parameterized by ordinary least squares (OLS) regression analysis. The effects of variables on other variables can be denoted by their standardized regression (beta) coefficients or path coefficients. Path analysis allows the researcher to decompose the correlation between an exogenous and an endogenous variable, or between two endogenous variables, into the following components:

(1) direct effect of one variable upon the other variable;
(2) indirect effects via mediating variables;
(3) unanalyzed effects due to correlated causes;
(4) spurious effects due to common causes.

The sum of the direct effect and the indirect effects is called the total effect of one variable on another. The sum of unanalyzed and spurious effects is often referred to as the noncausal part of the correlation coefficient. Not all correlations between the variables in the causal model consist of all of these four components. Spurious effects may be identified only for correlations among endogeneous variables. Unanalyzed effects, on the other hand, arise only when exogeneous variables are correlated. (See Alwin and Hauser (1975) for a detailed discussion of the decomposition of correlations in path analysis.)

In path analysis attention is mainly devoted to decomposition of the total effect or causal part of the correlation coefficient into direct and indirect effects. The total effect of a cue on perceived quality can be decomposed into (1) its indirect effects through the quality dimensions, and (2) its residual direct effect after the mediating role of the quality dimensions has been accounted for. In this way, decomposition of total effects helps to explain cue effects on perceived quality in terms of the mediating role of quality dimensions.

The direct effect of a quality cue and of a quality dimension is obtained by regressing perceived quality on the cues and the dimensions jointly. The resulting path coefficients or standardized regression coefficients are estimates of the direct effects of the cues and dimensions on perceived quality. The total effect of each cue on perceived quality is obtained by regressing perceived quality on the cues only. Total effects are given by the path coefficients. The difference between the total effect of a cue on perceived quality and its direct effect on perceived quality is the indirect effect via the quality dimensions. Formally, indirect effects are obtained in the following way. First, regress each quality dimension on the quality cues. Second, regress perceived quality on the cues and the dimensions jointly. Third, for a certain cue, multiply the path coeffi-

cient for the path leading from this cue to the quality dimension under consideration by the path coefficient from that dimension to perceived quality as was obtained by the estimation of direct effects. The value thus obtained represents the mediating role of the dimension in question with respect to that cue. Calculate for the same cue the indirect effects through the other dimensions as well. Fourth, add these dimension-specific indirect effects to obtain the estimated total indirect effect for the cue in question.

A cautionary note seems appropriate here. Path analysis assumes that the relationships between the variables in the model are linear additive. This implies that the marginal effect of variable A on variable B is independent of the value of A. Further, the effect of A on B does not depend upon the value of other predictor variables. In principle, this would exclude curvilinear effects and interactions, among other things. However, these effects can be cast into a linear form by use of mathematical transformations (Heise 1969, McDonald 1977). For example, if it is suspected that variables A_1 and A_2 might interact, a new variable $A_3 = A_1.A_2$ could be created and included in the regression equation, along with A_1 and A_2. This equation is again linear additive. In this way the total effect of interactions and curvilinear terms can also be decomposed into their direct and indirect effects.

Behaviorally, however, interest centers on the effect of one variable, A, upon another variable, B, and on the mediating role of other variables, and not so much on the mediating role of intervening variables with respect to different components (linear, curvilinear, etc.) of A. Therefore, almost all studies using path analysis consider only the main effects of variables because this allows a unambiguous decomposition of the total effects of a variable into its direct and indirect effects. Obviously, such a procedure is only justified if the nonlinear effects explain little of the total variance explained in the dependent variable.

Path analysis applied to the present study

The model of the quality perception process was estimated for saveloy and gammon using path analysis. Given the recursive nature of our model of the quality perception process, the path analysis consists of a number of sequential regression analyses. Below, the procedure adopted will be described in terms of the regression equations estimated.

Individual regression analyses were not feasible because each subject evaluated only four product alternatives. Analyses were conducted across subjects. The aggregate approach is consistent with (1) most quality perception research that is aimed at exploring fundamental relationships instead of concentrating on individual differences, and (2) the increased interest in models at the aggregate level in marketing research as is exemplified by the emergence of hybrid conjoint models, in which aggregate data play an important role (Green et al. 1981, 1983, Green 1984, Akaah and Kargaonkar 1983, Tantiwong and Wilton 1985, Steenkamp et al. 1986, Moore and Seminik 1988). It should be noted that the question which of the two levels of a cue denoted better quality (see Section 6.4) indicated a relatively high level of homogeneity among subjects.

The total effect of a quality cue in the quality perception process was estimated with the following regression model:

$$(6.3) \quad Q_{ij} = \sum_{a=1}^{m} \beta_a X_{ia} + \sum_{\substack{a=1 \\ b=a+1}}^{m} \beta_{ab} Y_{iab} + e_{ij}$$

where Q_{ij} denotes the summed rating on the normalized quality scales given by subject j to product alternative i, X_{ia} is a dummy variable indicating alternative i's level of quality cue *a* (a = 1,..., m), β_a is the path coefficient indicating the main effect of cue *a* on perceived quality, Y_{iab} is the two-way interaction term calculated by multiplying the dummy variables for cues *a* and *b*, β_{ab} is the path coefficient of the interaction, and e_{ij} is the error term with the usual assumptions (Maddala 1977).

The dummy variables were obtained by using effect coding. In effect coding, one cue level is assigned the value +1, and the other level the value -1. Effect coding was used instead of the better known 0-1 dummy coding because the former maintains orthogonality among main effects and interactions, which is not the case for dummy coding (Pedhazur 1982). Coding of cue levels is shown in Table 6.1 (see Section 6.2).

In our model of the quality perception process, it is hypothesized that overall perceived quality judgments are, at least predominantly, based on the quality dimensions (or attributes). However, this is a hypothesis to be tested in the empirical study. If this hypothesis is valid, the direct effects of the quality cues should be small (ideally: nonsignificant) in comparison to the total effects of the cues. To test the hypothesis, the direct effects of the quality cues must be estimated and compared with total cue effects. The direct effects of the quality cues and quality dimensions on perceived quality were investigated with the following regression model:

$$(6.4) \quad Q_{ij} = \sum_{k=1}^{n} \beta_k P_{ijk} + \sum_{a=1}^{m} \beta'_a X_{ia} + \sum_{\substack{a=1 \\ b=a+1}}^{m} \beta'_{ab} Y_{iab} + e_{ij}$$

where P_{ijk} denotes the principal component score of alternative i on quality dimension k (k = 1,..., n) for subject j, and β_k, β'_a, and β'_{ab} indicate the direct effects of dimensions, cue main effects, and cue interactions, respectively.

The effect of a quality cue on quality dimension k was estimated by substituting P_{ijk} for Q_{ij} in equation (6.3):

$$(6.5) \quad P_{ijk} = \sum_{a=1}^{m} \beta_{ka} X_{ia} + \sum_{\substack{a=1 \\ b=a+1}}^{m} \beta_{kab} Y_{iab} + e_{ij}$$

where β_{ka} denotes the path coefficient of the main effect of quality cue *a* on quality dimension k, and β_{kab} is the interaction effect. Equation (6.5) is estimated for all k dimensions separately.

The total, direct, and indirect effect of a cue in the quality perception process can only be estimated unambiguously when the cue does not interact with other cues (see above). If cues interact, the effect of a cue depends on the level of one or more other cues. However, when the interaction effects are small, cue effects can be approximated very well by the path coefficients of the main effects. The total effect of cue *a* is then approximated by β_a and cue *a*'s direct effect by β'_a. The indirect effect of cue *a* on perceived quality through quality dimension k,

IE_{ak}, can then be approximated by:

$$(6.6) \quad IE_{ak} = \beta_{ka}\,\beta_k$$

Equation (6.6) was used in the present study to approximate the indirect effects of the cues because the interaction effects were mostly small (see Chapters 7 and 8).

Unfortunately, we cannot compute the statistical significance of indirect effects (MacDonald 1977). However, it appears reasonable to assume that a fairly stable indirect effect is obtained if both β_{ka} and β_k are significant, i.e., if the cue has a significant effect on the quality dimension and the quality dimension, in its turn, has a significant effect on perceived quality. If β_{ka} and/or β_k are not significant, the estimate of the indirect effect presumably is less stable. In the tables of total, direct, and indirect effects to be reported in Chapters 7 and 8 we shall report whether the path coefficients upon which the estimate of the indirect effect was based, were both significant or not.

The total indirect effect or, more briefly, 'the indirect effect' of cue *a* on perceived quality, IE_a, might be approximated by the sum of the indirect effects through the n quality dimensions ($IE_a = \Sigma\, IE_{ak}$). The relative magnitude of IE_a vis-à-vis β'_a can be taken as measure of the intervening role of the quality dimensions in the quality perception process with respect to cue *a* (cf. Alwin and Hauser 1975). A problem arises, however, when direct and indirect effects counteract one another, i.e., when they differ in sign. The total effect is then smaller than the sum of the absolute values of the direct and indirect effects. A similar problem occurs when indirect effects of cue *a* (IE_{ak}'s) differ in sign. In that case, the total indirect effect is smaller than the sum of the absolute indirect effects ($IE_a < \Sigma\, |IE_{ak}|$). A solution proposed by Alwin and Hauser (1975) is to consider the *absolute* values of the effects in studying the relative importance of the indirect effects. This approach is followed in this study. In formula:

$$(6.7) \quad RIE_a = \frac{\sum_{k=1}^{n} |IE_{ak}|}{\sum_{k=1}^{n} |IE_{ak}| + |\beta'_a|} \cdot 100\%$$

where RIE_a denotes the relative importance of the indirect effects for cue *a*.

The proposed model of the quality perception process posits that quality dimensions act as mediating variables between quality cues and perceived quality. Therefore, the basic proposition of the model receives empirical support if the indirect effects are relatively large in comparison to the direct effects. On the other hand, when the indirect effects are relatively small vis-à-vis the direct effects the model should be seriously questioned. There is no clear-cut measure to determine what is 'large' or 'small'. It seems reasonable to require, however, that for the majority of the cues the total indirect effect (taken as the sum of the absolute values of the indirect effects through the various quality dimensions) should exceed (the absolute value of) the direct effect before the model can be considered to be supported by the data. To put it in another way, RIE_a should be greater than 50% for the majority of the cues.

Some reflections on the methodology employed

Equations (6.3) through (6.5) show that the compensatory model is used to investigate the quality perception process in this study. The compensatory model can be estimated by regression analysis. The validity of the regression analysis approach has been discussed in detail in Section 5.3.2. The validity of the compensatory model is enhanced by results of studies in which it was found that people usually employ a single-stage compensatory heuristic when the number of alternatives to be evaluated is three or four (see Section 5.1) as was the case in our study. Further, interactions are also taken into consideration in the present study. Models including interactions are an approximation to noncompensatory models (Carmone and Green 1981). Finally, the compensatory approach was supported by supplementary data concerning the quality perception process obtained in the data collection procedure. Following Holbrook and Moore (1981b), some insight into the judgment heuristic used was obtained by asking the subject to rate the following statement on a five-point Likert scale: 'When I rated the gammons (saveloys), I tried to add up their relative pluses and minuses'. Aggregated over the four experimental conditions, only 8.1% disagreed with this statement, suggesting that a compensatory model of the quality perception process is appropriate for most subjects.

Some remarks on the use of path analysis to explore the quality perception process seem warranted. Path analysis belongs to the family of multivariate techniques studying the causal relationships between variables on the basis of their covariances. Path analysis does not require a priori specification of the multi-item content of variables, and of the relationships between the variables. Another well-known covariance structure analysis technique is LISREL (Bagozzi 1980, Jöreskog and Sörbom 1984). LISREL requires that the multi-item content of variables and the relationships between the variables are specified a priori. For the present study LISREL was not appropriate for two reasons (cf. Holbrook 1981). First, it was unknown which quality attributes could be grouped together as expressions of the same underlying quality dimension. Principal components analysis was used instead to uncover the basic quality dimensions. Second, the important causal relationships were determined on the basis of the significance of the path coefficients. The perceived quality literature provides little guidance with respect to the nature and occurrence of interaction effects and to the effect of cues on specific quality dimensions. In these circumstances, path analysis is more appropriate as an analytical technique than is LISREL (Holbrook 1981, Pedhazur 1982). Another consideration favoring the use of path analysis is that the test statistics obtained by OLS are more robust to violations of statistical assumptions than those obtained by maximum likelihood estimation yielded by LISREL.

The results of the application of the proposed model of the quality perception process to saveloy and gammon are reported in Chapters 7 and 8, respectively. The results will be presented in the context of equations (6.3) through (6.7). The results will be primarily discussed from a theoretical perspective. In the context of the present theoretical study, detailed discussion of specific effects is less relevant. Marketing implications for the meat industry have been considered elsewhere (Steenkamp 1987c, d).

The hypotheses developed in Section 5.4 are tested in Chapter 9.

7. THE QUALITY PERCEPTION PROCESS FOR SAVELOY

7.1. The quality dimensions

Principal components analysis applied to the attribute ratings for each usage goal separately yielded three similar-looking components with eigenvalues exceeding one. These components accounted for 51.3% ('snack') and 52.6% ('sandwiches') of the variance in the attribute ratings.

The correspondence between the principal components structures of 'snack' and 'sandwiches' was investigated on the basis of three different approaches. All three approaches were applied to the component loadings of variables after varimax rotation as recommended by Cattell (1978). Insight into the stability of the quality dimensions can thus be obtained. Calculations were carried out for each pair of similar principal components. The approaches were:

- computation of the correlation coefficient (Holbrook and Moore 1981a);
- calculation of Burt's congruence coefficient (Wrigley and Newhaus 1955);
- calculation of Cattell's s-index (Cattell et al. 1969).

Correlation coefficients between the pairs of similar principal components were .982, .898, and .865, respectively. All three correlation coefficients were significant at $p < .001$. A drawback of the correlation coefficient as an index of correspondence between two principal components is that it is calculated on the basis of deviations from the mean of each set of loadings. When large positive loadings dominate, smaller positive ones become negative deviations. In judging the similarity between pairs of principal components, the sign of a loading (positive or negative) is often more important than its absolute magnitude (Cattell 1978).

Burt's congruence coefficient takes the magnitude of the loadings as well as their direction into account. Corresponding principal components are those with coefficients approaching 1, and noncorresponding principal components have small coefficients. The congruence coefficient was .985, .920, and .885, respectively for the pairs of corresponding principal components. The statistical significance of a congruence coefficient is difficult to determine since its sampling distribution is unknown. However, Cattell (1978) presents tables for the significance of congruence coefficients based on Monte Carlo procedures. Cattell's simulation results indicate that the above congruence coefficients were significant at $p < .001$, $p < .001$, and $p < .01$, respectively.

Cattell et al. (1969) distinguished between positive salient variables, negative salient variables, and hyperplane variables. Hyperplane variables are variables with a small positive or negative loading on the principal component in question. Two principal components have a maximum similarity when there is

agreement among salients with positive sign, among salients with negative sign, and among hyperplanes. Cattell's s-index measures this degree of agreement and can be tested for statistical significance. In our computations, common practice in marketing research and psychology was followed in considering principal components loadings $\geq .40$ as salient (cf. Hubbard and Allen 1987, Guadagnoli and Velicer 1988). The s-index was significant for all three pairs of similar principal components ($p < .001$, $p < .001$, and $p < .01$, respectively). In sum, all three methods indicated close correspondence between principal component structures, justifying pooling of subjects' responses for the two usage situations in a single principal components analysis. Pooling of the responses has the advantage that the results to be reported can be more easily compared across usage goals. Further, principal component patterns are more stable when they are based on larger samples (Guadognoli and Velicer 1988). Thus, principal components analysis was applied to the correlation matrix aggregated over all 240 subjects. Bartlett's test of sphericity ($p < .0001$) and the Kaiser-Meyer-Olkin measure of sampling adequacy (Kaiser 1970, Kaiser and Rice 1974) of .812 indicated that the correlation matrix was appropriate for principal components analysis. The eigenvalue criterion and the scree test both suggested a three-component solution. The three principal components explained 52.5% of the variance. The principal component loadings (after varimax rotation) are reported in Table 7.1.

A clear component structure emerged. All attributes had a salient loading and only one attribute, unwholesome, had a salient loading for more than one dimension. Further, 11 of the 13 salient loadings were greater than .50, and 9 out of 13 were greater than .60. The mean of the salient loadings was .626. All this suggests a high degree of meaningfulness and reliability for the principal components results (Holbrook and Batra 1987, Guadognoli and Velicer 1988). The dimensions were labeled judgmentally sensory perception, unwholesomeness, and keepability. The first dimension, sensory perception, was positively

Table 7.1. Principal component loadings relating quality attributes and quality dimensions after varimax rotation (salient loadings are underlined).

Attribute[a]	Sensory perception	Unwholesomeness	Keepability
Taste	<u>.777</u>	-.223	.108
Fat	-.127	<u>.613</u>	-.194
Coloring agents	-.138	<u>.609</u>	.255
Unwholesome	<u>-.400</u>	<u>.401</u>	-.130
Tender	<u>.761</u>	-.101	.185
Salt	.091	<u>.508</u>	.218
Keepable	.152	-.117	<u>.764</u>
Preservatives	-.101	.395	<u>.559</u>
Natural	<u>.616</u>	-.136	-.289
Bad for the figure	-.057	<u>.633</u>	-.068
Fresh	<u>.683</u>	.125	-.388
Juicy	<u>.818</u>	.017	.146
Cumulative variance (%)	24.5	39.8	51.2

[a] See Section 6.3 for complete attribute descriptions.

related to taste, tender, juicy, natural, and fresh, and negatively related to unwholesome. The second dimension was positively related to fat, coloring agents, unwholesome, salt, and bad for the figure. This dimension reflects the perceived healthiness of an alternative with high scores indicating a relatively unwholesome product. Therefore, the label 'unwholesomeness' was used for the second dimension. The third dimension, keepability, was related to keepable and preservatives.
Common factor analysis yielded similar dimensions.
Sensory perception and keepability can be considered as experience dimensions since they can be ascertained upon consumption. The (un)wholesomeness of a saveloy alternative cannot be ascertained upon consumption. Possible health-related consequences are only revealed (if at all) after a long period of consumption. Therefore, unwholesomeness is a credence dimension.
Principal component scores were computed for each subject and saveloy alternative, and served as input in subsequent regression analyses. The number of observations available for regression analyses was 4 (number of stimuli per subject) x 120 (subjects) = 480.
It was hypothesized that sensory perception and keepability had a positive influence, and unwholesomeness a negative effect on perceived quality judgments (cf. Steenkamp 1987a). Therefore, the significance of the path coefficients from the quality dimensions to perceived quality was tested one-tailed. Since no clear hypothesis could be developed for most quality cue effects (especially the interaction effects), it was decided to test cue effects on the quality dimensions, and on perceived quality two-tailed. An effect was considered to be significant when its p-value was less than .05. Further, the analytical procedure described in Section 6.5 was followed. The coding scheme adopted for the saveloy cues has been reported in Table 6.1.

7.2. Path analysis results for saveloy intended for use as snack

Total effects of quality cues in the quality perception process
The total effects of the quality cues in the quality perception process were estimated by regressing perceived quality on cue main effects and two-way interactions. Due to the effect coding, all these terms were uncorrelated. The results are listed in Table 7.2. The table shows the contributions to perceived quality for each main effect and each of the estimatable two-way interactions (cf. Section 6.1). The coefficients of the main effects reported in the table refer to the cue levels denoted by +1. For the interactions, the coefficient refers to the cue combinations (-1, -1) (and +1, +1). Table 7.2 and the other tables in Chapters 7 and 8 report both unstandardized regression coefficients ('b's') and path coefficients ('betas'). Path coefficients are scale-free and can therefore be compared across different variables. Unstandardized regression coefficients are the most appropriate ones when effects of individual variables or sets of variables are compared, and tested for differences, across different samples (Bielby and Kluegel 1977, Pedhazur 1982). Both types of comparisons are made in this study.
The main effects of all quality cues were significant. The role of the interactions in the quality perception process was small. Only one of the interactions was

Table 7.2. Total effects of quality cues in the quality perception process for saveloy intended for use as snack

Predictor variable	b	Path coefficient	p-value
Packaging (Pa)	.024	.102	.003
Price (P)	.032	.132	< .001
Color (C)	-.134	-.561	< .001
Texture (T)	-.072	-.301	< .001
Place of purchase (PP)	-.017	-.073	.033
Pa x T	-.010	-.040	.243
Pa x PP	.001	.004	.909
P x T	-.011	-.044	.198
P x PP	.027	.112	.001
C x T	-.007	-.030	.381
C x PP	.009	.040	.248
T x PP	-.015	-.062	.069
Intercept	.751		< .001

R^2 = .460 (p < .001)

significant. R^2 for the main-effects-only model was .437. Consequently, all interactions together accounted for only 2.3% of the variance in the quality ratings.

Table 7.2 indicates that the intrinsic cues color (-.561) and texture (-.301) were the most important for saveloy as a snack.[1] Pink saveloy of fine texture was perceived to be of especially high quality. Price (.132) and packaging (.102) were also of some importance. The cue levels unpackaged and higher price (Dfl. 2.19 per 100 grams) contributed to quality image. The main effect of place of purchase (-.073) suggested that the butcher's shop was evaluated more positively than the supermarket. The P x PP interaction (.112) indicated, however, that this was only true when saveloy was cheap (Dfl. 1.39 per 100 grams). At a low price, the butcher's shop had a higher quality image than the supermarket. At a high price, the place of purchase was of little importance (the supermarket even rated somewhat higher). The price x place of purchase interaction is depicted in Figure 7.1.[2]

Direct effects of quality cues and quality dimensions on perceived quality

Perceived quality was regressed on the quality cues and quality dimensions jointly. The results are reported in Table 7.3. The effect of keepability on perceived quality (-.014) was not significant. This was due to the inclusion of the quality cues since regression analysis of perceived quality on the quality dimensions only, revealed a weak but significant (p = .047) effect of keepability on

[1] Unless indicated otherwise, the figure in parenthesis denotes the path coefficient of the main effect.

[2] The predicted quality ratings shown in Figure 7.1 are based upon of the main effects of price and place of purchase, and the price x place of purchase interaction (and the intercept). Without loss of generality, the levels of the other cues are not considered. Unstandardized regression coefficients are used to provide a direct link with the summated quality scale used in this study.

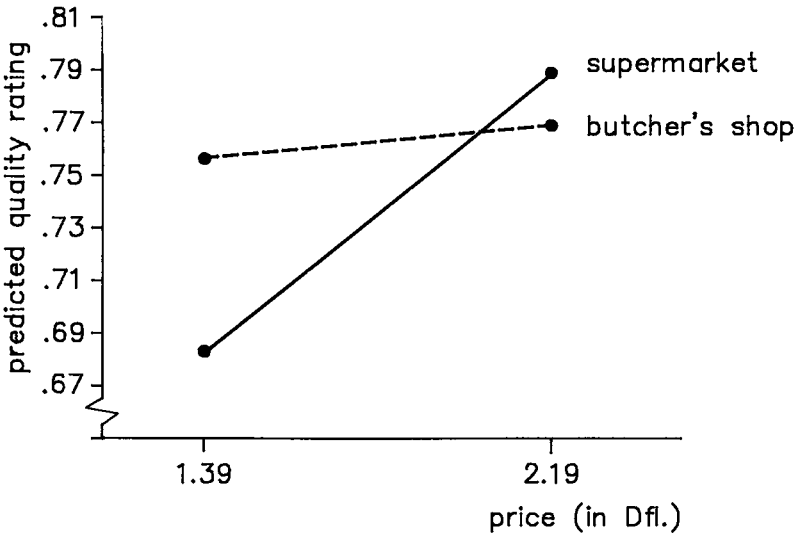

Figure 7.1. Price x place of purchase interaction for saveloy intended for use as snack (based on total effects).

Table 7.3. Direct effects of quality cues and quality dimensions on perceived quality for saveloy intended for use as snack

Predictor variable	b	Path coefficient	p-value[a]
Sensory perception	.147	.577	< .001
Unwholesomeness	-.036	-.157	< .001
Keepability	-.003	-.014	.835
Packaging (Pa)	-.001	-.004	.902
Price (P)	.016	.065	.014
Color (C)	-.063	-.262	< .001
Texture (T)	-.026	-.111	< .001
Place of purchase (PP)	-.005	-.021	.425
Pa x T	-.005	-.021	.431
Pa x PP	-.001	-.003	.904
P x T	-.003	-.013	.612
P x PP	.020	.084	.002
C x T	-.010	-.042	.110
C x PP	.005	.020	.439
T x PP	-.002	-.010	.701
Intercept	.750		< .001

$R^2 = .687$ ($p < .001$)

[a] The p-values reported for the quality dimensions are one-tailed since a direction was hypothesized a priori. The p-values for the quality cues are two-tailed.

perceived quality. Further, previous research strongly suggested that consumers consider keepability to be a quality aspect (Steenkamp et al. 1986a). Keepability was therefore not deleted from the path analyses.

As hypothesized, sensory perception (.577) was positively related, and unwholesomeness (-.157) was negatively related to perceived quality. Consistent

with previous studies concerning foods, sensory perception was found to be the most important quality dimension (cf. Yoshida 1981, Rosen 1984, Bonner and Nelson 1985, Steenkamp 1987a).
It was tested whether curvilinear or configural terms with respect to the quality dimensions were significant. The nonlinear terms in total accounted for an additional .5% of the variance in the quality ratings. Only one term, the quadratic effect of sensory perception, was significant ($b = .011, p = .028$). The positive sign of its coefficient indicates a negative ideal point for this dimension. However, the negative ideal point was situated far outside the range of ratings on the sensory perception dimension, -6.682 on a standardized scale. Thus, it can be concluded that the linear additive model adequately described the integration of the quality dimensions.
Again, interactions were of little importance. Only one interaction term, price x place of purchase was significant and the seven interactions effects taken together explained only an additional 1.0% of the variance in the quality ratings.
The most important result concerned the magnitude of the cue main effects. Inclusion of the quality dimensions caused the formerly significant main effects of packaging and place of purchase to disappear almost entirely. The effects of price, color, and texture were greatly reduced.

Effects of the quality cues on the quality dimensions
Regression analysis of each of the quality dimensions on the quality cues was performed to estimate the contribution of cue main effects and interactions to the perception on each dimension. The overall relationship was significant for each dimension: sensory perception $R^2 = .326$ ($p < .001$), unwholesomeness $R^2 = .192$ ($p < .001$), keepability $R^2 = .346$ ($p < .001$). The results are shown in Table 7.4.
The results indicated that the sensory aspects of saveloy were primarily inferred on the basis of color (-.467) and texture (-.230). Pink saveloy of fine texture rated high on this dimension. Packaging (.155), price (.104), and place of purchase (-.080) also affected sensory perception but were less important than the other two cues. The unwholesomeness of saveloy was inferred on the basis of texture (.377) and color (.194). Keepability was primarily inferred on the basis of packaging (-.540). The other four cues were considerably less important.
The influence of cue interactions was again limited. The interactions accounted only for 1.3%, .5%, and 1.6% of the variance in sensory perception, unwholesomeness, and keepability, respectively.

The intervening role of the quality dimensions
The intervening role of the quality dimensions was explored by decomposing the total main effect of a cue into its indirect effects through intervening quality dimensions and its residual direct effect after the mediating role of the quality dimensions had been accounted for. The results are shown in Table 7.5. Table 7.5, and the other tables in this study reporting the decomposition of total effects, are based on the path coefficients of the main effects only (cf. Section 6.5.). However, given the small importance of cue interactions in all steps of the

Table 7.4. Effects of quality cues on the quality dimensions sensory perception, unwholesomeness, and keepability for saveloy intended for use as snack

Predictor variable	Sensory perception			Unwholesomeness			Keepability		
	b	Path coefficient	p-value	b	Path coefficient	p-value	b	Path coefficient	p-value
Packaging (Pa)	.145	.155	< .001	-.060	-.058	.170	-.588	-.540	< .001
Price (P)	.098	.104	.007	-.053	-.050	.230	.084	.077	.043
Color (C)	-.438	-.467	< .001	.203	.194	< .001	-.118	-.109	.004
Texture (T)	-.215	-.230	< .001	.394	.377	< .001	-.141	-.129	< .001
Place of purchase (PP)	-.075	-.080	.038	.035	.033	.427	.072	.066	.079
Pa x T	-.027	-.029	.456	.020	.019	.656	-.000	-.000	.994
Pa x PP	.022	.024	.535	.046	.044	.290	-.026	-.024	.531
P x T	-.043	-.045	.236	.037	.036	.394	-.081	-.074	.051
P x PP	.041	.044	.253	-.020	-.019	.650	.014	.013	.728
C x T	.019	.020	.605	.001	.001	.979	-.059	-.054	.154
C x PP	.024	.026	.496	-.030	-.029	.494	.020	.018	.632
T x PP	-.076	-.081	.035	.031	.029	.485	.084	.077	.042
Intercept	.003		.924	.002		.968	-.001		.975
	$R^2 = .326$ ($p < .001$)			$R^2 = .192$ ($p < .001$)			$R^2 = .346$ ($p < .001$)		

path analysis, Table 7.5 provides an accurate picture of the decomposition of the total effects of the cues in the quality perception process.
For all cues RIE was greater than 50%, meaning that for all cues the sum of the absolute values of the indirect effects exceeded the absolute value of the direct effect.[3] This implies that the conceptualization of quality dimensions as intervening variables between quality cues and perceived quality is supported. Sensory perception was by far the most important intervening dimension. The intervening role of unwholesomeness was considerable with respect to texture and, to a lesser extent, with respect to color.
We will now illustrate the potential of the proposed model for understanding the quality perception process. Previous empirical studies, which did not distinguish between quality cues and quality dimensions, were not able to explain

Table 7.5. Decomposition of the effects of quality cues on perceived quality for saveloy intended for use as snack (main effects only)

Quality cue	Total effect[a]	Direct effect[b]	Indirect effects through intervening quality dimensions		RIE(%)[c]
Packaging	102[d]	-.004	Sensory perception	.089[e]	96.4
			Unwholesomeness	.009	
			Keepability	.008	
				.106	
Price	.132[d]	.065[d]	Sensory perception	.060[e]	51.5
			Unwholesomeness	.008	
			Keepability	-.001	
				.067	
Color	-.561[d]	-.262[d]	Sensory perception	-.269[e]	53.5
			Unwholesomeness	-.030[e]	
			Keepability	.002	
				-.297	
Texture	-.301[d]	-.111[d]	Sensory perception	-.133[e]	63.6
			Unwholesomeness	-.059[e]	
			Keepability	.002	
				-.190	
Place of purchase	-.073[d]	-.021	Sensory perception	-.046[e]	71.2
			Unwholesomeness	-.005	
			Keepability	-.001	
				-.052	

[a] See Table 7.2.
[b] See Table 7.3.
[c] Relative importance of the indirect effects (see equation (6.7)).
[d] $p < .05$
[e] Both path coefficients upon which the calculation of the indirect effect was based, were significant at $p = .05$ (cf. Section 6.5).

[3] See Section 6.5 for the rationale of considering absolute values in analyzing the relative magnitude of direct and indirect effects.

the results concerning specific cue effects on perceived quality. The proposed model allows one to explore the 'why?' of cue effects. For example, it had been found that color can affect quality perceptions (e.g., Wheatley and Chiu 1977), but it was not clear *why* consumers did use this cue. Our distinction between cues and dimensions showed that, in the case of saveloy, color was primarily valued because subjects thought that it said something about the sensory characteristics of the product. Color also had certain health connotations. To take another example, unpackaged saveloy was perceived to be of higher quality because subjects inferred that it possessed attractive sensory characteristics. Although vacuum-packaged saveloy rated high on keepability, sensory perception was much more important than keepability, the latter having in fact no significant influence on perceived quality for saveloy intended for use as snack, so that the shorter keepability of unpackaged saveloy was more than compensated for by its perceived superior sensory characteristics.
Thus, the distinction between quality cues and quality dimensions enables researchers to explain cue effects on perceived quality in terms of the mediating role of the quality dimensions, and assists them in product development and the formulation of a marketing strategy (see further Chapter 13).

Figure 7.2 depicts a summary overview of the path analysis results obtained for the quality perception process for saveloy intended for use as snack. In the figure, only the significant main effects are shown. To avoid a confusing tangle of arrows, the nonsignificant main effects and all interaction terms have been omitted. The reader is referred to Tables 7.2 through 7.4 for complete results.

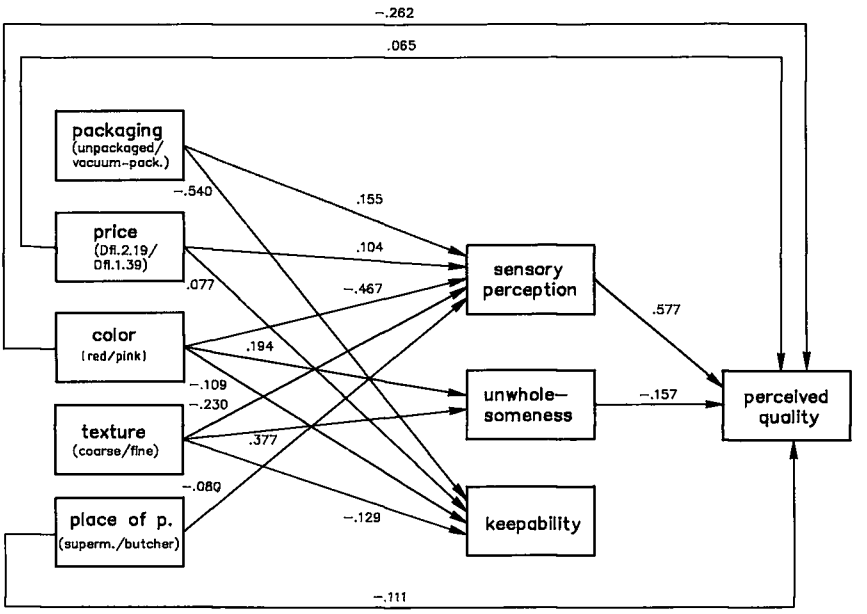

Figure 7.2 Summary overview of the path analysis results for saveloy intended for use as snack (significant main effects only)

Note: For each cue, the level before the slash (/) was coded +1, and the level after the slash -1.

7.3. Path analysis results for saveloy intended for use on sandwiches

Total effects of the quality cues in the quality perception process

The results of the regression analysis of perceived quality on cue main effects and interactions are reported in Table 7.6. Color (-.654) and, to a lesser extent, texture (-.205) were the predominant quality cues. Price (.105) was also of some importance. The main effects of place of purchase (-.033) and packaging (.059) were not significant. However, if the effect of packaging were tested one-tailed, it does not seem unreasonable to assume that unpackaged saveloy would rate rated higher than the vacuum-packaged product, packaging would have a significant effect on perceived quality.

Table 7.6. Total effects of quality cues in the quality perception process with respect to saveloy intended for use on sandwiches

Predictor variable	b	Path coefficient	p-value
Packaging (Pa)	.015	.059	.071
Price (P)	.026	.105	.002
Color (C)	-.162	-.654	< .001
Texture (T)	-.051	-.205	< .001
Place of purchase (PP)	-.008	-.033	.314
Pa x T	.004	.016	.635
Pa x PP	-.002	-.008	.811
P x T	.005	.018	.574
P x PP	-.011	-.045	.172
C x T	.015	.059	.072
C x PP	-.003	-.013	.683
T x PP	-.026	-.107	.001
Intercept	.750		< .001

$R^2 = .502$ ($p < .001$)

Place of purchase had some effect on perceived quality through an interaction with texture (-.107). Saveloy of fine texture offered at the supermarket received a slightly higher quality evaluation than the same saveloy offered at the butcher's shop.

Inclusion of the interaction terms contributed little to the variance explained in quality ratings: R^2 was .485 ($p < .001$) for the main effects only model and .502 ($p < .001$) for the full model.

The direction of the main effects in the quality perception process of saveloy intended for use on sandwiches was the same as for saveloy intended for use as snack. Some differences, however, were apparent. Packaging and place of purchase had a significant main effect on the quality perception of saveloy intended for use as snack. Further, in the quality perception process with respect to saveloy on sandwiches, the effect of color was somewhat greater, and the effects of price and texture were somewhat smaller.

Direct effects of quality cues and quality dimensions on perceived quality.

Table 7.7 reports the results of the regression analysis of perceived quality on cue main effects, cue interactions, and quality dimensions jointly. A significant

Table 7.7. Direct effects of quality cues and quality dimensions on perceived quality for saveloy intended for use on sandwiches.

Predictor variable	b	Path coefficient	p-value[a]
Sensory perception	.140	.600	< .001
Unwholesomeness	-.051	-.197	< .001
Keepability	.016	.057	.020
Packaging (Pa)	.030	.120	< .001
Price (P)	.019	.078	.001
Color (C)	-.077	-.313	< .001
Texture (T)	-.018	-.074	.004
Place of purchase (PP)	.002	.007	.753
Pa x T	-.002	-.007	.767
Pa x PP	-.002	-.008	.731
P x T	.004	.016	.495
P x PP	-.004	-.016	.501
C x T	.012	.048	.042
C x PP	-.008	-.032	.171
T x PP	-.018	-.073	.002
Intercept	.751		< .001

$R^2 = .744$ ($p < .001$)

[a] The p-values reported for the quality dimensions are one-tailed since a direction was hypothesized a priori. The p-values for the quality cues are two-tailed.

overall relationship was found: $R^2 = .744$ ($p < .001$). All three dimensions were significantly related to perceived quality. As hypothesized, perceived quality increased with sensory perception (.600) and keepability (.057), and decreased with unwholesomeness (-.197). Interactions between quality dimensions and curvilinear terms were not significant.

Cue interactions accounted for only an additional .9% in the variance in the quality ratings. Inclusion of the quality dimensions led to a considerable reduction of the cue effects on perceived quality. An exception was observed for packaging: its direct effect (.120) exceeded its total effect (.059), indicating an inverse indirect effect of -.061. This result will be discussed below.

Effects of the quality cues on the quality dimensions

Each of the three quality dimensions was regressed separately on cue main effects and interactions. The results are shown in Table 7.8. All three regression analyses yielded significant results: sensory perception $R^2 = .348$ ($p < .001$), unwholesomeness $R^2 = .101$ ($p < .001$), and keepability $R^2 = .265$ ($p < .001$). Packaging (-.480) and price (.086) contributed significantly to perceived keepability, color to sensory perception (-.563) and perceived keepability (-.091), and texture to all three quality dimensions (-.110, .299, and -.098, respectively). Place of purchase did not contribute significantly to any of the dimensions. None of the interaction terms had a significant effect on any of the three quality dimensions. Consequently, the contribution of the total set of interactions to R^2 was very small: .9% for sensory perception, .6% for unwholesomeness, and .8% for keepability.

Table 7.8. Effects of quality cues on the quality dimensions sensory perception, unwholesomeness, and keepability with respect to saveloy intended for use on sandwiches.

Predictor variable	Sensory perception			Unwholesomeness			Keepability		
	b	Path coefficient	p-value	b	Path coefficient	p-value	b	Path coefficient	p-value
Packaging (Pa)	-.065	-.062	.102	-.016	-.017	.706	-.432	-.480	< .001
Price (P)	.056	.053	.162	.049	.051	.248	.077	.086	.032
Color (C)	-.596	-.563	< .001	-.010	-.010	.817	-.082	-.091	.024
Texture (T)	-.117	-.110	.003	.285	.299	< .001	-.088	-.098	.015
Place of purchase (PP)	-.059	-.055	.141	.044	.047	.290	.031	.034	.390
Pa x T	.042	.039	.296	.007	.008	.862	.009	.010	.808
Pa x PP	-.016	-.015	.693	-.038	-.040	.363	.021	.023	.565
P x T	.007	.007	.860	-.004	-.004	.932	-.038	-.042	.294
P x PP	-.046	-.044	.244	.000	.000	.994	-.041	-.045	.260
C x T	.030	.028	.451	.029	.030	.496	.001	.001	.980
C x PP	.017	.016	.672	-.045	-.048	.280	.002	.002	.958
T x PP	-.068	-.064	.089	-.034	-.036	.415	-.049	-.055	.172
Intercept	-.005		.892	.000		1.000	.003		.936
	$R^2 = .348$ ($p < .001$)			$R^2 = .101$ ($p < .001$)			$R^2 = .265$ ($p < .001$)		

The intervening role of the quality dimensions

The intervening role of the quality dimensions was again studied by decomposing the total main effect of a cue into its direct and indirect effects. The results are shown in Table 7.9. The quality dimensions exerted a strong mediating effect on the relationship between cues and perceived quality although their role was somewhat less pronounced than in the quality perception process with respect to saveloy intended for use as snack. For color, texture, and place of purchase, the sum of the absolute values of the indirect effects exceeded the absolute value of their direct effects. However, the result obtained with respect to place of purchase should be considered with caution since neither the total effect, nor the direct effect, nor the effects on the quality dimensions were significant. A puzzling result was found for packaging. The direct effect of packaging (.120) indicated that unpackaged saveloy received a considerably

Table 7.9. Decomposition of the effects of quality cues on perceived quality with respect to saveloy intended for use on sandwiches (main effects only)

Quality cue	Total effect[a]	Direct effect[b]	Indirect effects through intervening quality dimensions		RIE(%)[c]
Packaging	.059	.120[d]	Sensory perception	-.037	35.8
			Unwholesomeness	.003	
			Keepability	-.027[e]	
				-.061	
Price	.105[d]	.078[d]	Sensory perception	.032	37.6
			Unwholesomeness	-.010	
			Keepability	.005[e]	
				.027	
Color	-.654[d]	-.313[d]	Sensory perception	-.338[e]	52.4
			Unwholesomeness	.002	
			Keepability	-.005[e]	
				-.341	
Texture	-.205[d]	-.074[d]	Sensory perception	-.066[e]	63.9
			Unwholesomeness	-.059[e]	
			Keepability	-.006[e]	
				-.131	
Place of purchase	-.033	.007	Sensory perception	-.033	86.3
			Unwholesomeness	-.009	
			Keepability	.002	
				-.040	

[a] See Table 7.6.
[b] See Table 7.7.
[c] Relative importance of the indirect effects (see equation (6.7)).
[d] $p < .05$
[e] Both path coefficients upon which the calculation of the indirect effect was based, were significant at $p = .05$.

higher quality evaluation than vacuum-packaged saveloy. On the other hand, the total effect of saveloy (.059) was considerably smaller and not significant. This was caused by opposite indirect effects through the quality dimensions. Vacuum-packaged saveloy was perceived to keep longer, to be more unwholesome, and to rate higher in sensory perception. However, the indirect effect with respect to sensory perception was unexpected, and should be considered with caution since it was based upon an insignificant effect of packaging on sensory perception.

Figure 7.3 depicts a summary overview of the path analysis results obtained for the quality perception process for saveloy intended for use on sandwiches. In the figure, only the significant main effects are shown. To avoid a confusing tangle of arrows, the nonsignificant main effects and all interaction terms have been omitted. The reader is referred to Tables 7.6 through 7.8 for complete results.

7.4. Comparison of the results between usage goals

Method

The results of the path analyses indicated that the quality perception process did not differ much between the two usage goals. The direction of cue and dimension effects was largely the same. The intrinsic quality cues color and texture were predominant cues for both usage goals, and sensory perception was by far

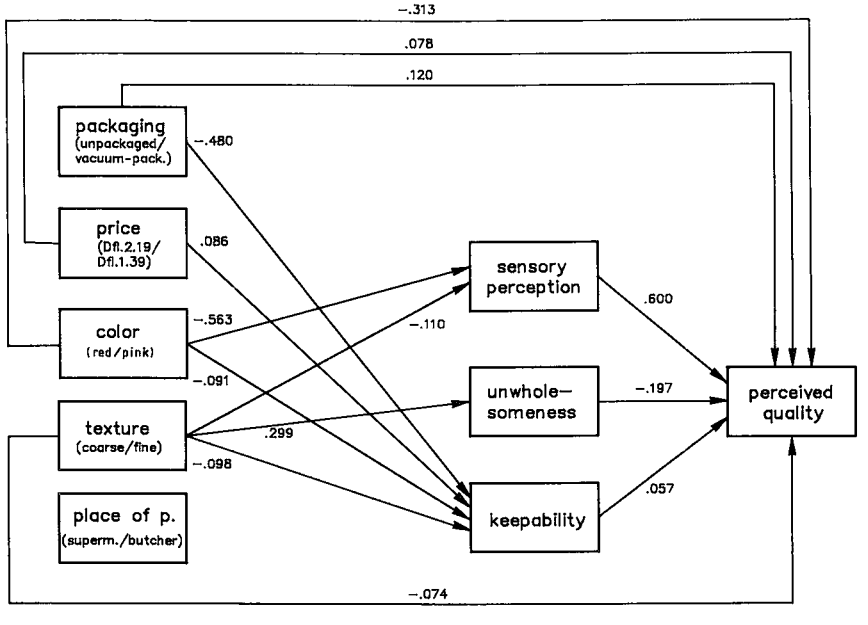

Figure 7.3 Summary overview of the path analysis results for saveloy intended for use on sandwiches (significant main effects only)

Note: For each cue, the level before the slash (/) was coded +1, and the level after the slash -1.

the most important quality dimension. Further, the quality dimensions acted as intervening variables between quality cues and perceived quality for both usage goals. However, some differences were found. For instance, in the case of the usage goal 'sandwiches', keepability was more important, and color had no significant effect on perceived unwholesomeness.

The results obtained for the two usage goals were compared formally by using the Chow test (Maddala 1977). The Chow test examines whether two regression equations differ significantly from each other or not. It is a test for stability of regression coefficients.

Significant differences between the two experimental conditions can be due to the influence of the usage goal on the quality perception process and/or to differences between subjects in the two groups. However, no significant ($p < .05$) differences between subjects in the two experimental conditions were found with respect to net annual household income, level of education of the subject, level of education of the main wage earner, number of persons in the household, age of the subject, region of residence, and employment. Further, the subjects in the two experimental conditions did not differ significantly with respect to quality-conciousness (mean rating in the 'snack' condition 28.38, mean rating in the 'sandwiches' condition 28.47; $p = .872$). Thus, it is plausible that possible differences between the experimental conditions were primarily due to different usage goals.

The Chow test was employed to explore whether significant differences exist between the experimental conditions for the following aspects of the model:

- total effects of quality cues (Tables 7.2 and 7.6);
- direct effects of quality cues and quality dimensions (Tables 7.3 and 7.7);
- effects of quality cues on quality dimensions, analyzed for each dimension separately (Tables 7.4 and 7.8).

It is likely that aspects of the quality perception process differ between usage goals (cf. Section 5.1). If an overall significant difference between the two regression equations was found, it was explored which coefficient(s) differed significantly between usage goals. Bonferroni's technique (Bielby and Kluegel 1977, Myers 1979) was used to test differences among corresponding coefficients. Bonferroni's technique allows tests of individual comparisons such that one is protected at a specified overall level against making a type I error for a group of comparisons. Otherwise, the probability of falsely concluding that a significant difference has been found in any one of the individual comparisons is greater than the p-value for which each of the comparisons were tested in the usual pairwise procedure.

The overall p-value for a group of comparisons was set at .10. The p-value per individual comparison was .10/m where m is the number of comparisons. For example, if 12 comparisons were made (this was done to compare Tables 7.2 and 7.6, and Tables 7.4 and 7.8) the significance level of an individual test was .008. As recommended by Bielby and Kluegel (1977), the tests were conducted on unstandardized regression coefficients since the usual test statistics do not apply to path coefficients.

Results of the comparisons between usage goals

Total cue effects differed significantly between usage goals ($F_{13,928} = 2.372$, $p <$

.01). A significant difference in coefficients was found for the price x place of purchase interaction. It was is not significant for the usage goal 'sandwiches' (b = -.011, p = .172) but it was significant for the usage goal 'snack' (b = .027, p = .001). This interaction has been discussed in Section 7.2. Further, a nearly significant difference was found with respect to the main effect of color (p = .016). Color was weighted more heavily in the 'sandwiches' condition (b = -.162) than in the 'snack' condition (b = -.134).

The Chow test revealed that direct effects of cues and dimensions differed significantly between usage goals ($F_{16,922} = 2.296$, $p < .01$). The effect of the price x place of purchase interaction, and the main effect of packaging differed significantly between 'sandwiches' and 'snack'. The direct effect of packaging on perceived quality was considerable for 'sandwiches' (b = .030, $p < .001$) but nonsignificant for the usage goal 'snack' (b = -.001, p = .902). No significant differences in direct effects were found for the three quality dimensions.

The results of the regression analyses of sensory perception and unwholesomeness on the quality cues significantly differed between usage goals (sensory perception $F_{13,928} = 2.644$, $p < .01$; unwholesomeness $F_{13,928} = 1.770$, $p < .05$). With respect to sensory perception, significant differences were found between usage goals for the main effects of packaging and color. Packaging had a significant effect on the sensory perception in the case of 'snack' (b = .145, $p < .001$). Unpackaged saveloy rated considerably higher than vacuum-packaged saveloy. No significant effect of packaging was found for 'sandwiches' (b = -.065, p = .102) although vacuum-packaged saveloy tended to rate somewhat higher. As noted in Section 7.3, this result was unexpected and should be considered with caution.

Color was weighted more heavily in the inference process with respect to sensory perception for 'sandwiches' (b = -.596, $p < .001$) than for 'snack' (b = -.438, $p < .001$). However, the direction of the effect was the same for both usage goals with pink saveloy receiving the highest rating. Color exerted a significant influence on perceived unwholesomeness for 'snack' (b = .203, $p < .001$), but not for 'sandwiches' (b = -.010, p = .817).

The Chow test revealed no significant differences in the results of the regression analyses with respect to the keepability dimension ($F_{13,928} = 1.542$, $p > .05$).

In sum, the differences in the quality perception process between usage goals were modest. Only few significant differences were found. The most important quality cue, color, played an important role in explaining these differences. The results indicated that color was more important in the case of 'sandwiches' and that this was primarily caused by the stronger inference from color to sensory perception in this usage situation. However, in all instances the direction of the effect of color was the same.[4]

[4] An exception was the effect of color on unwholesomeness. However, the effect of color on unwholesomeness was not significant in the case of 'sandwiches'.

8. THE QUALITY PERCEPTION PROCESS FOR GAMMON

8.1. The quality dimensions

Principal components analysis was applied to the attribute ratings for each usage goal separately. In each case, three components with eigenvalues exceeding 1 were obtained, accounting for 52.5% ('sandwiches') and 52.2% ('dinner') of the variance. The two principal components structures looked highly similar. Their correspondence was investigated formally using the correlation coefficient, Burt's congruence coefficient, and Cattell's s-index (see Section 7.1). The correlation coefficient between pairs of similar principal components was .978, .933, and .959, respectively. All three correlation coefficients were significant at $p < .001$. The congruence coefficients were .982, .964, and .944, respectively. These coefficients were significant at $p < .001$. The s-index was also significant for all three pairs of similar principal components at $p < .001$. Thus, the three methods indicated close correspondence between component structures across usage situations, justifying pooling of subjects' responses in a single principal components analysis. Bartlett's test of sphericity ($p < .0001$) and the Kaiser-Meyer-Olkin measure of sampling adequacy of .808 indicated that the pooled correlation matrix was appropriate for principal components analysis. The eigenvalue criterion and the scree test both suggested a three-component solution. The three-component solution explained 51.9% of the variance. Component loadings (after varimax rolation) are reported in Table 8.1.

The principal components structure is clear. All attributes had a salient loading and no attribute had a salient loading on more than one dimension. Eleven of the 12 salient loadings exceeded .50, and 9 of 12 were greater than .60. The average salient loading was .680. All this suggests a high degree of meaningfulness and reliability for the principal components results.

Dimension 1 was related to taste, tender, natural, fresh, and juicy: sensory perception. The second dimension was related to fat, unwholesome, and bad for the figure. We used the label 'fatness' for this dimension. Dimension 3 was related to coloring agents, salt, keepable, and preservatives. This dimension reflects the (perceived) additives aspect of gammon.

Common factor analysis yielded similar dimensions.

The interpretation of the second and third dimension differs between saveloy and gammon. The keepability aspect emerged for saveloy but not for gammon, which was not surprising since all gammon alternatives were unpackaged. An additives dimension was found instead. An unwholesomeness dimension emerged for saveloy, whereas for gammon a fatness dimension was found.

Table 8.1. Principal component loadings relating quality attributes and quality dimensions after varimax rotation (salient loadings are underlined).

Attribute[a]	Sensory perception	Fatness	Additives
Taste	.747	-.264	-.076
Fat	-.135	.732	-.004
Coloring agents	-.201	.044	.736
Unwholesome	-.254	.557	.225
Tender	.730	-.140	.058
Salt	.005	.284	.558
Keepable	.317	-.137	.475
Preservatives	-.203	.048	.692
Natural	.618	.008	-.117
Bad for the figure	.037	.794	.028
Fresh	.714	-.004	-.150
Juicy	.803	-.087	-.009
Cumulative variance (%)	24.1	38.1	51.9

[a] See Section 6.3 for complete attribute descriptions.

Fatness, however, has clear health connotations for consumers, as evidenced by the high loading of the attribute 'unwholesome' on this dimension.
Sensory perception can be considered an experience dimension since it can be ascertained upon consumption. Additives is a credence dimension. The status of the fatness dimension is more ambiguous. The fatness of gammon can be ascertained upon consumption but, on the other hand, the results for saveloy showed that consumer perceptions can be erroneous (see Section 10.4). However, since the quality perception process was studied from the point of view of the consumer, it is reasonable to regard fatness as an experience attribute. Further, comparison of the ratings of gammon alternatives on the salient attributes of the fatness dimension indicated that actually fatter alternatives (the alternatives with a fat brim) received a significantly higher rating on these attributes before and after tasting the samples ($p < .01$ for all comparisons).
Principal components scores were computed for each subject and each gammon alternative, and served as input in subsequent regression analyses. The number of observations available for regression analyses was 4 (number of stimuli per subject) x 120 (subjects) = 480.
It was hypothesized that sensory perception had a positive influence, and fatness and additives a negative effect on quality judgments (cf. Steenkamp 1987a). Therefore, the significance of the path coefficients from the quality dimensions to perceived quality were tested one-tailed. Cue effects were tested two-tailed (cf. Section 7.1). An effect was considered to be significant when its p-value was less than .05.
The coding scheme used for the quality cues of gammon has been given in Table 6.1.

8.2. *Path analysis results for gammon intended for use on sandwiches*

Total effects of quality cues in the quality perception process

Perceived quality was regressed on cue main effects and two-way interactions. The results are shown in Table 8.2.

The intrinsic indicators shape (.337), fat brim (.262), and color (.185) were the predominant quality cues, but price (.143) and place of purchase (-.103) were also of some importance. Regardless of the interaction effects, ovate gammon rated higher than rectangular gammon, gammon without a fat brim rated higher than gammon with a fat brim, pink gammon higher than variegated pink and red gammon, higher-priced gammon higher than lower-priced gammon, and gammon from the butcher's shop higher than gammon from the supermarket. The main effect of gloss (-.048) was not significant. However, gloss exerted some effect on perceived quality through interactions with color (.137) and fat brim (.098).

The role of cue interactions in the quality perception process was more pronounced for gammon than for saveloy. Four interaction effects were statistically significant. The twelve interaction terms taken together explained 7.4% of the variance in the quality ratings. However, the six main effects still accounted for more than three times as much of the variance explained.

Table 8.2. Total effects of quality cues in the quality perception process for gammon intended for use on sandwiches

Predictor variable	b	Path coefficient	p-value
Gloss (G)	-.010	-.048	.212
Price (P)	.029	.143	< .001
Color (C)	.038	.185	< .001
Shape (S)	.069	.337	< .001
Fat brim (F)	.054	.262	< .001
Place of purchase (PP)	-.021	-.103	.008
G x P	.001	.003	.936
G x C	.028	.137	< .001
G x F	.020	.098	.011
G x PP	.006	.031	.423
P x S	.005	.025	.524
P x F	.005	.023	.550
P x PP	-.015	-.072	.061
C x S	.015	.075	.051
C x F	.022	.107	.006
C x PP	-.025	-.122	.002
S x F	-.014	-.070	.068
S x PP	-.004	-.021	.586
Intercept	.750		< .001

$R^2 = .325$ ($p < .001$)

Table 8.3. Direct effects of quality cues and quality dimensions on perceived quality for gammon intended for use on sandwiches

Predictor variable	b	Path coefficient	p-value[a]
Sensory perception	.123	.611	< .001
Fatness	-.048	-.232	< .001
Additives	-.019	-.091	< .001
Gloss (G)	-.006	-.029	.286
Price (P)	.010	.050	.072
Color (C)	.013	.063	.025
Shape (S)	.030	.146	< .001
Fat brim (F)	.021	.105	.001
Place of purchase (PP)	.001	.004	.899
G x P	-.000	-.002	.953
G x C	.014	.070	.012
G x F	.009	.045	.104
G x PP	-.002	-.010	.716
P x S	.001	.007	.802
P x F	.001	.007	.803
P x PP	-.012	-.059	.031
C x S	.006	.028	.305
C x F	.016	.076	.006
C x PP	-.015	-.072	.009
S x F	-.007	-.032	.248
S x PP	-.003	-.016	.565
Intercept	.750		< .001

$R^2 = .665$ ($p < .001$)

[a] The p-values reported for the quality dimensions are one-tailed since a direction was hypothesized a priori. The p-values for the quality cues are two-tailed.

Direct effects of quality cues and quality dimensions on perceived quality

The results of the regression analysis of perceived quality on quality cues and quality dimensions jointly are reported in Table 8.3.

As hypothesized, sensory perception (.611) was positively related, and fatness (-.232) and additives (-.091) were negatively related to perceived quality. Sensory perception was by far the most important quality dimension. This result was also found for saveloy. Neither curvilinear nor configural terms approached statistical significance.

Cue interactions did not contribute considerably to the variance explained in the quality ratings. The twelve interactions taken together explained only an additional 1.7% of the variance. Comparison of Tables 8.2 and 8.3 shows that cue main effects were greatly reduced once quality dimensions were included in the analysis. (Note that the effect of most interactions was also reduced considerably.)

Effects of the quality cues on the quality dimensions

Each quality dimension was regressed separately on the quality cues. The results are listed in Table 8.4. The overall relationship was significant for sensory perception ($R^2 = .219$, $p < .001$), and for fatness ($R^2 = .305$, $p < .001$).

Table 8.4. Effects of quality cues on the quality dimensions sensory perception, fatness, and additives for gammon intended for use on sandwiches

Predictor variable	Sensory perception			Fatness			Additives		
	b	Path coefficient	p-value	b	Path coefficient	p-value	b	Path coefficient	p-value
Gloss (G)	-.043	-.042	.307	-.029	-.030	.450	.000	.000	.999
Price (P)	.167	.163	< .001	.049	.049	.212	-.050	-.051	.267
Color (C)	.153	.150	< .001	-.137	-.138	< .001	.022	.022	.627
Shape (S)	.301	.294	< .001	-.056	-.056	.151	.016	.017	.715
Fat brim (F)	.088	.086	.038	-.494	-.498	< .001	.114	.116	.012
Place of purchase (PP)	-.173	-.169	< .001	-.021	-.021	.587	.086	.087	.058
G x P	.006	.006	.887	.010	.010	.790	-.038	-.039	.399
G x C	.149	.146	< .001	.085	.085	.030	.027	.027	.550
G x F	.067	.065	.116	-.042	-.042	.284	-.043	-.043	.343
G x PP	.046	.045	.275	-.039	-.039	.321	-.045	-.046	.317
P x S	-.005	-.005	.904	-.089	-.090	.022	.001	.001	.979
P x F	.029	.029	.491	-.004	-.004	.918	.023	.024	.602
P x PP	-.016	-.016	.701	.025	.025	.524	-.025	-.026	.575
C x S	.069	.067	.107	-.048	-.049	.214	.055	.056	.220
C x F	.034	.033	.427	-.055	-.055	.161	.022	.022	.632
C x PP	-.066	-.064	.122	.059	.059	.130	-.035	-.036	.431
S x F	-.077	-.075	.071	.003	.003	.936	-.086	-.087	.057
S x PP	.002	.002	.953	.054	.054	.167	-.063	-.064	.163
Intercept	-.003		.942	-.005		.895	-.003		.944
	$R^2 = .219$ ($p < .001$)			$R^2 = .305$ ($p < .001$)			$R^2 = .048$ ($p = .350$)		

All cues except gloss had a significant main effect on sensory perception. Shape was the most important single cue (.294). Ovate gammon received a high rating on this dimension. High price, pink color, the absence of a fat brim, and the butcher's shop also contributed positively to the sensory perception. The positive contribution of pink color was especially high when the gammon was

Table 8.5. Decomposition of the effects of quality cues on perceived quality for gammon intended for use on sandwiches (main effects only).

Quality cue	Total effect[a]	Direct effect[b]	Indirect effects through intervening quality dimensions		RIE(%)[c]
Gloss	-.048	-.029	Sensory perception	-.026	53.2
			Fatness	.007	
			Additives	.000	
				-.019	
Price	.143[d]	.050	Sensory perception	.100[e]	69.9
			Fatness	-.011	
			Additives	.005	
				.094	
Color	.185[d]	.063[d]	Sensory perception	.092[e]	66.7
			Fatness	.032[e]	
			Additives	-.002	
				.122	
Shape	.337[d]	.146[d]	Sensory perception	.180[e]	57.2
			Fatness	.013	
			Additives	-.002	
				.191	
Fat brim	.262[d]	.105[d]	Sensory perception	.053[e]	63.2
			Fatness	.116[e]	
			Additives	-.011[e]	
				.158	
Place of purchase	-.103[d]	.004	Sensory perception	-.103[e]	96.7
			Fatness	.005	
			Additives	-.008	
				-.106	

[a] See Table 8.2.
[b] See Table 8.3.
[c] Relative importance of the indirect effects (see equation (6.7)).
[d] $p < .05$
[e] Both path coefficients upon which the calculation of the indirect effect was based, were significant at $p = .05$ (cf. Section 6.5).

moderately glossy (note the G x C interaction).
The perceived fatness of gammon was predominantly inferred on the basis of the fat brim (-.498). Variegated pink and red gammon also gave a fatter impression, especially when the extent of glossiness was low (note the G x C interaction). The P x S interaction was also significant.
The rating of gammon on the additives dimension was poorly explained by the quality cues. The overall relationship was not significant: $R^2 = .048$ ($p = .350$). The high p-value was due to the large number of insignificant terms. Fat brim (.116) exerted a significant main effect on this dimension. No other term was significant.
The influence of the interaction terms was limited. The interactions accounted for 4.4%, 3,2%, and 2.4% of the variance in sensory perception, fatness, and additives, respectively.

The intervening role of the quality dimensions
The total main effect of a cue was decomposed into its indirect effects through mediating quality dimensions and its residual direct effect. The results are listed in Table 8.5. Inclusion of the quality dimensions caused the main effect of place of purchase to disappear almost entirely, and the main effects of gloss, price, color, and fat brim to be greatly reduced. The sum of the absolute values of the indirect effects exceeded the absolute value of the direct main effect for all

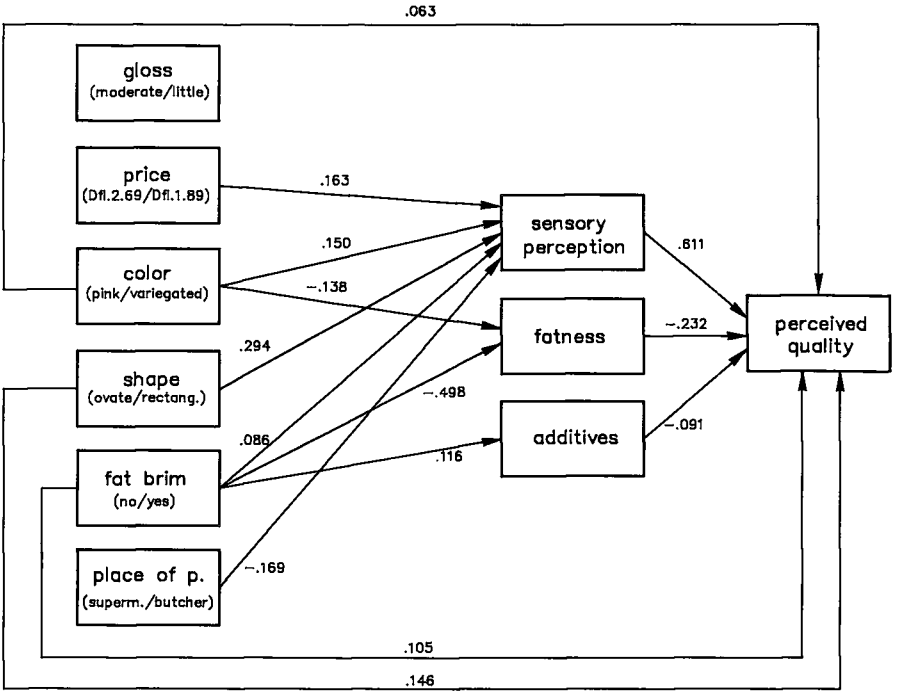

Figure 8.1 Summary overview of the path analysis results for gammon intended for use on sandwiches (significant main effects only)
Note: For each cue, the cue level before the slash (/) was coded +1, and the level after the slash -1.

cues.[1] However, the result obtained with respect to gloss should be considered with caution since neither the total effect, nor the direct effect, nor the effects on the quality dimensions were significant.
Sensory perception was the most important intervening dimension with respect to gloss, price, color, shape, and place of purchase. The effect of fat brim was primarily mediated by the fatness dimension. This dimension also played a considerable intervening role with respect to color. Although Table 8.5 is based upon the main effects only, the quality dimensions strongly mediated the effects of cue interactions as well (cf. Tables 8.2 and 8.3).

Figure 8.1 depicts a summary overview of the path analysis results obtained for gammon intended for use on sandwiches. The significant main effects are shown only. To avoid a confusing tangle of arrows, the nonsignificant main effects and all interaction terms have been omitted. The reader is referred to Tables 8.2 through 8.4 for the complete results.

8.3. Path analysis results for gammon intended for use at dinner

Total effects of the quality cues in the quality perception process
The results of the regression analysis of perceived quality on cue main effects and interactions are reported in Table 8.6. The twelve interactions accounted for 7.1% of the variance in the quality ratings.
Fat brim (.269) was the most important single quality cue. Gammon without a fat brim was perceived to be of higher quality than gammon with a fat brim. Shape had considerable influence on perceived quality through its main effect (.155), and via interactions with price (-.143) and fat brim (.133). Ovate gammon without a fat brim rated especially high. For this gammon, price contributed little to the quality perception (see below). The main effect of color (.102) was also significant. Pink gammon rated higher on quality than variegated pink and red gammon.
Gloss (.035) and place of purchase (-.070) had no significant influence on perceived quality. However, if the effect of place of purchase were tested one-tailed, it is reasonable to expect that the butcher's shop would rate higher than the supermarket, place of purchase would have a marginally significant effect on perceived quality.
The main effect of price (.113) was significant and in the expected direction: gammon of Dfl. 2.69 rated higher than gammon priced at Dfl. 1.89. The P x S interaction (-.143) indicated, however, this was only true when the gammon was rectangular. Price was of little importance for ovate gammon. Lower-priced gammon even rated slightly higher. An explanation could be that the rectangular gammon gave the subject the impression that she was actually presented a cheaper and lower-quality ham, called picnic ham (PVV 1982). A high price serves then as a reassurance that the rectangular ham was indeed gammon because picnic ham is sold in the Netherlands at about Dfl. 1.89, but not at Dfl. 2.69. It was not clear, however, why this effect was not found for gammon intended for use on sandwiches. The price x shape interaction is shown graphically in Figure 8.2.

[1] See Section 6.5 for the rationale of considering absolute values in analyzing the relative magnitude of direct and indirect effects.

Table 8.6. Total effects of quality cues in the quality perception process for gammon intended for use at dinner

Predictor variable	b	Path coefficient	p-value
Gloss (G)	.007	.035	.406
Price (P)	.022	.113	.008
Color (C)	.020	.102	.015
Shape (S)	.030	.155	< .001
Fat brim (F)	.052	.269	< .001
Place of purchase (PP)	-.013	-.070	.096
G x P	-.013	-.070	.097
G x C	.018	.092	.029
G x F	.004	.022	.605
G x PP	-.013	-.067	.113
P x S	-.028	-.143	< .001
P x F	.000	.002	.966
P x PP	.014	.075	.077
C x S	.015	.076	.072
C x F	.003	.017	.692
C x PP	-.010	-.052	.216
S x F	.026	.133	.002
S x PP	.001	.004	.929
Intercept	.750		< .001

R^2 = .197 ($p < .001$)

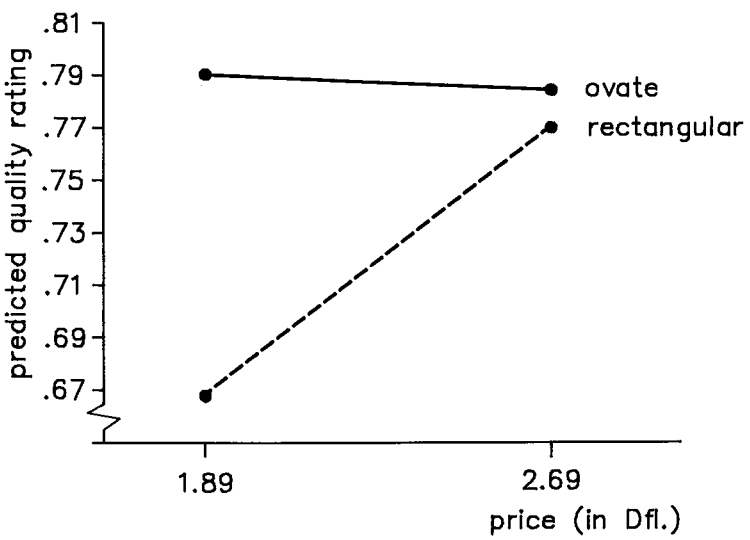

Figure 8.2. Price x shape interaction for gammon intended for use at dinner (based on total effects).

Direct effects of quality cues and quality dimensions on perceived quality

Table 8.7 reports the results of the regression analysis of perceived quality on quality cues and quality dimensions. The overall relationship was significant: $R^2 = .620$ ($p < .001$). Interactions between quality dimensions and curvilinear terms were not significant. The sign of the coefficients of the quality dimensions was in the hypothesized direction. Perceived quality increased significantly with increasing sensory perception (.666) and decreased significantly with increasing fatness (-.295). The effect for additives (-.024) was not significant ($p = .213$). Perceived quality of gammon intended for use at dinner was not significantly influenced by the perception of a product alternative for the additives dimension. However, the additives dimension had not been dropped from subsequent analyses to maintain compatibility across usage goals.

Cue main effects and cue interactions were considerably reduced when the effects of the quality dimensions were controlled for. Cue interactions accounted for an additional 1.9% in the variance of the quality ratings.

Table 8.7. Direct effects of quality cues and quality dimensions on perceived quality for gammon intended for use at dinner

Predictor variable	b	Path coefficient	p-value[a]
Sensory perception	.131	.666	< .001
Fatness	-.056	-.295	< .001
Additives	-.005	-.024	.213
Gloss (G)	.010	.052	.072
Price (P)	.001	.004	.886
Color (C)	.012	.063	.032
Shape (S)	.002	.012	.684
Fat brim (F)	.036	.186	< .001
Place of purchase (PP)	.006	.032	.279
G x P	.002	.008	.784
G x C	.016	.082	.006
G x F	-.001	-.007	.803
G x PP	-.005	-.024	.418
P x S	-.013	-.066	.024
P x F	.003	.018	.547
P x PP	.008	.040	.166
C x S	.008	.041	.162
C x F	-.003	-.017	.555
C x PP	-.010	-.053	.070
S x F	.007	.038	.196
S x PP	-.003	-.014	.630
Intercept	.750		< .001

$R^2 = .620$ ($p < .001$)

[a] The p-values reported for the quality dimensions are one-tailed since a direction was hypothesized a priori. The p-values for the quality cues are two-tailed.

Effects of the quality cues on the quality dimensions

The overall relationship between a quality dimension and the quality cues was significant for all three dimensions: sensory perception $R^2 = .165$ ($p < .001$), fatness $R^2 = .321$ ($p < .001$), additives $R^2 = .076$ ($p = .017$). (See also Table 8.8.) The twelve interaction terms accounted for 6.5%, 5.2%, and 3.6% of the variance in the ratings on sensory perception, fatness, and additives, respectively.

The main effects of shape (.215), price (.154), place of purchase (-.152), and fat brim (-.098) on sensory perception were significant. Gloss affected sensory perception through interactions (G x P, G x PP). Color had no significant effect on this quality dimension.

Fatness was primarily influenced by the fat brim cue (-.514). As might be expected, gammon with a fat brim was perceived to be fatter than gammon without a fat brim. Some cue interactions were also significant. Variegated pink and red gammon with moderate gloss that was priced at Dfl. 1.89 per 100 grams rated especially high on fatness. Such a gammon closely resembles the cheaper, and fatter, picnic ham.

The rating of a gammon alternative on the additives dimension was poorly explained by the cues. Cheap, ovate, variegated pink and red gammon without fat brim that was sold in the supermarket rated relatively high on this dimension.

The intervening role of the quality dimensions

Table 8.9 reports the results of the decomposition of the total main effects of the cues into direct and indirect effects. The quality dimensions played a strong intervening role in the quality perception process. The significant total main effects of price and shape disappeared almost entirely when the effects of the quality dimensions were controlled for. The main effects of color, fat brim, and place of purchase were greatly reduced. The sum of the absolute values of the indirect effects exceeded the absolute value of the direct main effect for price, shape, fat brim, and place of purchase. Sensory perception was the most important mediating dimension for all cues except fat brim. The effect of fat brim was primarily mediated by the fatness dimension.

Although not shown in Table 8.9, the effect of most cue interactions was also greatly reduced when the quality dimensions were included in the analyses (compare Table 8.6 with Table 8.7).

Figure 8.3 depicts a summary overview of the path analysis results obtained for gammon intended for use at dinner. The significant main effects are shown only. To avoid a confusing tangle of arrows, the nonsignificant main effects and all interaction terms have been omitted. The reader is referred to Tables 8.6 through 8.8 for the complete results.

Table 8.8. Effects of quality cues on the quality dimensions sensory perception, fatness, and additives for gammon intended for use at dinner

Predictor variable	Sensory perception			Fatness			Additives		
	b	Path coefficient	p-value	b	Path coefficient	p-value	b	Path coefficient	p-value
Gloss (G)	-.021	-.022	.613	.014	.014	.711	-.051	-.050	.268
Price (P)	.150	.154	< .001	-.015	-.015	.707	-.089	-.088	.053
Color (C)	.031	.031	.463	-.066	-.065	.092	.013	.013	.780
Shape (S)	.209	.215	< .001	-.006	-.006	.874	.103	.101	.025
Fat brim (F)	-.095	-.098	.023	-.516	-.514	< .001	.114	.112	.013
Place of purchase (PP)	-.148	-.152	< .001	-.005	-.005	.905	.084	.083	.066
G x P	-.163	-.167	< .001	-.113	-.113	.004	-.011	-.010	.818
G x C	-.030	-.031	.469	-.111	-.110	.005	.057	.057	.210
G x F	.029	.029	.494	-.030	-.030	.443	-.029	-.029	.524
G x PP	-.083	-.085	.049	-.047	-.047	.226	.017	.016	.718
P x S	-.102	-.105	.015	.024	.024	.531	.006	.006	.888
P x F	-.022	-.023	.600	.008	.008	.834	-.069	-.068	.131
P x PP	.034	.035	.419	-.031	-.031	.422	-.080	-.079	.081
C x S	.018	.019	.658	-.067	-.066	.087	-.110	-.108	.017
C x F	.022	.023	.591	-.063	-.062	.107	-.003	-.003	.954
C x PP	.045	.046	.280	.096	.096	.014	.066	.065	.151
S x F	.107	.109	.011	-.069	-.069	.075	-.069	-.068	.130
S x PP	.023	.024	.579	-.004	-.004	.911	-.026	-.026	.569
Intercept	.000		.997	.003		.945	.003		.953
	R^2 = .165 (p < .001)			R^2 = .321 (p < .001)			R^2 = .076 (p = .017)		

Table 8.9. Decomposition of the effects of quality cues on perceived quality for gammon intended for use at dinner (main effects only)

Quality cue	Total effect[a]	Direct effect[b]	Indirect effects through intervening quality dimensions		RIE(%)[c]
Gloss	.035	.052	Sensory perception	-.015	27.8
			Fatness	-.004	
			Additives	.001	
				-.018	
Price	.113[d]	.004	Sensory perception	.103[e]	96.5
			Fatness	.004	
			Additives	.002	
				.109	
Color	.102[d]	.063[d]	Sensory perception	.021	38.5
			Fatness	.019	
			Additives	-.000	
				.040	
Shape	.155[d]	.012	Sensory perception	.143[e]	92.5
			Fatness	.002	
			Additives	-.002	
				.143	
Fat brim	.269[d]	.186[d]	Sensory perception	-.065[e]	54.2
			Fatness	.152[e]	
			Additives	-.003	
				.084	
Place of Purchase	-.070	.032	Sensory perception	-.101[e]	76.5
			Fatness	.001	
			Additives	-.002	
				-.102	

[a] See Table 8.6.
[b] See Table 8.7.
[c] Relative importance of the indirect effects (see equation (6.7)).
[d] $p < .05$
[e] Both path coefficients upon which the calculation of the indirect effect was based, were significant at $p = .05$ (cf. Section 6.5).

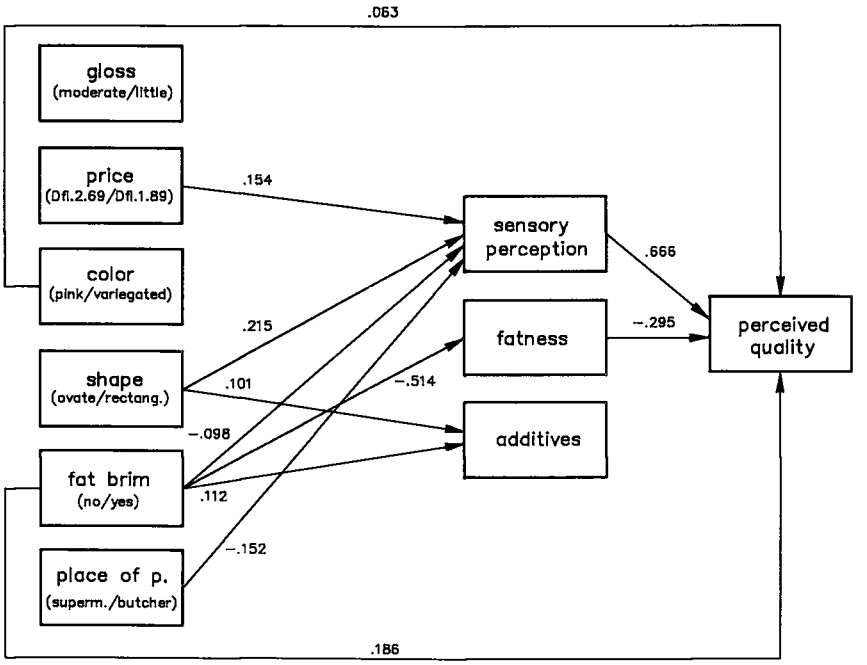

Figure 8.3 Summary overview of the path analysis results for gammon intended for use at dinner (significant main effects only)

Note: For each cue, the cue level before the slash (/) was coded +1, and the level after the slash -1.

8.4. Comparison of the results between usage goals

Method

No significant differences ($p > .05$) between subjects in the two experimental conditions were found with respect to the consumer characteristics net annual household income, level of education of the subject, level of education of the main wage earner, number of persons in the household, age of the subject, region of residence, and employment. Quality-consciousness ratings did not differ significantly between experimental conditions. Mean ratings in the 'sandwiches' and 'dinner' conditions were 27.75 and 28.06, respectively ($p = .556$). Thus, it is plausible that differences in results between the two experimental conditions were mainly due to usage goals. The results obtained for the two usage goals were compared by using the Chow test. It was tested whether significant differences existed between usage goals for the following aspects of the model:

- total effects of quality cues (Tables 8.2 and 8.6);
- direct effects of quality cues and quality dimensions (Tables 8.3 and 8.7);
- effects of quality cues on quality dimensions, analyzed for each dimension separately (Tables 8.4 and 8.8).

When the Chow test indicated that the regression equations differed significantly, Bonferroni's technique was used to test differences among individual regression coefficients. The overall p-value for a group of comparisons was established at .10.

Results of comparisons across usage goals

Total cue effects differed significantly between usage goals ($F_{19,916} = 3.059$, $p < .001$). Significant differences were found for the main effect of shape, and the shape x fat brim and price x shape interactions. The main effect of shape was larger for 'sandwiches' ($b = .069$, $p < .001$) than for 'dinner' ($b = .030$, $p < .001$). For 'dinner' the shape x fat brim interaction was significant ($b = .026$, $p = .002$), indicating that ovate gammon without a fat brim received an extra high quality rating. This interaction was not significant for 'sandwiches' ($b = -.014$, $p = .068$). The price x shape interaction was not significant for 'sandwiches' ($b = .005$, $p = .524$), but it was for 'dinner' ($b = -.028$, $p < .001$). This significant interaction for 'dinner' was discussed in Section 8.3.

Direct effects of cues and dimensions differed significantly between usage goals ($F_{22,910} = 2.103$, $p < .01$). The only individual effect that differed significantly between usage goals was the main effect of shape. The direct effect of shape was significant for 'sandwiches' ($b = .030$, $p < .001$), but not for 'dinner' ($b = .002$, $p = .684$).

The results of the regression analysis of sensory perception on cue main effects and interactions differed significantly between usage goals ($F_{19,916} = 3.006$, $p < .001$). Significant differences in regression coefficients were found for the interactions gloss x price and gloss x color. The former interaction was only significant for 'dinner' ($b = -.163$, $p < .001$). Higher-priced gammon with little gloss rated especially high on sensory perception. The gloss x color interaction was only significant for 'sandwiches' ($b = .149$, $p < .001$). Pink gammon with moderate gloss rated high. Further, two effects involving fat brim, viz. the main effect of fat brim and the shape x fat brim interaction, differed significantly between usage goals for sensory perception. For both usage situations, the fat brim cue was of little importance when the gammon was ovate. Ovate gammon rated relatively high on this quality dimension, regardless of the level of the fat brim cue. When the gammon was rectangular, a fat brim contributed positively to the sensory perception in the case of 'dinner', but not for 'sandwiches'. However, in both usage situations, rectangular gammon rated relatively low on the sensory perception dimension, regardless of the fat brim cue.

The regression equations also differed significantly for the fatness dimension ($F_{19,916} = 1.676$, $p < .05$). A significant difference in regression coefficients was found for the gloss x color interaction. The main effect of color in conjunction with the gloss x color interaction indicated that variegated pink and red gammon with little (moderate) gloss rated relatively high on fatness in the case of 'sandwiches' ('dinner').

The Chow test was not applied to the regression equations with respect to the additives dimension since no significant overall relationship was found for 'sandwiches'.

Just like in the case of saveloy, the differences in the quality perception process between usage goals were modest.

9. HYPOTHESIS TESTING

9.1. Introduction

In Section 5.4, nine hypotheses were developed concerning the quality perception process. The first three hypotheses, in particular hypothesis 1, are the most important ones to be tested since they are derived directly from the proposed model of the quality perception process.
In addition to these three core hypotheses, six supplementary hypotheses were developed. One of these hypotheses deals with the relevance of the predictive value/confidence value/intrinsicness-extrinsicness framework for explaining cue importance in the formation of quality perceptions. The other five hypotheses consider the influence of certain consumer characteristics on the quality perception process. The nine hypotheses will henceforth be designed as H_1 through H_9.
All hypotheses were tested for saveloy and gammon separately. Within each product, data were pooled across usage goals. Data pooling was primarily necessary for testing the hypotheses concerning the relation between various aspects of the quality perception process and consumer characteristics. For these hypotheses, the subjects were split into subgroups. If the data were not pooled, the number of observations in each subgroup would be rather small. The results reported in Chapters 7 and 8 indicate that pooling across usage goals will not seriously distort the results concerning the hypotheses. The same quality dimensions were found for each usage goal. Differences in cue and attribute importance were slight, and the direction of the effects was mostly the same.

9.2. Method of analysis and results

H_1: Quality attributes act as intervening variables, mediating the effects of quality cues on perceived quality judgments

Method
H_1 refers to the fundamental proposition of the proposed model of the quality perception process, i.e., quality cues are valued because they predict quality attributes. H_1 was tested by estimating the indirect effects of the cues via the intervening quality attributes (or more precisely, dimensions, since principal components were used to test H_1 and the other hypotheses), and its residual direct effect after the mediating role of the quality dimensions had been accounted for with path analysis. The hypothesis is supported if for the majority

of the cues, the total indirect effect of the cue exceeded its direct effect (see Section 6.5).

The path analysis results for each of the four experimental conditions separately (see Tables 7.5, 7.9, 8.5 and 8.9, in particular) already showed strong support for H_1. The same analyses were performed on the data pooled across usage goals, the results of which are reported below. (See Section 6.5 for details on the methodology.)

Results

The results of the path analyses are summarized in Table 9.1 which shows the relative importance of the indirect effects (RIE) vis-à-vis the direct effect for each quality cue (see equation (6.7) for the way RIE is computed).[1]

Table 9.1. Relative importance of the indirect effects (RIE) for each quality cue for saveloy and gammon (based on cue main effects only).

Saveloy		Gammon	
Quality cue	RIE(%)	Quality cue	RIE(%)
Packaging	41.7	Gloss[a)]	73.5
Price	40.7	Price	80.4
Color	53.5	Color	59.2
Texture	63.9	Shape	68.8
Place of purchase	84.9	Fat brim	50.9
		Place of purchase	86.0

[a] The finding for gloss should be considered with caution since none of the regression coefficients on which it was based, including the direct effect, were significant.

Consistent with the results reported in Chapters 7 and 8, Table 9.1 shows that for both products, the sum of the indirect effects exceeded the direct effect (i.e., RIE was greater than 50%) for the majority of the quality cues. Thus, the core tenet of our model of the quality perception process is supported. Quality attributes act as intervening variables, mediating the effects of the quality cues on perceived quality.

A corollary of H_1 is that, as hypothesized in our model of the quality perception process, perceived quality judgments are predominantly (ideally: completely) based on the perceptions of the quality dimensions. The strong support for H_1 indicates that this hypothesis is supported for both products. Another way of exploring this issue is to investigate whether cue effects contributed substantially to the variance explained in the quality ratings when the effects of the quality dimensions were controlled for. This was not the case. Aggregated over usage goals the results for saveloy were: for the quality dimensions only $R^2 = .638$, and for the quality dimensions, cue main effects, and cue interactions $R^2 = .705$. For gammon the R^2's were .592 and .626, respectively. Although the increase in R^2 due to the cue effects was significant for both products (due to the large number of degrees of freedom) it was not substantial. These results provide

[1] When direct and indirect effects have the same sign, RIE is simply the percentage of the total effect due to the indirect effects. See Section 6.5.

additional support that perceived quality judgments are predominantly based on quality attribute beliefs.

H_2: Experience attributes are weighted more heavily in the formation of perceived quality judgments than are credence attributes

Method

For saveloy, sensory perception and keepability are considered to be experience dimensions and unwholesomeness is a credence dimension. For gammon sensory perception and fatness are experience dimensions and additives is a credence dimension.

Two measures of the importance of experience dimensions vis-à-vis the credence dimension were used to test H_2. Both measures were based on the results obtained by regressing perceived quality on the quality dimensions.[2] The first measure involved the proportion of variance in perceived quality ratings that was accounted for by the two types of quality dimensions. The squared multiple correlation obtained by regressing perceived quality on the quality dimensions was partitioned into the R^2 produced by the two experience dimensions taken together, and the R^2 produced by the credence dimension.[3] However, the values of R^2 thus obtained should be corrected for the number of dimensions in each set, since the magnitude of R^2 is positively related to the number of predictor variables in a set. Therefore, R^2 obtained for the experience dimensions was divided by two. H_2 is supported when the average R^2 of the experience dimensions is larger than the R^2 produced by the credence dimension.

The second measure of the relative importance of experience versus credence dimensions was based on the individual (unstandardized) regression coefficients of the quality dimensions. When H_2 is valid in all instances, it is to be expected that, for any pair of experience and credence dimensions, the experience dimension has a larger regression coefficient (in an absolute sense) than the credence dimension.[4]

Regression coefficients can be tested for equality by constraining them to be equal and testing whether the residual sum of squares of the constrained equation is significantly larger than the residual sum of squares of the unconstrained equation (MacDonald 1977).

Results

Saveloy. Consistent with H_2, the average R^2 of the experience dimensions (.292) was much greater than the R^2 due to the credence dimension (.055). The tests on the equality of individual regression coefficients yielded mixed results. In line with H_2, the regression coefficient of sensory perception was significantly larger than that of unwholesomeness ($F_{1,950} = 368.01, p < .001$). The test on the

[2] The conclusions remained the same when the quality cues were included along with the quality dimensions.

[3] Partitioning of R^2 can be carried out unambiguously since the quality dimensions were uncorrelated.

[4] In the analyses, the direction of quality dimensions was reversed when necessary to ensure that all regression coefficients were positive. The sign of a coefficient is not relevant in the context of H_2 which deals with attribute importance, but it influences the probability levels of the comparisons.

equality of the regression coefficients of unwholesomeness and keepability, however, showed that, contrary to H_2, the effect of unwholesomeness was significantly larger ($F_{1,950} = 49.50$, $p < .001$).
Gammon. The average R^2 of the experience dimensions (.295) was again much greater than the R^2 for the credence dimension (.002). The tests on the equality of individual regression coefficients also supported H_2. The coefficients of sensory perception and fatness were both significantly larger than the coefficient of additives: $F_{1,950} = 476.54$, $p < .001$ and $F_{1,950} = 115.28$, $p < .001$, respectively.

The findings with respect to the average R^2 per dimension show that, at the general level, H_2 is supported. Experience dimensions taken as a whole were more important in the formation of perceived quality judgments than were credence dimensions. The tests on the equality of individual regression coefficients suggested, however, that H_2 need not be true for each pair of experience and credence dimensions. In some situations, a credence dimension is so important to consumers that this overrules the comparatively large uncertainty inherent in this type of quality dimensions. In the present study, this was found with respect to unwholesomeness vis-à-vis keepability. Although it was more difficult for subjects to make precise judgments about the (un)wholesomeness of a product than about keepability, and despite the fact that the consequences related to the former dimensions are temporally further away, unwholesomeness was weighted more heavily than keepability. This accords with the current trend in consumer behavior towards health-consciousness.

H_3: Consumers are more able to use quality cues in inference processes with respect to experience attributes than with respect to credence attributes

Method
H_3 was tested by regressing each quality dimension on cue main effects and interactions. When consumers are more able to use quality cues in inference processes with respect to experience dimensions than with respect to credence dimensions, the proportion of variance explained in the former type of dimensions is expected to be larger than in the latter type.

Results
The results are reported in Table 9.2. In all instances, the proportion of variance explained in an experience dimension was larger than the proportion of variance explained in a credence dimension. Thus, H_3 is supported.

H_{4a}: The higher the predictive value of a cue, the more important that cue is in the formation of perceived quality judgments
H_{4b}: The higher the confidence value of a cue, the more important that cue is in the formation of perceived quality judgments

Method
The measures used to collect data on the predictive value (PV) and the confidence value (CV) of the cues are described in Section 6.3. To reiterate briefly,

Table 9.2. Proportion of variance in the quality dimensions that is explained by the quality cues for saveloy and gammon.

Saveloy		Gammon	
Quality dimension	R^2	Quality dimension	R^2
Experience dimensions		*Experience dimensions*	
Sensory perception	.314[a]	Sensory perception	.143[a]
Keepability	.298[a]	Fatness	.289[a]
Credence dimension		*Credence dimension*	
Unwholesomeness	.130[a]	Additives	.045[a]

[a] $p < .01$

cue PV and cue CV were measured on a 7-point scale where a higher rating denotes a higher PV or CV.
H_{4a} (H_{4b}) is supported if there exists a monotonic relationship between cue PV (CV) and the total effect of a cue in the quality perception process. The total effect of a cue was approximated by regressing perceived quality on cue main effects (cf. Chapters 6 through 8).

Results

The unstandardized regression coefficients and average PV and CV ratings of each cue are reported in Table 9.3. Table 9.3 suggests that the relationship between the ranking of the main effects and the rankings of either cue PV or cue CV was weak. The only exception concerned PV for saveloy.

Table 9.3. Total main effects of quality cues in the quality perception process, and average predictive value (PV) and confidence value (CV) ratings of each cue for saveloy and gammon.

Product/ Quality cues	b	Rank[a]	Average PV	Rank	Average CV	Rank
Saveloy						
Packaging	.020[b]	4	3.575	5	5.425	5
Price	.029[b]	3	4.487	4	5.871	1
Color	-.148[b]	1	4.892	2	5.496	4
Texture	-.061[b]	2	5.059	1	5.867	2
Place of purchase	-.013[b]	5	4.592	3	5.506	3
Gammon						
Gloss	-.002	6	4.638	4	5.075	5.5
Price	.026[b]	4	4.867	2	5.786	1
Color	.029[b]	3	4.883	1	5.075	5.5
Shape	.049[b]	2	3.825	6	5.546	4
Fat brim	.053[b]	1	4.517	5	5.731	2
Place of purchase	-.017[b]	5	4.692	3	5.665	3

[a] Based on the absolute values of the regression coefficients.
[b] $p < .05$

Given the small number of ranking data, a formal statistical test for the correspondence in rankings is of limited value. Nevertheless, Spearman's rho was computed between the rankings of cue main effects and cue PV/cue CV to obtain some quantitative insight into the validity of H_{4a} and H_{4b}. Obviously, the value of rho should be considered with utmost caution. Spearman's rho was .600, .100, -.371, and .290 between the ranking of cue main effects and the ranking of cue PV (saveloy), cue CV (saveloy), cue PV (gammon), and cue CV (gammon), respectively. None of these coefficients was statistically significant, but for cue main effects and cue PV for saveloy the value of rho was rather large. These findings indicated that H_{4a} is partially supported and H_{4b} is rejected.
Several explanations can be put forward for the disappointing results concerning the PV-CV framework.[5] Chapters 7 and 8 have already reported that some cues interacted in the quality perception process, especially for gammon. As noted earlier (Section 4.5.1), the concepts of PV and CV do not deal adequately with cue interactions. Further, measurement procedures for cue PV and CV appear to be of questionable validity. Despite the elaborate introduction to the PV/CV questions, subjects had difficulty in understanding the concepts of PV and CV and, as a corollary, will have found it difficult to rate PV and CV of a cue (cf. Section 6.3). For example, packaging rated low on CV whereas it appears unlikely that subjects had difficulty in correctly interpreting whether saveloy was vacuum-packaged or unpackaged. A similar result was found by Rudell (1979) who reported that price rated lower on CV than ingredients, a result that is highly unlikely given the current nutritional knowledge of consumers.
The disappointing empirical results concerning PV and CV correspond with the findings obtained in earlier studies (see Section 4.5.1). However, this does not mean that PV and CV are not useful concepts in studying the quality perception process. The theoretical underpinning of these concepts is extensive and its heuristic value is considerable. Unfortunately, however, it appears that no adequate instrument exists to measure them. This will be elaborated in Chapter 13.

H_{4c}: Intrinsic cues are more important in the formation of perceived quality judgments than are extrinsic cues

Method
Two measures of the importance of intrinsic cues vis-à-vis extrinsic cues were used to test hypothesis H_{4c}: the average R^2 per intrinsic cue and per extrinsic cue, and the (unstandardized) regression coefficients of the individual cues. These measures are essentially the same as those used to test H_2. Both measures

[5] H_{4a} and H_{4b} are based upon Olson's (1972) predictions. Olson further predicted that PV and CV interact. The magnitude of the effect of a cue on perceived quality judgments was hypothesized to be especially high when both cue PV and CV are high. Our data were not very suitable for testing the latter hypothesis. Some insight into its validity, however, could be obtained by computing the average PV x CV rating for each cue and comparing its ranking with the ranking of the total main effects reported in Table 9.3. Spearman's rho was .800 for saveloy, and -.143 for gammon. Neither of the coefficients was significant but the high value of rho for saveloy gave some tentative support to Olson's hypothesis.

were based on the regression analysis of perceived quality on cue main effects.[6] H_{4c} is supported when (1) the average R^2 per intrinsic cue is larger than the average R^2 per extrinsic cue, and (2) the regression coefficient of any intrinsic cue is larger than the regression coefficient of any extrinsic cue.

Results

With respect to the average R^2 per intrinsic and extrinsic cue, the following results were obtained: intrinsic/saveloy .218, extrinsic/saveloy .008, intrinsic/gammon .038, extrinsic/gammon .012.

The results of the tests for equality of individual regression coefficients are reported in Table 9.4 (the regression coefficients of the cues for the unconstrained equations are shown in Table 9.3).

Table 9.4. Results of the tests on equality of individual regression coefficients of cue main effects for saveloy and gammon.

	Saveloy			Gammon	
	Color	Texture		Price	Place of purchase
Packaging	++	++	Gloss	*	n.s.
Price	++	++	Color	n.s.	n.s.
Place of			Shape	+	++
purchase	++	++	Fat brim	+	++

\+ = < .01 (in the predicted direction)
++ = p < .001 (in the predicted direction)
* = p < .01 (in the opposite direction)
n.s. = not significant

The average proportion of variance accounted for by an intrinsic cue was considerably larger than the average proportion of variance accounted for by an extrinsic cue. Thus, H_{4c} is supported at a general level, meaning that support is found for the notion that intrinsic cues, taken as a whole, are more important in the quality perception process than extrinsic cues. However, this does not mean that a *particular* intrinsic cue will always be more important in the quality perception process than a *particular* extrinsic cue. Table 9.4 indicates that in many cases individual intrinsic cues are more important, but also shows that exceptions do exist.

Previous studies had also found that intrinsic cues are more important than extrinsic cues. The intrinsic cue usually employed was the physical product which is, as has been noted in Section 4.2.2, actually a combination of (unidentified) intrinsic cues. Consequently, what was actually found in many

[6] Partitioning of total R^2 in the proportion of variance explained by intrinsic cues and the proportion of variance explained by extrinsic cues can be carried out unambiguously since the cues are uncorrelated. In the analyses, dummies were recoded to ensure that all regression coefficients were positive. Obviously, the sign of coefficients is of no importance to H_{4c}, but it influences the probability levels of the comparisons between the individual coefficients.

previous studies was that intrinsic cues as a whole are more important than extrinsic cues as a whole. This corresponds with the findings of the present study.

H_5: The intervening role of quality attributes in the quality perception process is greater for consumers with much experience with the product in question than for less experienced consumers[7]

Method

For each product, subjects were split into two groups: relatively inexperienced consumers and relatively experienced consumers. The criterion was the usage frequency of the product. Subjects consuming the product in question less than once a week were categorized as relatively inexperienced subjects. The other subjects were assigned to the group of relatively experienced individuals.

Path analysis involving quality cues, quality dimensions, and overall perceived quality was used to explore the extent to which quality dimensions intervene between quality cues and perceived quality. In order to investigate H_5, path analysis must be carried out for relatively inexperienced subjects and relatively experienced subjects separately. H_5 does not consider whether quality dimensions act as intervening variables. This issue was addressed in H_2. H_5 deals with the extent of the intervening role of the quality dimensions for inexperienced versus experienced consumers. To explore whether H_5 is supported or rejected, the following procedure was adopted.

First, path analysis was carried out for each group of subjects separately. With respect to the quality cues, only main effects were included in the path analysis (cf. Section 6.5). Subsequently, the sum of the absolute indirect effects was computed for each cue. Next, these values were summed over five (saveloy) or six (gammon) cues. We call the value thus obtained the 'grand indirect effect'. It is a measure of the intervening role of the quality dimensions because the larger it is, the greater the intervening role of the quality dimensions.

A disadvantage of the grand indirect effect as a measure of the difference in intervening role of the quality dimensions between experienced and inexperienced subjects is that it is strongly influenced by differences in magnitude of the regression coefficients between the two subgroups. Therefore, a second measure was developed which we call the 'relative indirect effect'. The relative indirect effect is computed as: 100% * [(grand indirect effect) / (grand indirect effect + sum of the absolute values of the direct effects)]. The grand indirect effect shows the magnitude of the indirect effects aggregated over quality cues, whereas the relative indirect effect shows the importance of the indirect effects

[7] H_5 through H_9 consider the influence of certain consumer characteristics on the quality perception process. Interpretational problems might arise when the consumer characteristics were strongly related, especially when the same aspect of the quality perception process was involved. We explored this issue by testing the relation between the consumer characteristics involved on a pairwise basis for each product separately. Only in one instance, quality-consciousness and perceived quality risk for gammon, a significant association ($p < .05$) was found. However, the hypotheses concerning quality-consciousness and perceived quality risk deal with different aspects of the quality perception process. Further, the hypothesis concerning quality-consciousness (H_6) is strongly supported whereas the hypothesis involving perceived quality risk (H_7) receives little support.

vis-à-vis the direct effects. Although these measures are not independent we decided to use both of them to provide a more rigid test of H_5. H_5 was considered to be supported when both the grand indirect effect and the relative indirect effect were larger for experienced than for inexperienced subjects. The measures were computed on the basis of the unstandardized regression coefficients to allow comparisons between the two groups of subjects.

Results

The grand indirect effect and the relative indirect effect of the quality cues for relatively experienced subjects and relatively experienced subjects, both for saveloy and gammon, are reported in Table 9.5.

Table 9.5. Grand indirect effect and relative indirect effect of quality cues for relatively inexperienced subjects and relatively experienced subjects for saveloy and gammon (main effects only).[a]

Product	Grand indirect effect		Relative indirect effect (%)	
	inexperienced	experienced	inexperienced	experienced
Saveloy	.149	.151	51.6	56.8
Gammon	.140	.141	69.0	62.7

[a] See text for an explanation of the terms 'grand indirect effect' and 'relative indirect effect'.

Unfortunately, it is not possible to compute the statistical significance of indirect effects, let alone to test the significance of a difference in grand indirect effects and relative indirect effects. However, Table 9.5 shows that the differences in grand indirect effects as well as the differences in relative indirect effects between inexperienced and experienced subjects were small for both products. Further, the results contradicted H_5 in the case of the relative indirect effect with respect to gammon. A sign test on the four pairwise comparisons of Table 9.5 (which is not strictly appropriate since the relative effect is not independent of the grand indirect effect, among other things), yielded a non-significant result ($p > .10$).

Thus, it should be concluded that H_5 is rejected. No evidence was found for the hypothesis that the intervening role of the quality dimensions is greater for experienced consumers than for inexperienced consumers. This finding might be explained by the way subjects were sampled. All subjects consumed the product in question in the experimental condition specified at least once a month. Therefore, our sample included only subjects who had at least some experience with the product. Consequently, our sample may not be discriminating enough with respect to the variable 'product experience'.

H_6: The intervening role of quality attributes in the quality perception process is greater for quality-conscious consumers than for consumers who are less quality-conscious

Method

The distribution of the quality-consciousness ratings over subjects was used for classifying subjects as either more quality-conscious or less quality-conscious.

The median rating was used as breakpoint for this grouping. This was done for saveloy and gammon separately. The same cutoff point was obtained for both groups of subjects. Subjects scoring 28 or less on the quality-consciousness scale were assigned to the group 'less quality-conscious subjects'. More quality-conscious subjects were defined as those scoring 29 or higher.
H_6 was tested in the same way as H_5.

Results
The grand indirect effect and the relative indirect effect of the quality cues for less quality-conscious subjects and for more quality-conscious subjects, both for saveloy and gammon, are reported in Table 9.6.

Table 9.6. Grand indirect effect and relative indirect effect of quality cues for less quality-conscious and more quality-conscious subjects for gammon and saveloy (main effects only).[a)]

Product	Grand indirect effect		Relative indirect effect (%)	
	less quality conscious	more quality conscious	less quality conscious	more quality conscious
Saveloy	.135	.180	50.9	59.8
Gammon	.135	.152	61.6	70.7

[a)] See H_5 for an explanation of the terms 'grand indirect effect' and 'relative indirect effect'.

Inspection of Table 9.6 reveals that H_6 is supported. For both products, the grand indirect effect and the relative indirect effect were greater for quality-conscious subjects. Further, the differences were substantial. It appears that the intervening role of the quality attributes is more pronounced for consumers who are more quality-conscious. This finding supports the relevance of the psychological concept 'quality-consciousness' for understanding the quality perception process.

H_7: Consumers experiencing high risk in evaluating the quality of the product alternatives have used fewer quality cues in the quality perception process than consumers experiencing low risk

Method
Perceived quality risk was measured after subjects had completed the product evaluation task (see Section 6.4 for details on the data collection procedure). The risk statements were formulated such that they did not measure the risk inherent in the product in general, but the risk the subject had experienced in evaluating the samples in question. Therefore, it is to be expected that when quality risk and the number of cues used in the quality perception process are related to each other, the former is influenced by the latter as is indicated by the formulation of H_7.
Subjects were categorized as either relatively low in quality risk or relatively high in quality risk. This was done on the basis of the distribution of the quality risk ratings as obtained by Bettman's model (see Section 6.3). Bettman's model was used instead of the Cunningham model to categorize the subjects, because

other analyses (see Section 10.3) revealed that the former model yielded somewhat more reliable quality ratings. The median quality risk rating as computed on the basis of Bettman's model was used as cutoff point for grouping. The median rating was 2.0 (on a scale ranging from 0 to 5) for the subjects evaluating gammon, and 2.5 for the subjects involved in the saveloy experiments. Subjects rating higher than the median were categorized as experiencing a relatively high quality risk. The other subjects were categorized as experiencing relatively little quality risk.

Path analysis was carried out to estimate the relationships between quality cues, quality dimensions, and perceived quality. This was done for each group of subjects separately. A cue was considered to be used when either its main effect and/or an interaction term involving the cue in question was significant at $p = .05$. H_7 was investigated in the following way. We determined the number of cues that exerted a significant total effect (as main effect and/or in conjunction with another cue) on perceived quality. This procedure was repeated for cue effects on each of the three quality dimensions. These four numbers were added and provided a measure of cue usage in the quality perception process. This measure ranged between 0 and 20 for saveloy (four regression analyses each involving five cues), and between 0 and 24 for gammon (four regression analyses each involving six cues). The regression analysis results involving both quality cues and quality dimensions (in order to obtain direct cue effects) were not used because they are influenced by the intervening role of the quality dimensions. If the intervening role of the quality dimensions differs between low-risk and high-risk subjects, this will affect the number of significant cue effects. Consequently, the results concerning H_7 would be confounded with possible differences between low-risk and high-risk subjects with respect to the extent to which quality dimensions intervene between quality cues and perceived quality. H_7 predicts that the number of cues used as computed by the procedure described above is higher for low-risk subjects than for high-risk subjects.

Results

The number of cues used, summed over overall perceived quality and the quality dimensions, were the following: low-risk/saveloy 13, high-risk/saveloy 14, low-risk/gammon 18, high-risk/gammon 14. The difference in the number of cues used for saveloy was very small and also in the wrong direction. The results for gammon are consistent with H_7, although the difference in number of cues was not large. Thus, H_7 is weakly supported for gammon and not supported for saveloy.

This finding might be explained by the unreliability of the quality ratings as obtained with Bettman's model. Although results obtained with Bettman's model were more reliable than with Cunningham's model, its reliability was still low (see Section 10.3). When quality risk is not measured reliably, one cannot expect that the distinction between low-risk and high-risk subjects is reliable and, consequently, that H_7 receives strong support.

H_8: Higher-educated consumers use more cues in the quality perception process than lower-educated consumers

Method

Subjects were divided into lower-educated individuals and higher-educated individuals on the basis of the number of years and level of formal education. H_8 was tested in the same way as H_7.

Results

The number of cues used, summed over perceived quality and the quality dimensions for the different combinations of type of subject and type of product were the following: lower-educated/saveloy 8, higher-educated/saveloy 15, lower-educated/gammon 15, higher-educated/gammon 13. H_8 is not supported for gammon. For this product, the difference in number of cues used between lower- and higher-educated subjects was very small, and in the wrong direction. On the other hand, higher-educated subjects evaluating saveloy rated nearly twice as high on our measure of cue usage than did lower-educated subjects. Thus, H_8 is partially supported. The predicted difference in number of cues used was evident for saveloy. However, for gammon no substantial difference was found between lower-educated and higher-educated subjects.

H_9: Cue interactions are more numerous in the quality perception process of higher-educated consumers than in the quality perception process of lower-educated consumers

Method

H_9 was investigated in a way similar to that for H_7 and H_8.[8] That is, the number of significant interactions was counted in each of the four regression analyses (i.e., regression analyses with perceived quality and each of the three quality dimensions as dependent variables) and added. This provided a measure of cue interactions in the quality perception process.

Results

The following results were obtained: lower-educated/saveloy 0, higher-educated/saveloy 6, lower-educated/gammon 7, higher-educated/gammon 6. For saveloy, these findings are clearly consistent with H_9. Further, in each of the four regression analyses, significant interactions were found for higher-educated subjects, whereas not a single significant interaction was found for lower-educated subjects. H_9 is not supported for gammon. In contradiction to H_9, the number of interactions was larger for lower educated subjects, although the difference was very small. Further, in three out of four regression analyses concerning gammon, the number of significant interactions did not differ with level of education.

In sum, H_9 is partially supported. Clear support is found for saveloy. However, no substantial difference in the number of interactions is found for gammon.

[8] Note that H_8 and H_9 are not independent.

Part III

Additional Research Concerning Product Quality: The Price-Perceived Quality Tradeoff and the Relationship between Price and Quality in the Marketplace

10. THE PRICE-PERCEIVED QUALITY TRADEOFF

10.1. Some reflections on the place of perceived quality in consumer decision-making

The main purpose of this work is to study the quality concept and the formation of quality perceptions. However, we also want to give some consideration to the role of perceived quality in consumer decision-making. This is done in the present and the next chapter. The attention is focused on the tradeoff of perceived quality against price.

Figure 10.1 presents a simple model of the role perceived quality plays in consumer decision-making. The dual role of price in decision-making is explicitly recognized. Following Monroe and his colleagues (Dodds and Monroe 1984, Monroe and Krishnan 1985), the 'classic' economic effect of price on choice behavior is modeled by the relationship between 'actual price' and 'perceived sacrifice'. The higher the price, the more must be sacrified to purchase the product and, therefore, the lower the purchase intention. The effect of actual price on perceived quality is also depicted in Figure 10.1. Higher prices have a positive effect on perceived quality (see Section 4.2.3., and Chapters 7 and 8), and this leads, in its turn, to a higher purchase intention. The relationship between actual price and perceived quality is represented by a dashed line to stress that quality attributes act as intervening variables.

Thus, the consumer trades off perceived quality against perceived sacrifice in forming purchase intentions. In the literature, this is usually called the 'price-perceived quality tradeoff'. Strictly speaking, the term 'perceived sacrifice-perceived quality tradeoff' better describes the psychological process. However, to avoid confusion, we shall also speak about the price-perceived quality tradeoff.

Attitude is not distinguished in our model of the role of perceived quality in consumer decision-making. Many models of consumer behavior include attitude, but not perceived quality, as a variable affecting purchase intentions (e.g., Howard and Sheth 1969, Hansen 1972, Howard 1977, Engel et al. 1986). Other studies only consider perceived quality (Hagerty 1978, Yamagishi and Hill 1981, Huber and McCann 1982, Levin and Johnson 1984, Levin et al. 1984; cf. Huber et al. 1986). These two streams of research have developed rather independently. The model depicted in Figure 10.1 could, in principle, be extended to include attitude, and possibly other variables that might influence purchase intention or choice. Little is known, however, about the relationship between perceived quality and attitude. An interesting research issue is to explore the relationships between perceived quality and attitude. We posit, as a

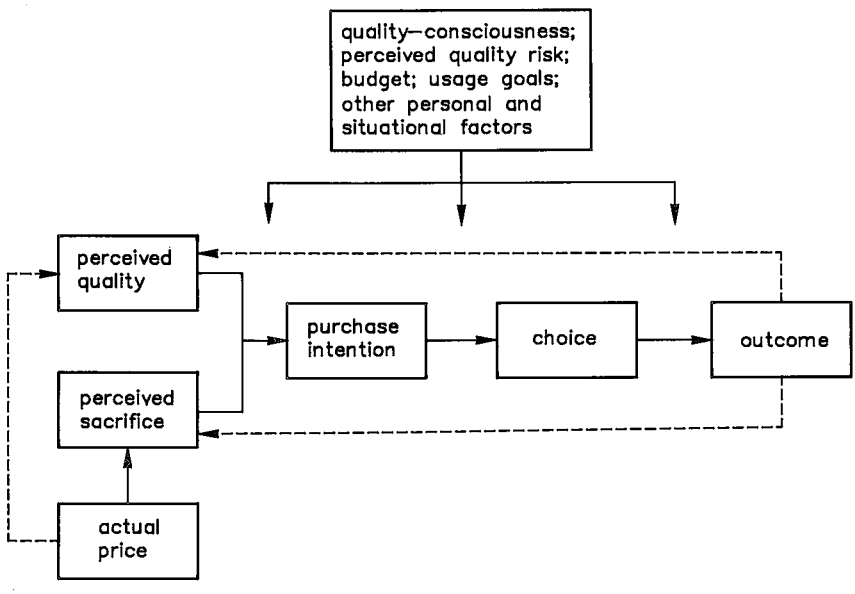

Figure 10.1. A simple model of the role of perceived quality in consumer decision-making.

preliminary hypothesis, that attitude is formed on the basis of perceived quality, price, and other aspects. For example, the attitude towards a retail outlet might be based on perceived quality, price, assortment, and distance (cf. Verhallen and DeNooy 1982). Another example: a consumer could have a negative attitude towards products from country X although the perceived quality of the products is high, because s/he disapproves of X's political system. Note, however, that some researchers (e.g., Olshavsky 1985) hypothesize that perceived quality and attitude are not related in some hierarchical way, and may even be unrelated.

In this study we do not consider the relationship between perceived quality and attitude. We shall concentrate on the price-perceived quality tradeoff in the formation of purchase intentions. This provides information to marketers as to whether it might be profitable to pursue a high quality strategy. The theoretical issue of perceived quality-attitude relationships is not adressed here. Future research might focus on this issue.

Two other aspects of the model are worth noting. First, it is explicitly recognized that the importance of perceived quality in the decision process is dependent upon personal and situational factors, such as quality-consciousness, perceived quality risk, the budget of the household, and usage goals. For example, the relative importance of quality vis-à-vis price may be positively related to the quality-consciousness of the consumer.

Second, choice and outcome are included in the model. Because of a host of personal and situational factors, a consumer may not buy the brand s/he intended to buy. When a brand is purchased and consumed, a certain outcome will result. The brand's performance may or may not meet expectations. This

will influence future perceptions of quality and sacrifice. A consumer's expectations can be (1) confirmed when the brand performs as expected, (2) positively disconfirmed when the brand performs better than expected, and (3) negatively disconfirmed when the brand performs worse than expected (Churchill and Suprenant 1982). In the third case, dissatisfaction will result. The experience with the product constitutes a feedback loop, affecting the quality perception process, perceived sacrifice, and the price-quality tradeoff. When expectations are confirmed, a priori beliefs will be strengthened. In case of positively disconfirming cases, it seems most likely that a priori beliefs will be enhanced. However, it is also possible that the unexpected outcome is attributed to the 'exception proves the rule' heuristic and is discounted accordingly (cf. Section 5.2.2). Such a reaction could occur if the consumer purchases another brand than s/he intended to. In case of negatively disconfirming experiences, informational and inferential relationships between cues and attributes might be weakened. Given the reluctance to change a priori beliefs (cf. Section 5.2.2), people could also engage in cognitive dissonance reduction processes.
In the present chapter and in Chapter 11, the tradeoff between price and perceived quality is investigated empirically. This chapter explores the price-perceived quality tradeoff using the correlational approach. Data were collected for saveloy and gammon along with data concerning the quality perception process (see Chapter 6). Further, the results of a sensory experiment, related to the 'Outcome' phase in Figure 10.1 are reported in this chapter. Chapter 11 studies the price-perceived quality tradeoff with a different methodology, the information integration approach.

10.2. The relationships between price, perceived quality, perceived sacrifice, and purchase intention

The relationships between price, perceived quality, perceived sacrifice, and purchase intention as depicted in figure 10.1 were investigated empirically for saveloy and gammon. The experimental design was discussed in Section 6.2. The measures for perceived quality and actual price were described in Section 6.3. The summative perceived quality scale constructed on the basis of the normalized ratings on three items was described in Section 6.5.
As suggested by Jacoby and Olson (1977), perceived sacrifice was operationalized by the statement 'is expensive', measured on a seven-point Likert scale ranging from 'completely disagree' (=1) to 'completely agree' (=7). Purchase intention was measured on a seven-point semantic differential scale with the poles 'will absolutely not purchase' (=1) and 'will absolutely purchase' (=7).[1] Perceived sacrifice and purchase intention ratings were normalized within subjects to reduce response bias. It would have been preferable to have multiple measures of perceived sacrifice and purchase intention. However, this would have taken too much data collection time. Besides, the study is mainly concerned with quality and the process of the formation of quality perceptions.
The hypothesized direction of the effects is as follows: price has a positive effect on perceived quality and on perceived sacrifice, perceived quality has a positive

[1] The version of the Likert scale and the semantic differential scale used was based on a pretest of different scales; see Section 6.3.

effect on purchase intention, and perceived sacrifice has a negative effect on purchase intention.

Ordinary least squares regression analysis was applied to parameterize the model. Since the direction of the effects was specified a priori, one-tailed t-tests were employed. The model presented in Figure 10.1 does not consider how the quality perceptions are formed. This issue was adressed in Chapters 7 and 8. In the present chapter, perceived quality judgments are considered to be given. However, since the model specifies the dual role of price in the formation purchase intentions, perceived quality is regressed on price. The purpose of this regression analysis is not to explain perceived quality (this would necessitate inclusion of the quality attributes, which was done in Chapters 7 and 8), but to explore the dual role of price. Regressing perceived quality on price only, does not lead to an overestimation of the total effect of price in the quality perception process, since the cues are uncorrelated.

Regression analyses were conducted for each experimental condition separately. The Chow test showed that for both meat products the results did not differ significantly between usage goals for any relationship estimated. Therefore, it was decided that the data could be pooled across usage goals. The results of the regression analyses on the pooled data are listed in Table 10.1.

The hypothesized relationships were supported by the data. Price had a significant effect on perceived quality and on perceived sacrifice. Price was more strongly related to perceived sacrifice than to perceived quality. The classic economic role of price as a cost factor is emphasized by the empirical results.

Table 10.1 The relationships between price, perceived quality, perceived sacrifice, and purchase intention for saveloy and gammon.

Equation/ variable	Saveloy		Gammon	
	b	β	b	β
Dependent variable: *Perceived quality*				
Price	.029[b]	.118	.026[b]	.130
Intercept	.750[b]		.750[b]	
R^2	.014[b]		.017[b]	
Dependent variable: *Perceived sacrifice*				
Price	.106[b]	.775	.086[b]	.659
Intercept	.250[b]		.250[b]	
R^2	.601[b]		.434[b]	
Dependent variable: *Purchase intention*				
Perceived quality	.467[b]	.822	.416[b]	.721
Perceived sacrifice	-.071[b]	-.070	-.149[b]	-.170
Intercept	-.082[b]		-.025[a]	
R^2	.687[b]		.583[b]	

[a] $p < 0.01$
[b] $p < 0.001$

Perceived quality and perceived sacrifice significantly affected purchase intention. The perceived sacrifice x perceived quality interaction was not significant for either of the meat products. The findings suggest that an additive model can describe the way consumers tradeoff price against perceived quality.
Perceived quality is more important in the formation of purchase intentions than perceived sacrifice. This result is discussed in more detail in Section 11.5.

After the subject rated each product alternative on the purchase intention scale, the interviewer probed for the reasons why (a) certain alternative(s) received the highest purchase intention rating (see Section 6.4). These free-response answers can serve as a validity check on the regression analysis results with respect to the quality perception process and the tradeoff between price and perceived quality. The free-response answers are listed in Table 10.2. Since the reasons did not differ considerably between the usage goals, the results are aggregated for each meat product. The results for each usage situation separately have been reported by Steenkamp (1987c, d).
Table 10.2 shows that, in general, the empirical results reported in Chapters 7 and 8, and in Table 10.1 are supported by the free-response answers of the subjects. Quality attributes such as taste and fatness, and intrinsic quality cues like texture/visible fat, color and 'general appearance' (a combination of several intrinsic quality cues) were often mentioned. The extrinsic quality cues place of purchase and packaging were mentioned by few subjects. This supports the comparatively small importance of these cues in the quality perception process as was found in Chapters 7 and 8. In line with the moderate importance of perceived sacrifice in the formation of purchase intentions, price was mentioned only by a small number of subjects. It is interesting to note that price was mentioned more often for gammon (8.2%) than for saveloy (4.5%). The regression analyses results did indeed show that the effect perceived sacrifice on purchase intention as measured by the unstandardized regression coefficient was greater for gammon ($t = 2.999$, $p < .01$).

Table 10.2. Free-response answers with respect to the reasons why a certain product alternative received the highest purchase intention rating for saveloy and gammon (multiple reasons allowed)[a]

Saveloy (n=240)		Gammon (n=240)	
Reason	%	Reason	%
Looks tastier	15.9	Looks less fatty/	
Fine texture	11.9	no fat brim	20.6
Looks less fatty	11.2	Looks tastier	11.6
Attractive appearance	9.8	Attractive appearance	11.0
Attractive color	8.7	Attractive price	8.2
Looks fresh	7.7	Attractive, natural shape	5.3
Attractive price	4.5	Attractive color	5.2
Tender/juicy	2.5	Tender/juicy	5.2
From the butcher	2.4	Has fat brim	3.1
Coarse texture	2.3	No preservations or	
Unpackaged	2.2	coloring agents	2.5
		From the butcher	2.4
		Good composition	2.1

[a] Reasons were only included if they were mentioned by at least five subjects.

A model of the determinants of the relative importance of perceived quality vis-à-vis price

In Figure 10.1 a simple model of the role of perceived quality in overall decision-making was presented. It was posited that the importance of perceived quality vis-à-vis price depends on personal and situational factors. One such factor could be the budget of the household the consumer belongs to. The importance of the budget in choice behavior is well documented in economic theory (cf. Sections 3.3 and 3.4 of the present work). The budget of the consumer may affect the relative importance of perceived quality versus price.

A second potential determinant of the importance of perceived quality vis-à-vis price is the quality-consciousness of the consumer. It is plausible to assume that individuals who are more sensitive to quality notions and give more consideration to quality in their decision process, will translate their opinions and values into action, i.e., give relatively much weight to quality in choice behavior. Further, it is hypothesized that people having a larger budget tend to be more quality-conscious. The reasoning behind this hypothesis is as follows. Price is perceived to be positively related to quality (cf. Section 4.2.3). Therefore, persons with larger budgets can 'afford' (subjectively speaking) to give more consideration to quality. On the other hand, individuals with a smaller budget will tend to give less consideration to quality because they perceive (on the basis of the price-perceived quality relationship) that they are not able to buy the better-quality item. To avoid this potential frustration, they will tend to be less quality-conscious, and more price-conscious.

A third factor might be perceived quality risk (cf. Section 4.4). The sign of the effect, however, is unclear. In riskier situations consumers might follow a price reliance strategy. This would result in consumers giving less weight to the perceived sacrifice aspect of price and more weight to its quality implications. However, a price reliance strategy also enhances financial risk. Higher financial risk together with higher quality risk present an unattractive choice situation to consumers which could be managed by purchasing a less expensive alternative.

A fourth factor could be the product in question. The price-perceived quality tradeoff may vary between products. For example, Steenkamp and Van Trijp (1989a) found considerable variation in the importance of perceived quality across meat cuts.

A fifth factor might be the usage goal for which the consumer buys the product. The empirical results reported in Section 10.2 suggest, however, that usage goals might not be that important. Therefore, this factor is not considered here.

Figure 10.2 depicts how the concepts budget, quality-consciousness, perceived quality risk, and the product in question are thought to affect the relative importance of perceived quality vis-à-vis price along with the hypothesized sign of their effects.

Measures

The model was investigated empirically for saveloy and gammon. Several measures were secured from each subject. Two measures of perceived quality risk were developed: quality risk measured by Cunningham's model and quality

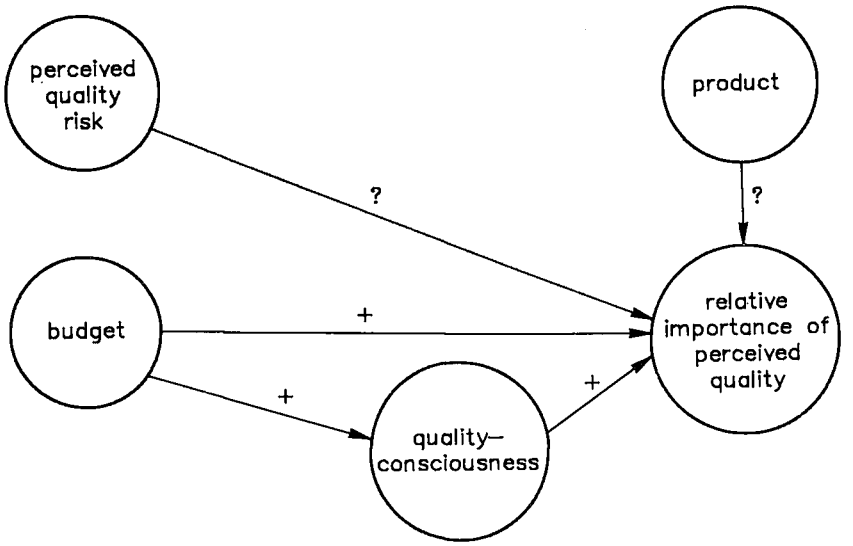

Figure 10.2. A model of the determinants of the relative importance of perceived quality vis-à-vis price.

risk measured by Bettman's model. Quality-consciousness was measured by one global statement and by the multiple-item scale. (See Section 6.3 for details.) Budget was measured by the net annual household income divided by the number of persons in the household (AHIPP). AHIPP was preferred to the net annual household income because it is more closely related to the financial potential of the household.[2]

An individual measure of the relative importance of perceived quality was obtained by regressing purchase intention on perceived quality and perceived sacrifice for each subject separately. The absolute value of the ratio between the unstandardized regression coefficient of perceived quality (b_{PQ}) and the unstandardized regression coefficient of perceived sacrifice (b_{PS}), $|b_{PQ}/b_{PS}|$, was taken as measure of the relative importance of perceived quality.[3] b_{PQ} and b_{PS} are unstable since the regression analyses were performed with one single degree of freedom. However, they are still the best estimates available of the true coefficients. To limit the influence of the instability of the parameter estimates on the results, two requirements were developed which a subject had to meet before she was included in the final database. First, a subject was only

[2] Admittedly, AHIPP is a crude measure for the actual budget of the household. The actual financial possibilities depend on other factors than the net annual household income divided by the number of persons in the household, such as financial obligations and the stage in the life cycle the household is in.

[3] Standardized regression coefficients were not used for two reasons. First, they are affected by sample characteristics, and data are pooled across experimental conditions. Second, standardized coefficients are affected by the standard deviations of the dependent and independent variable. Given that the regression analyses are only based on four observations, these standard deviations are unstable. The use of standardized regression coefficients would have enhanced the instability of the measure of the relative importance of perceived quality.

included when her regression coefficients had the 'appropriate' sign, $b_{PQ} \geq 0$, $b_{PS} < 0$. The 'appropriateness' of these signs was based on theoretical considerations, and is supported by analyses of the pooled responses (see Section 10.2). Second, subjects were excluded when $|b_{PQ}| > 10^*|b_{PS}|$, or when $|b_{PQ}| < 0.1^*|b_{PS}|$. It was felt that a range of $|b_{PQ}/b_{PS}|$ values from perceived quality being one-tenth as important as perceived sacrifice to perceived quality being ten times as important is broad enough to cover choice behavior of almost all consumers. When a subject falls outside of this range, it is more likely to be due to instability in parameter estimates than to any underlying behavioral disposition. Further, without this requirement, results would be disproportionately affected by subjects with an (unreliable) regression coefficient for perceived sacrifice that is close to zero.

As a result of these requirements and because of missing values for the various measures, especially with respect to AHIPP, only 166 out of 480 subjects were included in the analyses. Because of the large number of missing subjects, the results to be reported below should clearly be considered as tentative.

Analysis

The model of the determinants of the relative importance of perceived quality vis-à-vis price was investigated with LISREL VI (Jöreskog and Sörbom 1984). The variable 'product' was included as a dummy variable in the analyses (Joreskog 1979, Bagozzi 1980).[4] Gammon was coded 1 and saveloy was coded 0. Table 10.3 presents the latent constructs and their indicators in LISREL notation. Figure 10.3 depicts the proposed model of the determinants of the relative importance of perceived quality vis-à-vis price in LISREL format. The variable x_4 denotes the variable 'product' (gammon versus saveloy). 'Product' is an experimental manipulation that is measured without error, and does not serve as an indicator for an underlying construct (see Jöreskog 1979, Bagozzi 1980). Therefore, it is not included in Table 10.3.

Results

The correlation matrix was input to the LISREL program.[5] The overall fit of the hypothesized model to the data was mediocre. The chi-square value was significant ($\chi^2_{12} = 66.80$, $p = .000$), the goodness of fit index was .910, and the adjusted

[4] Another possibility is to investigate the model of the determinants of price-perceived quality tradeoffs for gammon and saveloy separately. This would eliminate the variable 'product' from the estimation procedure. Comparison of the parameter estimates across products provides information about the influence of the product on the determinants of price-perceived quality tradeoffs. This procedure was not followed for two reasons. First, the direct effect of the product in question on the relative importance of perceived quality vis-à-vis price that is posited in Figure 10.2 could not be estimated. Second, the number of observations was insufficient for this approach. Boomsma (1982) has found that the robustness of LISREL for small sample sizes is limited. He concluded that it is dangerous to use sample sizes smaller than 100 because the researcher runs severe risks such as no convergence. In the present study, the number of subjects per meat product was smaller than 100 (saveloy 74, gammon 92). In fact, the iterative procedure did not converge when the data were analyzed for saveloy only.

[5] In a strict sense, the chi-square test statistic and the t-values of the parameter estimates are only valid when a covariance matrix is used. In this application, however, t-values and the chi-square value were the same for both types of input data.

Table 10.3. Latent constructs and observed indicators in LISREL notation.

Construct	LISREL notation	Indicator	LISREL notation
Quality-consciousness	η_1	global rating	y_1
		rating on the multi-item scale	y_2
Relative importance of perceived quality	η_2	$\lvert b_{PQ}/b_{PS} \rvert$	y_3
Perceived quality risk	ξ_1	Bettman's model	x_1
		Cunningham's model	x_2
Budget	ξ_2	AHIPP	x_3

goodness of fit index was .791. A number of modifications were tried out but the fit of the model did not improve (see also below).
The parameter estimates, standard errors, t-values, and measures of overall fit are reported in Table 10.4. If a t-value exceeds two, it can be assumed that the parameter differs significantly from zero.
Table 10.5 reports (1) the reliability of the individual measures, ϱ_i, (2) the reliability of the constructs, ϱ_c, and (3) the average variance extracted for a construct, $\varrho_{vc(c)}$ (see Fornell and Larcker 1981 for the formulas). $\varrho_{vc(c)}$ measures the amount of variance that is captured by the construct in relation to the amount of variance due to measurement error. It is a measure of the convergent validity for the indicators of the construct.

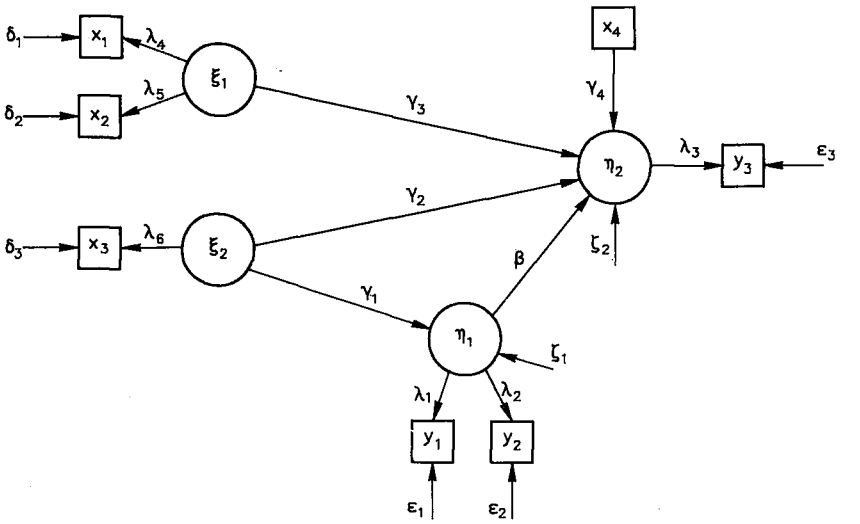

Figure 10.3. Model of the determinants of the relative importance of perceived quality vis-à-vis price in LISREL format.

Table 10.4. Parameter estimates for the model of the determinants of the relative importance of perceived quality vis-à-vis price.

Parameter	LISREL estimate	Standard error	t-value	Standardized value
λ_1	1.000[a]			.715
λ_2	1.049	.320	3.282	.750
λ_3	1.000[a]			1.015
λ_4	2.487	2.892	.860	.615
λ_5	1.000[a]			.247
λ_6	1.000[a]			1.000
β	.346	.143	2.425	.244
γ_1	.173	.071	2.420	.241
γ_2	-.034	.080	-.426	-.034
γ_3	-1.106	.734	-1.508	-.270
γ_4	.088	.076	1.159	.087
θ_{ε_1}	.488	.160	3.051	.488
θ_{ε_2}	.437	.173	2.529	.437
θ_{ε_3}	.000[a]			.000
θ_{δ_1}	.622	.453	1.372	.622
θ_{δ_2}	.939	.126	7.439	.939
θ_{δ_3}	.000[a]			.000
Var ζ_1	.482	.168	2.860	.942
Var ζ_2	.890	.134	6.623	.863

$\chi^2_{12} = 66.80$ ($p = .000$)
Goodness of fit index = .910
Adjusted goodness of fit index = .791
[a] constrained

Table 10.5 suggests that the main reason of the disappointing fit of the model is the unreliability of the perceived quality risk measures. The reliability was .378 for Bettman's model and .061 for Cunningham's model.[6] The perceived risk measures were not significantly related to their underlying construct.[7] Consequently, the construct reliability was only .322, and 78.0% of the average variance in ξ_1 was due to error.

The reliability of the individual measures of quality-consciousness as well as the construct reliablity were acceptable (cf. Fornell and Larcker 1981). The average extracted variance of .537 indicated that the convergent validity for the individual indicators of the quality-consciousness construct was also acceptable (Fornell and Larcker 1981).[8] Further, $\varrho_{vc(\eta_1)}$ exceeded the squared correlation

[6] A variant of of Bettman's model in which the number of alternatives at or above the minimum acceptable quality rating was counted yielded similar results. Further, a variant of Cunningham's model in which the perceived quality variation rating and the perceived competence to judge this variation were added instead of multiplied did not lead to better results.

[7] λ_4 was not significant. When λ_4 was constrained and λ_5 was set free it was found that x_2 was not significantly related to ξ_1.

[8] In this study, however, we would be better off by using the multi-item measure of quality-consciousness only. The reliability of the construct of .699 was lower than the reliability of the multi-item measure of .83 reported in Section 6.5. The reliability of the multi-item measure and of the composite construct were reduced because of the acceptable but still modest convergent validity of the quality-consciousness construct. It appears that the global measure is too simple to capture the full extent of the quality-consciousness construct. See also footnote 11.

Table 10.5. Evaluation of the measurement model for the multi-indicator constructs.

Construct/indicator	ϱ_i	ϱ_c	$\varrho_{vc(c)}$
Quality-consciousness		.699	.537
y_1: Global rating	.512		
y_2: Multi-item rating	.563		
Perceived quality risk		.322	.220
x_1: Bettman's model	.378		
x_2: Cunningham's model	.061		

between η_1 and η_2. This indicated that discriminant validity with respect to η_1 and η_2 was achieved (Fornell and Larcker 1981). Thus, the results support the notion that quality-consciousness is not identical to the importance of quality in the formation of purchase intentions (cf. Section 5.1).

Two parameters of the structural model were significant. Quality-consciousness had a significant effect on the relative importance of perceived quality. The effect was in the hypothesized direction. Subjects who were more quality-conscious attached more importance to perceived quality than subjects who were less quality-conscious. The budget of the household influenced the tradeoff between price and perceived quality through the quality-consciousness of the subject, people with a larger being more quality-conscious.
Perceived quality risk was inversely related to the importance of perceived quality. However, the effect did not reach statistical significance and, given the unreliability of the risk measure, should be considered with caution. The experimental manipulation 'product' had no significant effect on the price-perceived quality tradeoff.[9] This means that the relative importance of perceived quality versus price did not differ significantly between saveloy and gammon.[10] Obviously, it is very well possible that a product type effect is found for other products. For example, one could hypothesize that perceived quality is more important for consumer durables than for nondurables.[11]

[9] The variable 'product' also had little influence on the other determinants of the relative importance of perceived quality vis-à-vis price. None of the correlations between x_4 and an indicator of any of the determinants was significant, the largest correlation being .083. Further, the modification indices indicated that the fit of the model would hardly, and certainly not significantly, improve when relations between x_4 and ξ_1, ξ_2 and/or η_1 were specified.

[10] A Chow test on the results of Table 10.1 revealed significant differences between saveloy and gammon with respect to the effect of perceived quality and perceived sacrifice on purchase intention. Thus, the absence of a significant product effect in the LISREL analysis appears to contradict the results of Section 10.2. However, the significant F-value found in the Chow test was due to the great number of observations (1919). The difference between restricted and unrestricted residual sum of squares was very small. If the number of observations were less than 858, as is the case in the LISREL analysis, no significant difference would be obtained.

[11] A disadvantage of LISREL is that the unreliability of a single construct (in this case perceived quality risk) might affect the relations between other constructs as well. To explore this issue, path analysis was carried out on the data. The most reliable indicator of each construct was included in the path analysis, i.e., x_1, x_3, y_2, and y_3, along with x_4. The same significant relations were found. AHIPP had a significant effect on quality-consciousness, and quality-consciousness was the only variable that had a significant effect on the relative importance of perceived quality. The effect of perceived quality risk on the latter variable was marginally significant ($p = .061$).

10.4. Outcome and repeat choices

After a product alternative is bought, it is consumed and a certain outcome results. The outcome will affect future choice behavior (see Figure 10.1). To obtain insight into the correspondence between expectations and outcome, and to explore the effect of outcome on future choices, a sensory experiment was conducted (see Section 6.4).

Outcome

At the end of the data collection session, subjects tasted all four product alternatives and rated each alternative on six quality attributes likely to affect sensory experience. These quality attributes were:

- has a good taste
- contains much fat
- is tender
- contains much salt
- is fresh
- is juicy.

The rating of the product alternative on each of the quality attributes was correlated with the attribute rating the alternative received on the basis of the quality cues obtained earlier in the experiment. Thus, insight is obtained in the correspondence between sensory expectations and sensory performance. No information is obtained about non-sensory aspects such as keepability and wholesomeness.

The correlation coefficients are reported in Table 10.6. The correlations were computed across usage situations to provide a more concise picture of the correspondence between sensory expectations and sensory performance. The results for each usage situation separately are reported elsewhere (Steenkamp 1987c, d).

Except for the quality attribute salt with respect to gammon, sensory expectations and sensory performance were significantly correlated. It is unlikely that this result is due to a halo effect because a number of other tasks were performed by the subjects between the measures of sensory expectations and sensory performance were taken (see Section 6.4).

Table 10.6. Correlations between sensory expectations and sensory performance for saveloy and gammon.

Quality attribute	Saveloy	Gammon
Has a good taste	.352[a]	.357[a]
Contains much fat	.306[a]	.462[a]
Is tender	.287[a]	.312[a]
Contains much salt	.141[a]	.025[b]
Is fresh	.417[a]	.329[a]
Is juicy	.313[a]	.349[a]

[a] $p < .001$
[b] not significant

The results reported in Table 10.6 indicate that subjects were, at least to some extent, able to predict the sensory performance of the product alternative at the point of purchase. However, given the magnitude of the correlations, the predictive accuracy was modest. The nonsignificant correlation for salt in the case of gammon is not surprising because subjects had difficulty to discern the gloss cue (cf. Section 6.2).

A particularly interesting result was obtained for the quality attribute fat, in the case of saveloy. The correlation between expectations and performance with respect to fat was .306. Analysis of the ratings of the saveloy samples revealed that saveloy of coarse texture was perceived to be much fatter than saveloy of fine texture, both before and after tasting (t-test, in both cases $p < .001$). The real percentage of fat, however, did not differ between the saveloy alternatives. Two explanations can be given for this result. First, differences in texture can lead to differences in sensory sensation, even if the real percentage of fat in the sample is the same. Second, a priori beliefs that saveloy of coarse texture is fatter than saveloy of fine texture might have influenced subjects' perception of fatness, even after tasting.

The explanations are not incompatible. Both factors might have contributed to the significant correlation between expectations and performance with respect to fat. In our opinion, however, the 'a priori beliefs' factor is the most influential in shaping fatness perceptions after tasting. First, the tenderness of the fat was the same for coarse and fine texture. Second, meat product experts did not consider the effect of texture on sensory performance to be substantial. Third, the effect of visual information on sensory performance is well-established in the literature. Fourth, it has been shown that a priori beliefs are very tenacious, even if they are disconfirmed by new information (cf. Section 5.2.2).

Repeat choices

After the tasting experiment, the subject was asked to indicate which alternative she would choose on the basis of the sensory experience. In each experimental condition, about two-thirds of the subjects chose the product alternative that had received the highest purchase intention before. This result is significantly better than chance ($p < .001$), suggesting that, at least in these experiments, outcome will not lead to considerable changes in repeat choice behavior. Subjects were fairly stable in their choices, especially so when one realizes that no information was available anymore about packaging, place of purchase, and price. Product experience might be a factor that mediates the stability of repeat choices. No relationship, however, was found between the stability of repeat choice behavior and experience with the product in any of the experimental conditions ($p > .10$ for all cases).

A remark seems warranted on repeat choices in relation to the gloss cue. Aggregated over usage goals, 50.7% of the subjects gave the highest purchase intention rating to gammon with little gloss (meaning 16% brine). After tasting, 55.0% of the subjects chose gammon with little gloss. This shift is not significant. Thus, even after tasting no clear preference emerged for gammon with a low percentage of brine. This result was also found in qualitative research preceding the present study. In that research, it was found that a number of subjects preferred gammon containing a relatively high percentage of brine

because of the hearty taste (PVV 1982).
Given that the percentage of brine is inversely related to production costs (more brine means less meat per unit of weight), it might be profitable for (some) producers to increase the percentage of brine. This is an example of the way quality perception research can assist firms to reduce production costs.

11. THE PRICE-PERCEIVED QUALITY TRADEOFF REVISITED: THE INFORMATION INTEGRATION APPROACH[1]

11.1. The information integration approach

In the previous chapter, the price-perceived quality tradeoff was investigated using the correlational approach. It was concluded that the tradeoff could be described by the additive model. The correlational approach, however, has a number of drawbacks (see Section 5.3.2). It has been recommended to study the same phenomenon with different methodologies (e.g., Bettman 1979, Einhorn et al. 1979). If different approaches yield similar results, confidence in the validity of the conclusions is enhanced.
Therefore, we have also studied the price-perceived quality tradeoff with another methodology, viz. the information integration approach. This approach, which is an ANOVA type of methodology (see Section 5.3.2), was developed in psychology by Anderson and his colleagues (Anderson 1970a, 1971, 1972, 1974, 1981, 1982, Anderson and Shanteau 1977, Birnbaum 1974a, b, Birnbaum and Veit 1974a, b). See Lynch (1985) for an excellent introduction to the information integration approach in the marketing literature.

The information integration paradigm
The theoretical foundation of the information integration approach is the information integration paradigm. This paradigm posits that overt responses to stimuli are the result of a three-stage process. We shall briefly describe the information integration paradigm for an experiment in which stimuli consist of two pieces of information (or 'factors'), viz. information about the price and the quality of a product. This experiment strongly resembles the empirical study to be reported in Sections 11.3 and 11.4. Extension to more than two factors is immediate.
Let us suppose that subjects are presented with a number of gammon profiles, each consisting of a unique combination of price and quality information. Price is varied on four levels (Dfl. 1.79, Dfl. 2.19, Dfl. 2.59, and Dfl. 2.99 per 100 grams). Four levels are also used for quality (●, ●●, ●●●, ●●●●) where more dots denote better quality. The subject evaluates each of the 16 hypothetical gammon profiles on purchase intention. She gives her evaluation on a 20-cm graphical scale. The information integration paradigm posits that the relationship between the input stimulus information about price and quality, and the numerical rating of the purchase intention can be described by the three-stage process that is shown in Figure 11.1. In the figure (and in the text), the

[1] An earlier version of this chapter was presented at the 1987 EMAC conference (Steenkamp 1987e).

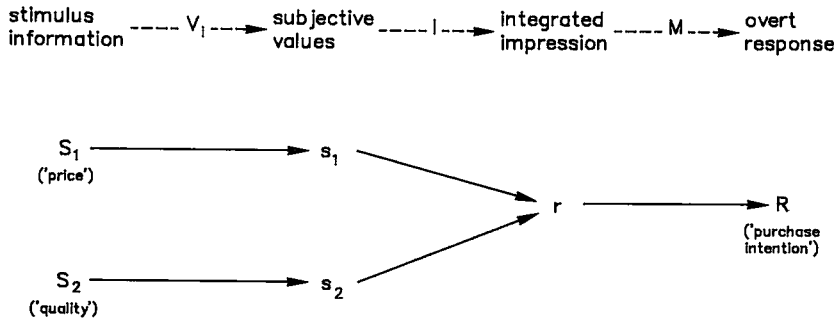

Figure 11.1 The information integration paradigm applied to purchase intention based on information about price and quality.

observable stimuli and responses are denoted by uppercase letters S and R, whereas lowercase letters s and r are used to denote their unobservable counterparts.

In the *valuation* stage, the information provided (S_1, S_2) is processed into their psychological values (s_1, s_2). It is assumed that the subject evaluates each piece of information (S_1, S_2) separately. The resulting subjective scale values s_1 and s_2 reflect the implication of S_1 and S_2, respectively, for the purchase intention. For example, the scale values for different levels of quality reflect the desirability of these qualities for the consumer, as measured by their contribution to purchase intentions. The valuation function, V_i, reflects the nature of the relationship between the objective stimulus information for a certain factor i and its subjective scale values. The valuation function can differ between factors: $s_i = V_i(S_i)$. No a priori assumptions need be made about the form of V_i.

In the *integration* stage, the subjective scale values are combined into an integrated implicit impression, r. The integration function, I, represents the model that describes how the subjective values are combined, $r = I(s_1, s_2)$. For example, the implicit purchase intention for a certain gammon might be based on *adding* the subjective scale values of its levels of price and quality.

In the *response* stage, the implicit impression r is transformed into an observable response, R. R is usually a response on some kind of rating scale. In our experiment, for example, the subjects were asked to rate the purchase intention of each gammon alternative on a 20-cm graphical scale. The relationship between r and R is given by the response function, $R = M(r)$. The issue of the form of the response function has caused much controversy in the information integration literature (e.g., Anderson 1982, Birnbaum 1982). It suffices to say here that Anderson has developed experimental procedures that help to create a linear response function, meaning that the observable responses comprise an interval scale of the implicit impressions.

Applications of the information integration approach

According to Cohen et al. (1980, p. 161), the information integration approach 'has been responsible for a vast and impressive literature based upon some of the most careful and finely tuned empirical research in the entire human information processing field'. It has been applied to a vast array of topics. To mention just a few examples, the information integration approach has been

applied to morality judgments (Birnbaum 1973), psychophysics (e.g., Anderson 1970b, DeGraaf et al. 1987), social value judgments (Leon et al. 1973), consumer risk perceptions (Bettman 1975), consumer attitudes (e.g., Bettman et al. 1975a, b, Troutman and Shanteau 1976, Jaccard and Becker 1985), and transportation decisions (Louviere and Levin 1978, Louviere and Meyer 1981, Levin 1982).
Information integration studies are usually conducted in controlled laboratory situations. The external validity of these laboratory findings is encouraging (Levin et al. 1983). It seems that the information integration approach holds great promise for fundamental and applied consumer and marketing research (Lynch 1985).

Comparison of the information integration approach with three related approaches to model judgment formation
The information integration approach has several advantages over the *correlational approach* (Bettman 1979, Lynch 1985). First, a priori scaling assumptions for the predictor variables are not required, since scale construction is an integral part of the information integration approach. Second, actual integration of information is studied, because subjects are presented with pieces of information they must necessarily combine to arrive at an overall evaluation. Third, deviations from theoretical models are easily tested. Fourth, the graphical plots obtained in information integration studies are a powerful tool to assist the researcher to understand why a model failed when statistical tests cause one to reject it.
The information integration approach is closely related to *axiomatic conjoint measurement* (Luce and Tukey 1964, Krantz and Tversky 1971). Both approaches focus on the way individuals integrate information on different aspects. However, the information integration approach differs from axiomatic conjoint measurement (ACM) in some important points (Anderson 1974, 1981). To summarize briefly, ACM assumes that the overall evaluations of the stimuli contain only ordinal information, whereas the information integration approach assumes that metric information exists in the data, although a monotonic transformation is sometimes necessary to extract it. Further, ACM lacks an error theory by which to evaluate deviations from the ordering predicted by a model. As a result, the information integration approach can be used to test a wider variety of composition rules and provides a more powerful diagnostic test between alternative rules (cf. Emery and Barron 1979, Messier and Emery 1980, Emery et al. 1982).
The information integration approach differs from *numerical conjoint measurement* (NCM), or conjoint analysis, in that NCM typically assumes a certain composition rule, usually the additive model, and proceeds to estimate the subjective scale values (in NCM called 'part worths') of the factor levels on the basis of that model (Green and Wind 1975, Green and Srinivasan 1978, Jain et al., 1979, Carmone and Green 1981). NCM can be applied to ordinal and metric data and has been frequently used in marketing research (Cattin and Wittink 1982). The difference in scope is obvious: NCM focuses on the estimation of part worth utilities, whereas the information integration approach (and ACM) is concerned primarily with the integration function.

Purposes of the present investigation

This chapter actually serves two purposes. First, the information integration process with respect to price and perceived quality is studied. The results obtained will be compared with the results of the correlational approach reported in Chapter 10. Second, the validity of the information integration approach is assessed for two aspects: the possible occurrence of imputation processes in the information integration task, and the stability of the results across different experimental designs. In this respect, the study goes beyond the immediate problem of the tradeoff between price and perceived quality to explore more general aspects of the information integration approach. These aspects are relevant to research on the price-perceived quality tradeoff as well as to other research concerning integration of information.

Before the results of the empirical study will be reported (Sections 11.3 and 11.4), Section 11.2 will give some attention to imputations and experimental designs in information integration research. Insight into these issues is relevant to researchers in the domain of price-perceived quality tradeoffs as will be shown below.

11.2. The effect of missing information[2]

Adding and averaging

The adding model and the (equal weight) averaging model are the two information integration models that have been most extensively researched.

The adding model states that subjects add the subjective values of different factors to form an overall judgment. Under the assumption of a linear output function, the adding model can be written as:[3]

$$(11.1) \quad R_2 = w_1 s_1 + w_2 s_2$$

where w_1 and w_2 denote the weights associated with factors S_1 and S_2, respectively, s_1 and s_2 are the subjective values of S_1 and S_2, respectively, and R_2 is the observed numerical rating based on two factors (accordingly, R_1 is the overall judgment based on one factor).[4] The adding model assumes factor independ-

[2] Section 11.2 is rather technical in scope and might be skipped by readers who are less familiar with the information integration approach without serious loss of continuity. The essence of the subsequent sections can be largely understood without knowledge of Section 11.2. Some basic knowledge of models of judgment formation, however, is required.

[3] In principle, the model should be stated in terms of the implicit impression r: $r_2 = w_1 s_1 + w_2 s_2$. When the output function is linear, however, the subjective scale values s_1 and s_2 can be directly related to the observed numerical ratings. In case the output function is monotonic but not linear, a monotonic transformation might be applied to the numerical ratings. Anderson has developed the 'parallellism theorem' to test the output function for linearity. It suffices to say here that information integration experiments generally yield a linear output function (see Anderson 1982 for details). In this section, therefore, we shall follow common practice in information integration research and formulate the models in terms of the observed ratings. This has the advantage that model predictions can be directly related to the ratings provided by the subject.

[4] Without loss of generality, the weight (w_0) and the subjective value (s_0) of the subject's initial opinion or response bias are omitted from equation (11.1). For ease of presentation the models are discussed for two pieces of information only. Generalization to more pieces of information is immediate.

ence, i.e., it assumes that the variables do not interact.
The adding model predicts that adding an item of positive (negative) subjective value always increases (decreases) the overall judgment, regard less of the original information. This means that $R_2 = w_1s_1 + w_2s_2$ is always greater than $R_1 = w_1s_1$ if $s_2 > 0$. If $s_2 < 0$, then R_2 will always be smaller than R_1. However, the effect of a factor on the overall judgment is independent of other factors. Hence, $R_2(S_1)$ is parallel to $R_1(S_1)$.
The averaging model states that subjects average the values of different factors. It has the same formulation as the adding model, but requires that the weights sum to unity. This implies that in the averaging model the effect of each factor is dependent upon the number of other factors. The effect of a particular factor decreases as the number of other factors with which it is combined increases. Hence, $R_1(S_1)$ has a steeper slope than $R_2(S_1)$. However, $R_2(S_1)$ for any S_2 has the same slope as $R_2(S_1)$ for any other S_2. Thus, one cannot distinguish between an adding model and an averaging model if the number of factors is held constant. Both models predict that the factors do not interact. This is shown graphically by a parallel set of curves. Adding and averaging models give different predictions, however, if the amount of information is varied between stimuli. An averaging model predicts that the curves representing the responses to stimuli for which information is missing have steeper slopes than the curves representing the responses to full information stimuli whereas an adding model predicts that the curves are parallel.
Most information integration studies have contrasted the adding model with the averaging model (Johnson and Levin 1985). A common way to distinguish between these two models is to vary the amount of information across stimuli. The adding model is supported when the effect of a factor on the overall judgment is independent of the number of other factors. The averaging model is supported when the effect of a factor presented in isolation is greater than the effect of that factor when it is presented in combination with other factors. In most information integration studies, the results of this critical test have supported the averaging model (Anderson 1981).
A crucial assumption in these studies has been that, in making their judgments, subjects rely only on the information presented. If information on one or more factors is missing, it is assumed that these factors are completely ignored by the subjects. This assumption has been questioned by a number of researchers, many of them doing research on the price-quality tradeoff (Yamagishi and Hill 1981, Huber and McCann 1982, Levin et al. 1982, 1984, 1985, Levin and Johnson 1984, Johnson and Levin 1985). While judging stimuli for which information on one or more factors is missing, subjects may impute values to the missing factors by assuming specific relationships between missing factors and presented factors, and subsequently integrate the imputed values with the presented values. Such imputations undermine the validity of the conclusions drawn from an information integration study. For instance, one might erroneously conclude that subjects use an averaging model whereas the results are due to an adding model with imputations about missing information. Therefore, research on the incidence of imputations in information integration studies is of theoretical and practical relevance (cf. Cohen et al. 1980, Anderson 1983).
This chapter investigates the effects of the experimental design used on imputa-

tions with respect to price and quality. The experimental design is a context element which could seriously affect the results of an information integration study. A context effect refers to changes in the judgment process or its outcome as a function of the other stimuli to be judged (Chakravarti and Lynch 1983). Is the overall judgment of a stimulus affected by the informational context of the other stimuli? Are imputations stimulated when subjects judge stimuli for which information on one or more aspects is missing if this judgment takes place in an information context of stimuli that provide information on all aspects? This is an important topic since imperfectly informed consumers usually do not possess complete information about price and quality for all objects. If consumer judgments are affected by the experimental design this could jeopardize the external validity of the information integration approach and limit its applicability to research on the price-perceived quality tradeoff.

A model for imputations

As stated above, the information integration approach assumes that subjects base their judgments only on the information provided. A number of researchers have challenged this assumption, contending that subjects are apt to make imputations to missing factors on the basis of presented factors.

Yamagishi and Hill (1981) proposed a model that can account for the hypothesized tendency of subjects to impute values to missing factors on the basis of perceived interdimensional relationships between factors. Their model has been refined and extended by Levin and his colleagues (Levin et al. 1985, Johnson and Levin 1985). The Levin model of imputed information will be briefly discussed.

Suppose that the factors S_1 and S_2 are perceived to be correlated so that subjects can impute values to missing information as a function of available information. Overall judgments of two-factor stimuli are assumed to be based on the following model:

$$(11.2) \quad R_2 = w_1 s_1 + w_2 s_2$$

where R, w and s are as defined above. In case the weights are assumed to sum to unity this additive model becomes an averaging model.

When information about one factor, e.g., S_2, is missing, the overall judgment is assumed to be:

$$(11.3) \quad R_1 = w_1 s_1 + w_2' s_2'$$

where s_2' and w_2' are the imputed value of factor S_2 and its weight ($w_2' \leq w_2$), respectively.

It is assumed that the following relationship exists between the imputed value (s_2') and the presented value (s_1):

$$(11.4) \quad s_2' = ms_1 + k$$

where m denotes the perceived relationship between the presented factor and the missing factor, and k is a constant.

Substituting equation (11.4) in equation (11.3) gives the following prediction of the overall response if information about one factor (in this case S_2) is missing:

(11.5) $R_1 = (w_1 + mw_2')s_1 + kw_2'$

If $m > 0$, then increasingly desirable levels of one factor are associated with increasingly desirable levels of the other factor. This implies that the response to the presented factor is increased by the positive imputation about the missing factor. An example could be the factors durability and reliability. If $m < 0$, then increasingly desirable levels of one factor are associated with increasingly undesirable levels of the other factor. The response to the presented factor is decreased because of the negative imputation about the missing factor. An example is the perceived association between price and quality.

The mere fact that information on one or more factors is missing can affect overall judgments. This effect is represented by the constant, k. Subjects sometimes impute a constant value to missing information that is independent of the presented information. Consumers might be negatively, or sometimes positively, inclined to products that do not provide full information on all salient factors.

One would expect $k \leq 0$ because missing information creates uncertainty which is evaluated negatively by consumers (Meyer 1981). k could also be negative if respondents would suspect that the information withheld is unfavorable. However, k could be positive if the factor itself for which information is missing would be viewed negatively (Levin et al. 1985).

Levin's imputations model makes the following predictions about the effects of missing information on overall judgments (see Johnson and Levin 1985 for details).

1. If $m > 0$, then the slope of $R_1(S_1)$ is steeper than the slope of $R_2(S_1)$, and the results obtained are identical to the averaging model.[5]
2. If $m = 0$, then the slope of $R_1(S_1)$ is equal to the slope of $R_2(S_1)$, and the integration process can be described by the adding model.[6]
3. If $m < 0$, then the slope of $R_1(S_1)$ is flatter than the slope of $R_2(S_1)$. This result can only be explained by assuming that the subject imputes values to the missing factor as a function of the presented factor.[7]
4. If $k < 0$ ($k > 0$), then the elevation of $R_1(S_1)$ is lower (higher) than the elevation of $R_2(S_1)$.

Previous research on imputations

A number of studies have investigated imputations in information integration studies. The evidence with regard to the hypothesis that imputed values vary with presented information is not unequivocal. Yamagishi and Hill (1981)

[5] The slope of $R_2(S_1)$ is w_1. The slope of $R_1(S_1)$ is $(w_1 + mw_2')$ which is always greater than w_1, if $m > 0$.

[6] Another model that can account for these results is the averaging model with missing information imputed a constant value and assigned the same weight as if that information had actually been presented (i.e., $w_2' = w_2$). See Levin et al. (1984) and Singh (1984).

[7] Both Levin's imputation model and the averaging model with imputations about missing information can account for these results. When the experimental design includes only two factors, it cannot be determined which of the two imputation models is used by the subjects (Singh 1984).

found that subjects in an information integration experiment make imputations about quality on the basis of price, but reported ambiguous results with respect to imputations about price on the basis of quality information. Huber and McCann (1982) reported small but statistically significant imputations. Levin et al. (1984) reported imputations for about one third of the subjects. Johnson and Levin (1985) found imputations if factors were negatively related but not if they were positively related. Levin et al. (1985) reported imputations of marginal statistical significance. Levin et al. (1982) found no evidence that subjects impute values to missing information. Singh et al. (1979) reported imputations within the context of the averaging model.

In some studies it was found that stimuli for which information on one or more factors was missing, were on the average rated lower than stimuli with information on all factors (Yates et al. 1978, Meyer 1981, Huber and McCann 1982, Johnson and Levin 1985). Thus, subjects sometimes impute a value to a missing factor by assigning it a constant negative value that is independent of the observable information. Recently, however, Levin et al. (1985) showed that the sign of the imputed constant value depends on framing effects. If the factors are stated in negative terms (e.g., % fat of meat, or the probability of losing in gambling), missing information tends to increase overall judgments whereas the opposite effect is found if the information is formulated in positive terms (e.g., % lean of meat, or the probability of winning in gambling).

The present investigation extends previous research on imputations by investigating the effect of the experimental design on the results obtained in an information integration study. Two experimental designs were employed, a within-subjects design and a partially-between-subjects design. These designs are the most appropriate experimental designs for information integration studies (Anderson 1982).

In a within-subjects design the number of pieces of information (in this case price and quality versus only one of these factors) is varied within subjects. In a partially-between-subjects design subjects receive either information on both factors or information on only one of the factors. Most researchers have employed a within-subjects design because it has greater power, the context in which judgments are made is the same for all subjects and it entails lower costs. However, Yamagishi and Hill (1981) hypothesized that the context of varying information in a within-subjects design might induce subjects to impute values to missing factors. They recommended to conduct studies that investigate systematically the effect of the experimental design on information integration processes.

11.3. Method

Within-subjects experiment

Thirty female purchasers of meat products participated in the within-subjects experiment. They were sampled from the consumer panel of Research International, a large market research agency (see Section 6.4). Each subject was individually interviewed at the test centre of that agency.

The stimuli consisted of different combinations of price and/or quality information with respect to gammon intended for use on sandwiches. Four levels

were used for price (Dfl. 1.79, Dfl. 2.19, Dfl. 2.59, and Dfl. 2.99 per 100 grams) covering the range from very cheap to very expensive. Four levels were also used for quality (●, ●●, ●●●, ●●●●) where one dot denoted a very poor quality and four dots denoted a very good quality. Quality levels were not described in verbal terms (very poor, rather poor, rather good, very good) as a pilot study indicated that words create strong demand biases. Only the end levels were described to create approximately the same perceptual range in quality levels to all subjects (see below).

In addition to the 16 price-quality combinations, there were 8 stimuli which resulted from presenting each level of a factor alone. Each subject evaluated all 24 stimuli.

The judgment task was presented in a booklet form. On each page of the booklet a different combination of price and/or quality information was printed. Below each description was a 20-cm graphical scale along which the subjects were to place a slash mark to indicate their response. The boundaries were labeled 'will absolutely not purchase' at the left end and 'will absolutely purchase' at the right end. Responses were measured to the nearest millimeter and were recorded on a scale from 0 to 200. Thus, a higher figure represented greater purchase intention. For each subject, the 24 stimuli in the booklet were randomly ordered.

Subjects were read the instructions aloud. They were told that each page of the booklet contained a different gammon described by price and/or quality. The price and quality ranges were shown. The meaning of the dots was explained. The end levels (one dot and four dots) were described by the words very poor quality and very good quality, respectively, and the subject was told that two and three dots represented intermediate quality levels.

The use of the graphical scale was explained. Subjects were told to base their judgments solely on the information provided and that there were no 'correct' or 'incorrect' answers. Subjects completed the task at their own pace.

In the case of the full-information stimuli, price only acts as a cost factor, i.e., the sacrifice aspect of price is only measured, since there is no need for subjects to make imputations about quality. If price is the only information available, purchase intention ratings reflect either the perceived sacrifice aspect only (when no imputations are made), or both the perceived sacrifice and the perceived quality connotations of price (when imputations are made about quality).

Partially-between-subjects experiment

Ninety female purchasers of meat products participated in the partially-between-subjects experiment. They were sampled from the consumer panel of the same market research agency and were individually interviewed at the test centre of that agency.

The same levels for price and quality information were used. However, the subjects were randomly assigned to one of three subdesigns. The first group of 30 subjects received all 16 combinations of price and quality, the second group of 30 subjects received the four levels of price alone, and the third group of 30 subjects received the four levels of quality alone.

The evaluation task was the same as was used for the within-subjects experi-

ment. Each stimulus was rated on the 20-cm graphical purchase intention scale. The stimuli were randomly ordered per subject.
After the evaluation task had been completed, the subjects in the second and the third group received additional questions with respect to their perception about the price-perceived 'quality relationship. Subjects in the second group were asked, for each price level, to rate the quality of that gammon on a 20-cm graphical scale. The boundaries were labeled 'very poor quality' at the left end and 'very good quality' at the right end. Responses were measured to the nearest millimeter and were recorded on a scale from 0 to 200. Thus, a higher figure represented a higher perceived quality. Subjects in the third group were asked to estimate the price of the gammon (in Dutch guilders) from information given about its quality (as expressed by the number of dots). These additional questions were included as a validity check on the hypothesized relationship between price and quality.
The instructions were basically the same as those used for the within-subjects experiment.

11.4. Results

Within-subjects experiment
Figure 11.2 shows the mean purchase likelihood ratings of two-factor stimuli (solid curves) and one-factor stimuli (dashed curves). The dashed curve of the left-hand panel represents the mean ratings of the 'no-price' stimuli and the dashed curve of the right-hand panel represents the mean ratings of the 'no-quality' stimuli.
The main effect for quality was significant, $F_{3,87} = 102.94$, $p < .001$. The main effect for price was also significant, $F_{3,87} = 9.62$, $p < .001$. Further, the price x quality interaction was significant, $F_{9,261} = 2.15$, $p = .026$. The differential spread and slopes of the curves show that quality is weighted more heavily than price, at least for the stimulus range used.
The shape of each curve reflects the nature of the valuation function for that

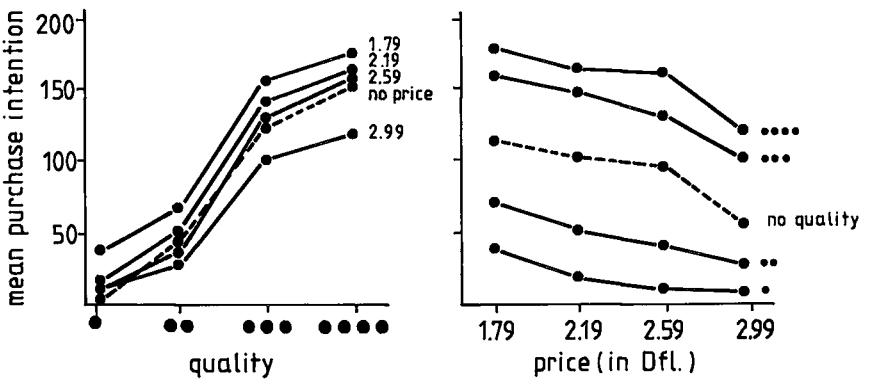

Figure 11.2. Mean purchase intention ratings in the within-subjects experiment as a function of quality for different levels of price (left-hand panel) and as a function of price for different levels of quality (right-hand panel).

factor. The relationship between quality and purchase intention is nonlinear. Purchase intention increases disproportionately when quality changes from below average (two dots) to above average (three dots). A similar effect was found by Hagerty (1978). The subjects do not appear to be willing to buy less than average quality gammon. The effect of price on purchase intention is approximately linear.

The dashed curves are approximately parallel to the solid curves. Only one of the eight comparisons between the slopes of the dashed and solid curves was statistically significant. Moreover, there was is no significant difference in slope between the no-price curve and the average-price curve, nor between the no-quality curve and the average-quality curve.

There was no significant difference in elevation between the no-quality curve and the average-quality curve. The elevation of the no-price curve was significantly lower than the elevation of the average-price curve, $F_{1,29} = 5.68$, $p = .024$, but the average difference was rather small: 8.3.

The tests on slope differences neither support the averaging model nor the imputation model. The imputation model predicts that the dashed curves have flatter slopes, and the averaging model predicts that the dashed curves have steeper slopes. The observed parallelism is consistent with the additive model. There is some evidence that subjects assumed a constant, slightly negative, value for missing price information. This result is not inconsistent with the adding model. However, the significant price x quality interaction contradicts the adding model. A multiplying model is also not supported because the statistically significant portion of the price x quality interaction is not concentrated in the bilinear trend component (Anderson 1982).

Thus, neither the adding model, the averaging model, the multiplying model, nor the imputation model received support. However, the results are consistent with the interactive model (Levin et al. 1981). The interactive model assumes that factor weights vary across levels. Ratings decrease disproportionately when a factor reaches an unfavorable level.[8]

The nature of the interaction effect can be seen in Figure 11.2. The quality curves tend to converge at the price level of Dfl. 2.99. A price of Dfl. 2.99 has a substantial lowering effect on purchase intentions. In fact, the price x quality interaction was almost completely due to responses to the price of Dfl. 2.99. The interaction disappeared when this price level was omitted from the analyses ($F_{6,174} = .418$, $p = .866$). This means that price and quality were traded off in an

[8] The results are also consistent with the differential weight averaging model, which also allows for unequal weighting of the levels within a factor, if it is assumed that subjects impute a constant value to missing information and assign it the same weight as if that information was actually presented. Thus, the present data do not provide an unequivocal test between the two models of price-perceived quality tradeoffs (cf. Singh 1984, Anderson, personal communication). However, the interactive model is favored for two reasons. First, it provides a more parsimonious and plausible interpretation of the results. The differential weight averaging model requires that the weight of a factor in judgment formation is independent of whether the information is presented or not. This is a strong assumption, given the uncertainty attached to missing information. The interactive model requires no such assumption. Second, an additive integration rule as was found for low to moderately high prices is consistent with previous research on price-quality tradeoffs (Hagerty 1978, Yamagishi and Hill 1981, Huber and McCann 1982, Levin and Johnson 1984).

additive way for low to moderately high price levels. However, at a high price, the weight of the factor price increased substantively.

Partially-between-subjects experiment

As hypothesized, the validity check showed that subjects can impute high prices when quality is high and low prices when quality is low, and vice versa. For each successive price level, prompted quality ratings were higher. All differences in quality ratings were significant (Newman-Keuls test, $p < .05$). Subjects also can impute high quality when the price is high. All differences in prices were significant.

The results of the partially-between-subjects experiment are plotted in Figure 11.3.

Both main effects were statistically significant, $F_{3,87} = 136.59$, $p < .001$ for quality and $F_{3,87} = 32.56$, $p < .001$ for price. The interaction between price and quality was also significant, $F_{9,261} = 4.02$, $p < .001$. Again, the differential spread and slopes of the curves show that quality is weighted more heavily than price.

The dashed curves are approximately parallel to the solid curves. Only two of the eight slope comparisons between dashed and solid curves were statistically significant. Further, there was no significant difference in slope between the no-price curve and the average-price curve, nor between the no-quality curve and the average-quality curve.

The respondents did not appear to impute a constant value to missing information. Elevation differences did not approach significance ($p > .10$).

The results are very similar to the results of the within-subjects experiment. An interactive model can account for the data. The price x quality interaction was mainly due to the effect of the price of Dfl. 2.99. The weight of the factor price was greatest when the price was very unfavorable. The interaction disappeared when this price level is omitted from the analyses ($F_{6,174} = .889$, $p = .504$).

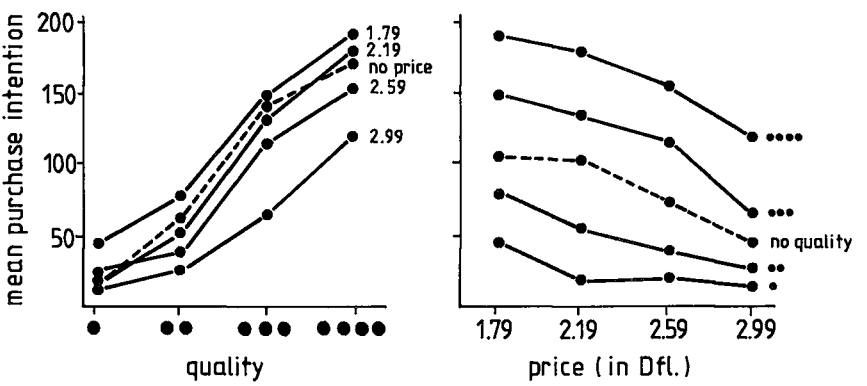

Figure 11.3. Mean purchase intention ratings in the partially-between-subjects experiment as a function of quality for different levels of price (left-hand panel) and as a function of price for different levels of quality (right-hand panel).

Comparison of the results

The results of the within-subjects experiment and the partially-between-subjects experiment were very similar. Both experiments supported an interactive model of the tradeoff between price and perceived quality, and both indicated that imputations were not strong.

The correspondence between the results of the two experiments was investigated formally by testing whether the purchase intention ratings differed significantly between the designs. In these tests, price and/or quality were within-subjects factors and the group comparison was a between-subjects factor. Although some differences can be observed, none of the comparisons concerning slope and elevation differences approached statistical significance ($p > 0.10$ for all cases). For example, if we consider the purchase intention ratings for the 'no-quality' stimuli, there were no significant differences in elevation nor in slope between the purchase intentions given by the subjects in the within-subjects design and the ratings given by the subjects in the 'no-quality' information group of the partially-between-subjects design.

11.5. Conclusions

The first major finding concerns the price-quality tradeoff process. An interactive model was supported in both experiments. Subjects weighted price more heavily if price reached a very unfavorable level. It might be argued that the deviation from parallelism is due to a nonlinear output function. The price x quality interaction could be removed by a monotonic transformation of the data. However, a monotonic transformation would only be justified if the data would show irregular patterns to the same extent for all curves. In this study no such irregular patterns were found. On the contrary, the almost perfect parallelism between the curves for the price levels Dfl. 1.79, Dfl. 2.19 and Dfl. 2.59 strongly suggests a linear output function because it validates the integration rule and the output function simultaneously (Anderson 1982). This implies that the nonparallelism for the Dfl. 2.99 curve cannot be due to a nonlinear output function. Therefore, the price x quality interaction should not be spirited away by a monotonic transformation in order to achieve additivity.

The results of the information integration study do not contradict the results obtained by the correlational approach. Both approaches led to essentially the same conclusion. The parallelism between the curves in the price range from Dfl. 1.79 to Dfl. 2.59 coincides with the nonsignificance of the price x perceived quality interaction reported in Section 10.2 for a slightly different range, Dfl. 1.89 to Dfl. 2.69. Both methodologies supported an additive model for prices ranging from low to moderately high.

Another important result with respect to the price-perceived quality tradeoff concerns the relative importance of both variables in choice behavior. The correlational approach as well as the information integration approach indicated that consumers weight quality more heavily than price in the formation of purchase intentions. This does not mean that quality is always more important than price in the consumer decision process. The experimental designs employed may affect the results since no actual expenditure was required from the subjects. However, the difference in relative importance between quality

and price is so great that it is unlikely to be caused by the experimental design only. Further, Verhallen and De Nooy (1982), Sloan et al. (1984), Folkers (1986), and Glerum-Van der Laan (1986), using different methodologies, also reported that quality is weighted more heavily than price in the consumer decision process. Thus, the results of our experiments support the importance of perceived quality as a variable in consumer behavior.

The disproportionately large increase in purchase intention when quality changed from below average to above average, together with the finding that consumers are willing to pay for higher quality, suggests that it may be particularly profitable to firms to produce products of higher than average quality. This conclusion accords with studies showing that is it profitable to offer good-quality products (Schoeffler et al. 1974, Buzzel et al. 1975, Buzzell and Wiersema 1981, Phillips et al. 1983, Falkenberg 1984, Buzzell and Gale 1986, Luchs 1986, Gale 1987, Jacobson and Aaker 1987).

The second and the third major finding of the study do not concern the price-perceived quality tradeoff, but methodological aspects of the information integration approach. However, these findings are also relevant to future research on the tradeoff between price and perceived quality using the information integration approach (see below).

The second major finding is that the results of an information integration study are not dependent upon the experimental design employed. The results of the within-subjects experiment were very similar to the results of the partially-between-subjects experiment. Given the stability of the results over experimental designs, a within-subjects design is to be preferred because it entails lower costs, has more power, and creates the same evaluation context for all subjects.

The third major finding is that subjects did not appear to impute values to missing information on the basis of presented information within an information integration experiment.[9] No evidence was found that subjects imputed values to missing information as a function of presented information. The hypothesis that subjects impute a discounted constant value to missing information and integrate the imputed value with the value of the presented information to form a judgment was not consistently supported. Only for one out of four comparisons the responses to stimuli for which one factor was missing was significantly lower than the responses to full-information stimuli. These results are not meant to imply that people make no imputations about missing information in real-life decision situations, but indicate that these imputations do not 'contaminate' experimental results in information integration studies in such a way as to lead to erroneous conclusions about the integration rule used. A corollary of this finding is that a full information context as represented by a within-subjects design does not appear to stimulate imputations. Although the validity check indicated that subjects can impute

[9] It could be possible that the data contain a mix of some subjects who conform to the averaging model and some subjects who conform to the imputation model (cf. Levin et al. 1984). At the aggregate level, these opposing effects would tend to cancel each other out and, as a result, the one-factor stimuli would be parallel to the two-factor stimuli. Inspection of the individual graphic plots indicated that no such effect was present in the data.

high quality when the price is high and low quality when the price is low, and vice versa, the results indicate that subjects did not use this relationship when evaluating stimuli for which price or quality information is missing. This provides support for the assumption of information integration theory that subjects are able of evaluating each stimulus solely on the basis of the information provided. Thus, the results of this study support the validity of the basic tests used in the information integration approach to discriminate between models. In sum, the findings reported in this chapter suggest that the information integration approach is a valid procedure to investigate the price-perceived quality tradeoff. It is an attractive alternative to the widely used correlational approach. When a within-subjects design is used, the cost of data collection is rather low. Future research on the price-perceived quality tradeoff might omit the instruction to the subjects that they should base their judgments solely on the information provided. This will enhance the external validity of the information integration experiment. Rather complicated experimental designs are required, however, to reach unambiguous conclusions (see Singh 1984 for details). Further, other factors hypothesized to influence purchase intention could be included in the experimental design along with price and quality. This will also increase the external validity of information integration research on the tradeoff between price and perceived quality in consumer choice behavior.

12. THE RELATIONSHIP BETWEEN PRICE AND QUALITY IN THE MARKETPLACE[1]

12.1. Introduction

In this work, considerable attention has been devoted to the role of price as a cue in the quality perception process. The meta-analysis reported in Section 4.2.3 showed that consumers often use price as quality cue. In our empirical study of the quality perception process it was also found that price influences quality perceptions. In this chapter it is explored whether consumers are actually 'right' in using price as quality index, i.e., is there a strong, positive relationship between price and product quality as measured by standardized techniques and experts?

Economic theory states that in a competitive situation a higher price reflects the higher unit cost of production. If this were not so, abnormal profits would be earned and new firms would enter the market until abnormal profits were eliminated. Assuming efficient production, unit cost is higher if quality is better (better materials, etc.). Therefore, in a competitive market one might expect price and (objective) quality to be strongly correlated.

The actual relationship between price and quality in the market might be weaker than is assumed in the economic theory of competitive markets. Consumers are usually imperfectly informed about the market and this enables some producers to charge noncompetitive prices. The strength of the price-quality relationship is thus weakened. However, several authors including Salop and Stiglitz (1977), have pointed out that the reliance of imperfectly informed consumers on price as a quality indicator is completely justifiable if there are relatively large numbers of well-informed consumers in the market. Well-informed consumers will 'discipline' the market so that price differences will reflect true variation in quality. In this way poorly informed consumers can benefit indirectly from the information held by others. However, when the proportion of well-informed buyers is small it might be profitable for firms to cut on quality, especially when it is difficult for the consumer to judge the product's quality (cf. Scitovsky 1945, Klein and Leffler 1981, Shapiro 1983). This would tend to weaken or even reverse the positive relationship between price and quality. The veridicality of price as market signal of quality is thus essentially an empirical question.

In the present chapter the empirical relationship between price and quality in the Dutch market is investigated. The temporal stability of price-quality corre-

[1] This chapter is a slightly adapted version of an article that has appeared in *De Economist* (Steenkamp 1988b).

lations is also studied. Further, hypotheses are developed and tested which might explain the variation in the price-quality relationship across products. The following section briefly reviews previous empirical research on the relationship between price and quality. Three hypotheses are presented. These were developed to explain variations in price-quality correlations across products. Data and the method of analysis are discussed in Section 12.3 and the results are presented in Section 12.4. Section 12.5 contains the conclusions.

12.2. Price and quality in the marketplace

12.2.1. A review of empirical research on the relationship between price and quality

In order to study the veridicality of price as market signal of quality, one needs a measure of objective quality. Such a measure is provided by the product tests data published by consumer magazines such as *Consumer Reports*. Consumer magazines are a major source of product quality information. Products are tested and given an ordinal quality evaluation, e.g., very good, good, bad, etc. Prices are list prices or prices paid by members of the Consumer Union or some other consumer organization.

A number of researchers have used the price and quality data published by consumer magazines to explore the strength of the price-quality relationship. The procedure generally followed in these studies is to calculate the rank order correlation coefficient (nearly always Spearman's rho) between price and overall quality for a product category, using test results published in a consumer magazine. If price is an accurate signal of quality, the rank order correlation coefficient should be near to 1.

Oxenfeldt (1950) was the first researcher to study the price-quality relationship in this way. He computed Spearman's rho for 35 products offered in the American marketplace (durable goods, clothing, and foods). It was found that the relationship between price and quality was relatively weak for most products. Spearman's rho ranged from -.81 to .82. The overall mean was .25. For nine of the 35 products the cheaper brands typically were of higher quality than the more expensive ones. Spearman's rho was positive and significant at $p = .05$ (one-tailed) for only thirteen products.

Other studies on the relationship between price and quality within the U.S.A. have been carried out by Friedman (1967), Morris and Bronson (1969), Sproles (1977), Riesz (1978, 1979), Sutton and Riesz (1979), Dardis and Gieser (1980), and Gerstner (1985). These studies also reported a weak overall relationship between price and quality. Tellis and Wernerfelt (1987) conducted a meta-analysis of the empirical results of the American studies and found that the correlation between price and quality is rather weak but highly significant ($p < .0001$). Mean Spearman's rho was .27 and median rho was .31.

Research on price-quality relationships has been recently carried out in Japan (Yamada and Ackerman 1984) and Canada (Bodell et al. 1986). These studies also showed that price-quality relationships are product specific and weak in general. Table 12.1 gives a summary of the results obtained in previous studies. As can be seen in Table 12.1, most of the empirical studies on price-quality

Table 12.1. Summary of the results of previous studies dealing with the relationship between price and objective quality.

Reference	Data Source	Country	Number of Product Tests	Mean of Rank Correlation Coefficients	Percentage of Significant (Positive) Correlations	Range of Rank Correlation Coefficients
Oxenfeldt (1950)	Consumer Reports 1939-1949	USA	35[a]	.25	37	-.81 to .82
Friedman (1967)	Consumer Reports 1961-1965	USA	29[b]	.15	?	-.59 to .78
Morris	Consumer Reports 1958-1967	USA	48[c]	.29	25	-.66 to .96
Bronson (1969)						
Sproles (1977)	Consumer Reports Consumer Res. Mag. 1972-1974	USA	135[d]	.26	30	-.66 to .90
Riesz (1978)	Consumer Reports 1961-1975	USA	685[e]	.26	?	?
Riesz (1979)	Consumer Reports 1961-1975	USA	40[f]	.09	10	-.65 to .88
Sutton	Consumer Reports 1961-1978	USA	54[g]	.11	13	-.71 to .94
Riesz (1979)						
Dardis	Consumer Reports 1970-1977	USA	105[d]	.28	31	-.83 to .86
Gieser (1980)						
Yamada	Monthly Consumer 1972-1871	Japan	79[d]	-.06	9	-.80 to .87
Ackerman (1984)						
Gerstner (1985)	Buying Guide 1980-1982	USA	145[e]	.11	21	-1.00 to .72
Bodell et al. (1986)	Canadian Consumer 1978-1985	Canada	91[e]	.19	?	-.82 to .93

[a] Product categories were durables, clothing and food products.
[b] Cleaning and maintenance, clothing and food products.
[c] Nearly all were durables.
[d] Durables only.
[e] Broad range of product categories.
[f] Packaged food products only.
[g] Toilet articles, cosmetics, clothing.

correlations concern the American marketplace. The present chapter concerns the Dutch market. It is important to know whether similar results concerning the strength of price-quality correlations are also found in smaller countries like the Netherlands where information about prices and product quality can be more quickly disseminated.
Previous studies in general did not attract much attention in the theoretical literature because they tended to give little consideration to the causes of variation in price-quality correlations across products. Below, three hypotheses are discussed which may further our insight into the reasons why the relationship between price and quality is not stable across products.

12.2.2. Hypotheses

It is postulated that the price-quality relationship will be stronger for durable products than for nondurables because consumers are expected to search more for them and be better informed about them. A durable product of superior quality pays dividends over a longer period of time in terms of lower maintenance costs than a nondurable item of superior quality (cf. Tellis and Wernerfelt 1987). Thus, consumers are more likely to benefit from being informed about quality when purchasing durables than nondurables. This will 'discipline' the markets for durable products more than for nondurable products and results in a stronger relationship between price and quality for durable items (cf. Salop and Stiglitz 1977). The following hypothesis has therefore been formulated:

H_1: Durable products exhibit a stronger price-quality relationship than nondurable products.

In his seminal article *The economics of information*, Stigler (1961) developed the hypothesis that the extent of search is positively related to price dispersion for any product. The rationale for this hypothesis is that the expected benefits from search are positively related to the degree of price dispersion. More search leads to consumers being better informed about the market. Consequently, one would expect that the relationship between price and quality increases with the degree of price dispersion:

H_2: The larger the price dispersion in the market, the stronger the price-quality relationship will be.

Jacoby and other researchers (Jacoby et al. 1974a, b, Malhotra 1982) investigated the effect of the number of brands available for a product on consumer decisions. It was found that the probability of information overload increased with the number of available brands. Information overload resulted in an increase in haphazard and erroneous consumer decision making. Such ill-considered decision making could lead to a weakening of the price-quality relationship in the market because firms could exploit this information overload by charging noncompetitive prices (Schwartz and Wilde 1985). On the other hand, when the number of competing brands is small, it is possible that collusive

oligopolies may be formed. Collusive oligopolies reduce competition and this can very well lead to a weakening of the price-quality relationships. It is hypothesized therefore, that the relation between the number of available brands and the strength of the price-quality relationship is curvilinear.

H_3: The relation between the number of available brands and the strength of the price-quality relationship is curvilinear.

12.3. Methodology

12.3.1. Measurement of quality and price

The data used in this chapter were obtained from *Consumentengids*, a magazine published monthly by the Dutch Consumers Union. *Consumentengids* reports the results of product tests and provides other information of interest to consumers. Product tests are conducted by the Stichting Vergelijkend Warenonderzoek, an independent testing agency subsidized by the Dutch government, and other laboratories. In this section, we shall briefly consider the way the product tests are conducted. It is obvious that the validity of the results of an empirical investigation into the price-quality relationship depends upon the validity of the price and quality data used.

The Dutch Consumers Union uses a nine-point ranking scale for quality: bad, bad/mediocre, mediocre, mediocre/middling, middling, middling/good, good, good/very good, very good. However, in most product tests less than nine categories are used. Quality rankings are based on the following procedure:

1. *Delimitation of the product category*. If there exists large variation in the product category, brands are grouped into more homogeneous categories and the following steps are carried out for each category.
2. *Identification of relevant product attributes*. Out of necessity product tests are biased towards objectively measurable attributes. Factors like style and design are usually not considered. On the other hand, sensory attributes like taste, which are very important for food products, are included. Where subjective attributes are considered to be of paramount importance for the consumers but cannot be objectively measured, the product is not tested.
3. *Selection of methods for measuring product attributes and measurement*. Standard techniques are often available that are generally accepted by testing agencies and manufacturers (cf. Oxenfeldt 1950). Expert panels are used where sensory attributes are important.
4. *Assignment of weights to product attributes*. Attribute weights are assigned by a panel of experts. The selection of weights, however, is affected to a considerable extent by the importance of the attributes to the 'average' consumer.
5. *Quality ranking of products*. Overall quality ratings are calculated as weighted additive composites of the attribute ratings. Overall quality ratings are transformed onto the nine-point ranking scale. These ranks order evaluations are reported in *Consumentengids*.

The prices of the brands are determined in the following way:

1. *Consumentengids* uses actual transaction prices.

2. The major retailers are identified for each brand separately and the market share of each retailer with respect to each brand is estimated by experts from the Dutch Consumers Union.
3. Actual transaction prices in local markets and their respective retailers are reported by a number of members from the Dutch Consumers Union.
4. The brand price reported in *Consumentengids* is an average of prices charged by different retailers, weighted by their share of the market in respect of the brand in question.

The use of product test data to study the strength of price-quality relationships has been discussed by Oxenfeldt (1950) and more recently by Maynes (1976). A major strength of these data is the testing agency's reputation, integrity, impartiality, and experience. Major limitations are the identification of the relevant product attributes and the assignment of weights to the attributes. Both limitations will be discussed briefly.

As has already been mentioned above, subjective and esthetic factors like style are usually not included in testing procedure. However, there is no reason to expect that brands that rate high on objectively measurable attributes will rate low on other attributes. As Oxenfeldt (1950, p. 303) already noted:

'The brand with the highest point score will not necessarily have universal taste appeal, but in the absence of positive information to the contrary, it can be considered *equal* to other brands in non-measurable qualities. Accordingly, products of highest measurable quality may be taken as highest in all around quality *for the average consumer.*'

Hjorth-Anderson (1981, 1984) has criticized the use of overall quality rank order data. According to him, overall rankings are completely dependent upon the weights chosen by the experts. Since the selection of attribute weights is always subjective, he claimed that overall ranking data are only appropriate if the brands are vertically differentiated (Lancaster 1979), that is if a brand occupies approximately the same rank position on each attribute. Hjorth-Anderson's criticism has been countered by Curry and Faulds (1986). They showed that overall quality scores are only affected by the attribute weights used when two conditions are met simultaneously: (1) one person's weights are the reverse of another person's weights, and (2) attribute ratings are predominantly negatively correlated. Curry and Faulds analyzed attribute correlations for 385 consumer tests involving over 3500 brands. They found that in most product categories the attributes were positively correlated. In at least 88 percent of the product tests, reverse weighting schemes did not appreciably affect overall quality rankings. It was concluded that: 'Previous research using published quality ratings should not be discounted or declared invalid on the basis of an argument about sensitivity to weights' (Curry and Faulds 1986, p. 143). Thus, one can validly use overall quality ranking data in assessing price-quality relationships.

12.3.2. Data

The data set consisted of 413 product tests involving 6580 brands published in *Consumentengids* over the ten year period 1977-1986. A product test was only included if at least seven brands were examined in the product test. A reason-

ably large number of brands is required if the correlation coefficient is to have stability. For a number of tests, mostly involving foods, brands' unit sizes differed within the product category. In these cases the price per unit of measure was used as brand price (cf. Riesz 1978, Gerstner 1985).
Although the number of product tests is large, the products tested are not completely representative of the total market of consumer products. Most tests (74.8%) involve nonfrequently purchased consumer durables, a reflection of the main interests of *Consumentengids* subscribers. The range of products covered however is very broad.
For each product test, Spearman's rho and Kendall's tau rank correlation coefficient, both corrected for ties, were computed between quality and price ranking data. A directional or one-tailed test (H_0: rho,tau = 0; H_a: rho,tau > 0) was employed to examine the significance of the rank correlation coefficient. This test considers both the absolute magnitude of the correlation coefficient as well as the sign of the coefficient in assessing the significance of the result. A directional test is more appropriate than a nondirectional (two-tailed) test when theory clearly suggests the direction of the alternative hypothesis. This is the case in the present research since, from a theoretical point of view, it is to be expected that the true alternative to no relationship between price and quality is that they are positively correlated. A corollary of this testing procedure is that the significance of large negative correlations is not considered. However, hypothesis testing should be based on theoretical considerations which suggest in this case that a directional test is called for.
To explore the strength of association between price and quality, rank order correlation coefficients were used instead of a linear correlation coefficient. There are three reasons for this. First, there is no reason to assume that the relationship between price and quality should be linear. In fact, the work of Klein and Leffler (1981) and Shapiro (1983) suggests a monotonically increasing but nonlinear relationship. They showed that higher quality products must sell at a premium above cost. The price premium is necessary as a compensation for the profit the firm foregoes by not following a hit and run strategy. In a hit and run strategy the firm would earn high profits for a short time by 'cheating' the consumer by selling a low quality product at a high price. Empirical research on hedonic price functions also suggests a monotone but nonlinear relationship (see Section 3.4). A monotone association between price and quality can be measured by a rank order correlation coefficient but not by a linear correlation coefficient.
Second, given the difficulty of measuring quality objectively and because of the ranking method employed by *Consumentengids*, a rank order correlation method is more appropriate.
Third, it allows the results of the present research to be compared with results found in other studies.
A high rank order correlation coefficient indicates a strong monotonic relationship between price and quality. However, it does not necessarily reflect the incremental difference between any two observations of price and quality. For instance, the price difference between the quality levels good and good/very good might be Dfl. 10,- whereas the difference between good/very good and very good could be Dfl. 50,-. Which quality level is the best buy depends on

each consumer's marginal valuation of price and quality.
Further, for each product test, the price of the cheapest brand in the group of highest-quality brands (P_b) and the price of the most expensive brand in the sample of brands tested (P_h) were identified and the price ratio P_b/P_h was computed.[2] The price ratio is bounded by 0 and 1: $0 < P_b/P_h \leq 1$. It is a crude measure of the maximum percentage loss which an uninformed consumer might incur by blindly following a 'price-equals-quality' buying strategy instead of adopting a 'being well-informed' buying strategy. For example, if the price ratio for a certain product category is .60, consumers could make an expenditure saving of 40% by buying the cheapest highest-quality brand instead of the most expensive brand. Obviously, the price ratio measures the maximum loss that can be incurred since many consumers do not follow the rule of buying the most expensive brand.
The average price of the brands tested and the standard deviation of prices in a given product category were also computed for each product test.

12.4. Results

12.4.1. General findings on price-quality correlations in the Netherlands

Table 12.2 provides a summary of the results. Spearman's rho ranged from -.83 to .92 with a mean of .29. Only 40.0% of these correlations were significant and nearly 20% were negative. In general, Kendall's tau was somewhat smaller than Spearman's rho due to the different computational procedure. However, the results obtained were highly similar.

Table 12.2. Summary of price-quality relationships in the Netherlands based on 413 product tests

Statistic	Spearman's rho	Kendall's tau	Price ratio
mean	.29	.24	.59
median	.32	.25	.58
range	-.83 to .92	-.69 to .83	.04 to 1.00
percentage of significant correlations	40.0	38.5	n.a.
percentage of negative correlations	19.6	18.9	n.a.

n.a. = not applicable

The results show that the overall weak relationship between price and quality is an international phenomenon. In general, price is a rather unreliable market signal of quality in the U.S.A., Japan, Canada, as well as in the Netherlands. It is interesting to note that the empirical results found for the Netherlands closely correspond to those of Tellis and Wernerfelt's meta-analysis of American studies. Tellis and Wernerfelt reported a mean rho of .27, and a median rho of .31.

[2] If more than one brand was assigned to the highest quality category, the cheapest brand was taken. Where only one brand ranked highest, the price of that brand was used.

Low rank correlation reflect informationally imperfect markets. Brands offering a relatively low quality at a relatively high price can only exist if at least some consumers are imperfectly informed about prices and quality. Consumers can make substantial savings if their knowledge of the market increases. Maximum potential savings are indicated by the price ratio. On average, consumers could save a maximum of 41.0% in their expenditures if they would buy the cheapest highest-quality brand instead of following the rule of 'price-equals-quality' (i.e., buying the highest priced brand in order to get the highest possible quality). Frequently, they will also obtain a brand of better quality. Of course, the actual average saving of being perfectly informed will usually be less than 41.0% since many consumers will not buy the highest priced brand. Further, the price ratio varies across product categories. The magnitude of the price ratio is nevertheless an indication that substantial savings are possible.
It can be said therefore, that low rank order correlation coefficients, a price ratio ranging from .04 to 1.00 with a mean of .59 and a median of .58 all suggest that the markets for most products are informationally imperfect.

12.4.2. Temporal stability of price-quality correlations

The data set consisted of product tests covering a period of ten years. In order to assess the stability of the price-quality relationship in this period, the mean value of Spearman's rho and Kendall's tau was computed separately for each year on the basis of the product tests conducted in that year. Mean annual values of Spearman's rho are plotted in Figure 12.1.[3]

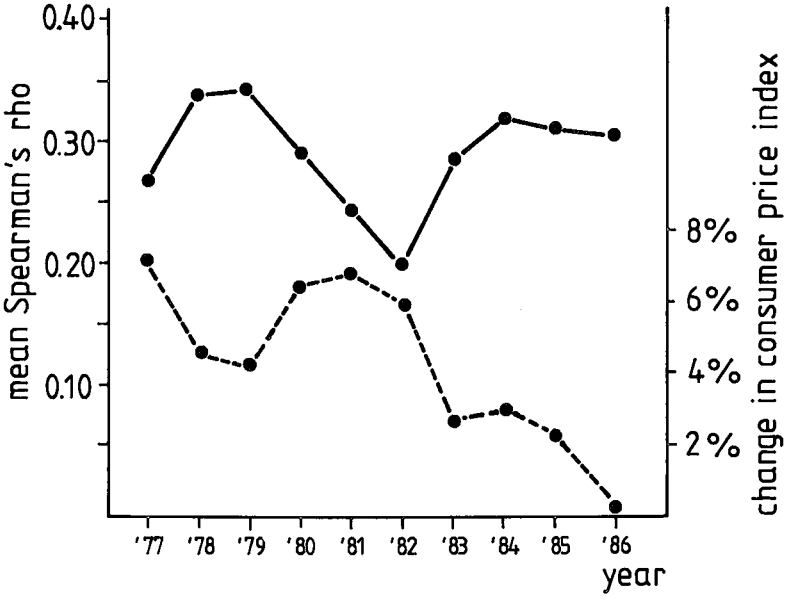

Figure 12.1. Mean Spearman's rho (solid line) and percentage change in the consumer price index (dashed line) by year.

Figure 12.1 shows a decrease in the mean value of Spearman's rho from 1980-1982. One explanation of this finding could be that in these years the mix of products tested differed substantially from that in 1977-1979 and 1983-1986. The degree of stability in the product mix over the three periods was assessed on the basis of three criteria: the percentage of product tests involving consumer durables, the mean value of the standard deviation of prices, and the average number of brands included in a product test. It should be noted that these three criteria are derived from the three hypotheses developed above. The results are reported in Table 12.3.[3]

Table 12.3. Composition of the mix of products tested for the periods 1977-1979, 1980-1982, and 1983-1986 as assessed on three criteria.

Criterion	1977-1979	1980-1982	1983-1986
percentage durables	87.5	91.6	84.6
mean standard deviation of prices (in guilders)	90.6	92.8	143.8
mean number of brands included in product test	17.0	16.1	15.4
	(n=81)	(n=117)	(n=215)

[3] Kendall's tau yielded a similar plot.

Table 12.3 shows that the percentage of consumer durables was somewhat higher in 1980-1982 but results (see below) indicated that price-quality correlations were, on average actually higher for durables than for nondurables. An overall test on the equality of means showed that neither the mean value of the standard deviation of prices, nor the mean number of brands included in a product test differed significantly between the three periods: $F_{2,410} = 1.72$ and $F_{2,410} = 1.05$, respectively; both F-values were not significant at $p = .10$.[4] Further the Scheffé test showed that for both criteria, none of the pairwise comparisons between time periods was significant at $p = .10$.

It appears that the decrease in the strength of the price-quality relationship during 1980-1982 cannot be explained by variations in the product mix as assessed on the basis of the three criteria mentioned above.

Another explanation for the lower price-quality correlations in the period 1980-1982 can be found by comparing the mean correlations with the annual percentage change in the Consumer Price Index. When the inflation rate is relatively high, consumers' knowledge of prices and of the relationship between prices and quality is likely to be less useful. Riesz (1978) suggested that in such a market situation price changes adverse to consumers would be particularly likely to occur. This could result in a weakening of the price-quality relation-

[4] The mean value of the standard deviation of prices in the period 1983-1986 was rather large when compared to the previous periods. However, this was mainly due to a single product test in which the standard deviation of prices of the brands was about three times as large as the next largest observation for this criterion. If this one extreme observation were deleted, the mean value of the standard deviation of prices decreased from 143.8 to 122.2.

ship.[5] The annual percentage change in the Consumer Price Index is also plotted in Figure 12.1. It appears that mean price-quality correlations are indeed inversely related to the inflation rate. Spearman's rho between the inflation rate and the mean annual value of rho was -.479 (significant at p = .10).[6]

12.4.3. Hypotheses testing

It was found above that there exists considerable variation in price-quality correlations across products and over time. The variation in price-quality correlations over time can be (partially) explained by the annual inflation rate. In this section, possible determinants of the variation in price-quality correlations across products are explored by testing the hypotheses developed in Section 12.2. The hypotheses are not independent. For example it was found, not surprisingly, that the price dispersion is greater for durables than for nondurables. The hypotheses should therefore be tested simultaneously. This can be done by estimating the following regression equation:

$$(12.1) \quad R_i = b_0 + b_1 D_i + b_2 SDP_i + b_3 N_i + b_4 N_i^2 + e_i$$

where R_i denotes the rank order correlation coefficient, Spearman's rho or Kendall's tau, between price and quality in product test i, D_i is a dummy variable for product test i, and is equal to zero for nondurable products and one for durable products, SDP_i denotes the standard deviation of prices in product test i, N_i is the number of brands in product test i, and e_i is the error term.
H_1 stating that the price-quality relationship is stronger for durable products than for nondurables, is supported if b_1 is positive and significant. H_2 states that the larger the price dispersion in the market, the stronger the price-quality relationship will be. The standard deviation of brand prices in a product test was used as measure of price dispersion for the product in question. H_2 is supported when b_2 is found to be positive and significant.
H_3 states that there exists a curvilinear relation between the number of available brands and the strength of the price-quality relationship. In principle, this hypothesis can only be tested if all available brands of a product are included in the product test. This is not the case as the Dutch Consumers Union concentrates on brands having a relatively high market share. Product tests published in *Consumentengids* cover a high proportion of the sales volume but not

[5] In particular low-quality producers might be tempted to exploit imperfect information on the side of the consumers by charging noncompetitive prices. This hypothesis is based on Comanor and Wilson's (1979) contention that low-quality products generate fewer repeat purchases. Low-quality producers have therefore less incentive to refrain from cheating on quality, i.e. sell a low-quality product at a high price (cf. Klein and Leffler 1981). It is also possible that high-quality products deteriorate in quality in inflationary times in order to keep price within an acceptable range. It seems to us that the British automobile company Jaguar followed this strategy in the early 1980s.

[6] If the mean annual value of rho is considered to be an interval-scaled variable, one could as an alternative to Spearman's rho, compute Pearson's r between the inflation rate and the mean annual value of rho. Pearson's r is more powerful than Spearman's rho. However, a similar result was obtained using Pearson's r. Pearson's r was -.503 (significant at p = .10).

necessarily a high proportion of the brands. However, we can obtain some insight into the validity of H_3 by assuming that the number of brands tested relative to the total number of available brands is approximately constant across product tests. If this assumption is correct, the number of brands tested reflects the total number of available brands. In line with this assumption, H_3 was tested on the basis of the number of brands in the product test. H_3 is considered to be supported if (1) the increase in R^2 from adding N and N^2 to the regression model including only D and SDP as predictor variables is significant, and (2) b_3 is positive and significant and b_4 is negative and significant.

Equation (12.1) was estimated using Spearman's rho as well as Kendall's tau as dependent variable. Conclusions did not depend on the type of rank order correlation coefficient employed. For this reason and in order to enhance the readability of the chapter, results will be reported only for Spearman's rho. Spearman's rho was chosen since it is more widely applied than Kendall's tau in price-quality research. The regression analysis was also carried out after a Fisher r-z transformation was applied to the rank order correlation coefficients. The conclusions were the same.

The results of the regression analysis of Spearman's rho on D, SDP, N, and N^2 are reported in Table 12.4.[7]

Table 12.4. Results of the regression analysis of Spearman's rho on type of product (D), standard deviation of prices in a product test (SDP), and the number of brands in a product test (N, N^2).

Predictor variable	b	β	p-value[a]
D	.122	.120	.008
SDP	1.504 E-04	.126	.009
N	1.507 E-04	3.803 E-03	.491
N^2	2.809 E-05	.035	.919
Intercept	.155		.058

R^2 = .036 (p = .005)

[a] One-sided

Table 12.4 shows that H_1 is supported. The regression coefficient for the type of product, durable versus nondurable, were positive and significant. Mean Spearman's rho was .31 for durables and .17 for nondurable items. The mean values for Kendall's tau were .26 and .14, respectively.

The positive and significant value of the regression coefficient for SDP shows that H_2 is supported as well. The larger the standard deviation of the prices in a product test, the stronger the price-quality relationship.

As mentioned above, price dispersion was significantly greater for durables than for nondurables. One could hypothesize that differences in price dispersion were the underlying reason why durable products exhibited a stronger price-quality relationship than nondurables items. A larger price dispersion

[7] The conclusions remained unaltered when the product test with the extreme observation on SDP (cf. footnote 4) was deleted from the data.

induces consumers to search more since the potential monetary savings are higher, resulting in a stronger price-quality relationship. If this reasoning is correct, the effect of type of product, durable versus nondurable, should disappear when the effect of price dispersion is controlled for. However, Table 12.4 shows that type of product exerted a significant influence on price-quality correlations even if the effect of price dispersion was taken into account. Thus, differences in price dispersion could not completely account for the effect of product type on the strength of the price-quality relationship. Apart from price, other factors related to product type like the length of commitment to the product and quality risk (cf. Wiggins and Lane 1985) presumably influence the extent of search, and, consequently, the effect of product type on price-quality correlations.

H_3 is rejected. The increment in R^2 from adding the variables N and N^2 to the restricted regression model including only D and SDP was very small (.002), and not significant ($F_{2,408} = .423$, $p > .10$). Further, neither the coefficient for N nor the coefficient for N^2 was significant (see Table 12.4).

An explanation for the result of H_3 could be that the proportion of available brands being tested varied across product tests. This implies that the number of brands in a product test is not a valid measure of the total number of available brands. Another explanation could be that the data set included only product tests involving seven or more brands. It is possible that for nearly all product tests the number of available brands is already too large for consumers.[8] Wright (1975), for instance, suggested that six brands represents the maximum comfortable information load and Malhotra (1982) reported information overload for as few as ten brands. As a consequence, no relationship will be found between the number of brands tested and the strength of the price-quality relationship.

12.5. Conclusions

The findings indicate that for most products price and objective quality are positively correlated. Mean Spearman's rho was .29 and 81.4% of the correlations was positive. Better quality does on average command a higher price. However, one should not be overly optimistic about the working of the market. Most correlations are weak whereas the economic theory of competitive markets suggests a strong relationship between price and quality. The conventional wisdom of 'you get what you pay for' is challenged by the results reported in this chapter.

Price-quality correlations varied over time. It was found that correlations were lower when the inflation rate was rather high.

Variation in price-quality correlations were also observed across products.

[8] The actual number of brands available to a consumer is unknown. On the one hand consumers are usually not confronted with all brands available in the market place (some brands are only sold in certain regions for example). On the other hand not all available brands are tested. Therefore we have to assume as a best guess that the number of brands tested is more or less equal to the number of brands available to an individual consumer. Obviously, given this assumption, the second explanation is only tentative.

Correlations were higher for durable products than for nondurables. Further, the correlation between price and quality in a product test is positively related to the degree of price variation for that product. The hypothesized curvilinear relationship between the number of available brands and the strength of the price-quality relationship was not found. Price-quality correlations did not vary with the number of brands. Our data set, however, included only product tests involving seven or more brands.

Thus, two determinants of the variation in the strength of the price-quality relationship across products in the marketplace have been identified in this investigation: type of product, durable versus nondurable, and the degree of price dispersion in a product category. Both determinants are related to the extent of consumer search for product information. However, given the low proportion of variance accounted for by these determinants, it is clear that much remains to be done before the causes of the variation in price-quality correlations in the marketplace are fully understood.

Low price-quality correlations reflect informationally imperfect markets. Consumers do buy brands that are sometimes very inefficient. For instance, results concerning the price ratio indicate that brands exist in the marketplace that are substantially higher priced and frequently of lower quality than the cheapest highest-quality brand available. This confirms Schwartz and Wilde's (1985) contention that firms exploit imperfect information on the side of consumers by charging noncompetitive prices.

It seems worthwhile to attempt to increase consumer knowledge of the markets, their prices, and their qualities. An obvious way of enhancing consumer knowledge is consumer education. Another possibility is to stimulate the spread of test results. Most consumer organizations discourage or prohibit firms from using test results in advertisements. However, the purpose of product tests, increasing consumer information about prices and quality of competing brands, is furthered by allowing wider dissemination of this information through advertising. After test results are widely circulated price and quality may be more strongly correlated than before since the market will become less informationally imperfect. Tentative support for this contention is provided by Archibald et al. (1983).

At present the results are clear. Price is a poor market signal of quality for most products.

Part IV

Summary and Conclusions

13. SUMMARY AND CONCLUSIONS

The objectives of the present work are (1) to review the literature on product quality from different perspectives, (2) to develop a model that describes the way consumers form judgments about product quality, and (3) to investigate the proposed model empirically. In addition, price-perceived quality tradeoffs and the relationship between price and product quality in the marketplace are investigated. The main conclusions are summarized in this chapter.

The concept of product quality

The concept of product quality has received attention in various disciplines. Four major approaches to product quality are identified: the metaphysical approach, the production management approach, the economic approach, and the perceived quality approach. To enhance our insight into the product quality concept, each of these approaches is discussed, the most attention being given to the economic and the perceived quality approaches.

The metaphysical approach concentrates on the being of quality. Quality is regarded by many authors as being synonymous with innate excellence. In essence, it is an unanalyzable property that an individual can learn to recognize only through experience. People differ about quality not because quality is different but because people are different in terms of experience.

The production management approach differs from the metaphysical approach in that it regards quality as a concept that is objectively measurable. In the production management approach, quality is described in technical specifications. Quality is conformity with these technical specifications. This approach concentrates on producing a product of a given predetermined quality level. This level of quality is achieved by quality of design, quality of production, continuity of service, and customer service after sale. The most important recent development in the production management approach is the emergence of the 'zero defects philosophy'. In the traditional view, very few or no defects are not economical because such perfectionism would cause the costs of preventing defects to exceed the costs of having the defects. However, it has been shown that quality improvement need not lead to higher costs, and increasingly, companies, especially Japanese firms, adopt the zero defects philosophy.

The economic approach to quality studies the role of product quality in the market. Important areas of research are quality as a competitive weapon of the firm, the hedonic approach, and the role of quality in consumer behavior, both when consumers are perfectly informed about the market and when they are imperfectly informed. It is remarkable that these areas of research have developed rather independently from each other. Notable exceptions are the wide-

spread adoption of Lancaster's conceptualization of the product as a bundle of characteristics, and the increasing attention in economic theory in general for the notion that consumers are imperfectly informed.

The production management approach and the economic approach have in common that they both define quality in terms of objectively measurable product characteristics. The three approaches to quality hitherto mentioned share the notion that quality is an objective property inherent in the product.

The perceived quality differs from the other approaches in that it regards quality neither as absolute nor as objective. Quality is a subjective concept, dependent on the perceptions, needs, and goals of the individual consumer. One of its tenets is that people are imperfectly informed about quality. They need cues to form quality perceptions. Since these cues are usually imperfect indicators of quality, quality risk will be experienced. A meta-analysis of studies dealing with the effects of quality cues on perceived quality shows that the cues price, brand name, store name, country of origin, and the physical product (i.e., the physical characteristics of the brand) influence quality perceptions. This does not imply, however, that all of these cues have a significant effect on perceived quality for all products and in all situations. Presently, not much is known about the mediating role of personal and situational characteristics on cue effects. It is important to note that few models of the quality perception process have been proposed in the literature.

A development in consumer behavior research that is relevant to the perceived quality approach is the increasing use of descriptively realistic but more limited models. These models usually are empirically testable, which is not the case for the large integrated models, and also stand a better chance of being applied outside the academic setting.

The confusion surrounding the concept of quality is largely due to differences in perspective taken by different authors. A consumer behavior researcher and a philosopher have something quite different in mind when they communicate about quality. It is therefore important that a researcher clearly states the view on quality taken by him/her.

It cannot be said that any one approach to quality is superior to any other. All four approaches are valuable in their own right. The usefulness of a certain approach is dependent on the issues to be investigated.

The four approaches to product quality have developed largely independent from each other. However, it is possible to develop relations between the approaches as was done in this work. Briefly, the results of a study employing the perceived quality approach can be used to develop the technical quality specifications employed in the production management approach. This integration of the perceived quality approach and the production management approach has been called 'quality guidance', the theoretical underpinnings of which are discussed more fully in Steenkamp and Van Trijp (1988a, 1989b). The economic approach can be used, in conjunction with the production management approach and the perceived quality approach to select the quality level that yields the highest profit or market share. The metaphysical approach draws attention to the role of esthetic product aspects in consumer evaluations.

A model of the quality perception process

In the remainder of the study, we adopt the perceived quality approach (with the exception of Chapter 12). A model of the quality perception process is developed that integrates concepts developed in information processing, social and cognitive psychology, and economics. The model is based on a definition of perceived quality developed within the broader context of value. The main elements of this definition are that perceived quality (1) involves preference, (2) involves a subject-object interaction, (3) is relativistic in that it is comparative, personal, and situational, and (4) resides in the consumption of the product.

A distinction is made between quality cues and quality attributes. Quality cues can be ascertained by the senses prior to consumption. Quality attributes are benefit-generating product aspects and cannot be observed prior to consumption. It is posited that overall quality judgments are based on quality attribute perceptions. Quality cues are valued because they predict quality attributes. A consumer uses quality cues since direct information about the quality attributes is usually not available to consumers at the point of purchase.

Quality cues are categorized as either intrinsic or extrinsic. Intrinsic cues are part of the physical product. Extrinsic cues are related to the product, but are physically not part of it. A distinction is further made between experience quality attributes and credence quality attributes. Experience attributes can be ascertained on the basis of the actual experience of the product, whereas credence attributes cannot be ascertained even after normal use for a long time.

The most important process governing the use of quality cues in the formation of (experience and credence) quality attribute perceptions is the process of inferential belief formation. People infer quality attribute beliefs on the basis of cues that are acquired and categorized. It is hypothesized that the magnitude of the effect of a certain cue in inferential belief formation with respect to a certain attribute is (1) positively affected by the strength of the perceived relationship between the cue and the attribute in question, i.e., by the predictive value of the cue with respect to that attribute, (2) positively affected by the confidence an individual has in his/her ability to accurately perceive and categorize the cue, i.e., by the confidence value of the cue, and (3) is usually greater for an intrinsic cue than for an extrinsic cue. Cue confidence value and cue intrinsicness or extrinsicness are independent of the inferred attribute. Further, it is assumed that consumers are homogeneous with respect to their perceptions of a cue's intrinsicness or extrinsicness.

Personal and situational variables are hypothesized to influence the quality perception process. The personal variables prior experience, level of education, quality-consciousness, and perceived quality risk, and the situational variables usage goal for which the product is purchased, physical surroundings, social surroundings, and time pressure appear especially relevant. Quality-consciousness is a new concept developed in this work. It is defined as 'A mental predisposition to respond in a consistent way to quality-related aspects, which is organized through learning and influences behavior'.

An empirical investigation into the proposed model of the quality perception process[1]

The proposed model of the quality perception process is tested empirically for two meat products, saveloy and gammon. For each meat product, two usage goals were specified: for saveloy, use on sandwiches and use as snack, for gammon, use on sandwiches and use at dinner. Thus, the empirical investigation into the model of the quality perception process involves four different combinations of products and usage goals. An experimental design was developed to parameterize the relationships between quality cues, quality attributes, and overall perceived quality for each product/usage goal combination separately. Real samples of saveloy and gammon were used instead of verbal descriptions. The products were factorially composed from a set of intrinsic and extrinsic quality cues, using highly fractionated designs, and had been produced by a meat products firm.

From the consumer panel of a large Dutch market research agency 600 subjects were sampled. In each of the four experimental conditions (i.e., saveloy for sandwiches or snack, gammon for sandwiches or at dinner) 120 subjects participated. The remaining 120 subjects participated in an information integration experiment concerning price-perceived quality tradeoffs (see below).

The most important proposition of the model: 'Quality attributes act as intervening variables mediating the effects of quality cues on perceived quality judgments' receives strong support. For most quality cues, indirect effects exceed direct effects. In line with this result, as hypothesized, perceived quality judgments appear to be predominantly based on the quality attributes. Cues add little to the variance explained in perceived quality judgments when the effect of the quality attributes is controlled for. Cues are valued not for their own sake but because they predict quality attributes.

For each product, the results are compared across usage goals to explore the effect of the usage goal for which the product is purchased on the quality perception process. Although some effect of the usage goal on the quality perception process is found, the differences are, in general, modest. It suggests that the quality perception process is not strongly dependent on the usage goal.

A number of other hypotheses concerning specific aspects of the model of the quality perception process and the influence of certain consumer characteristics thereupon are tested.

Experience attributes taken as a whole are more important in the formation of perceived quality judgments than credence attributes, but this need not be true for every pair of experience and credence attributes. Some credence attributes (e.g., attributes related to health issues) are so important to consumers that this overrules the rather large uncertainty inherent in this type of attributes.

Consumers are found to be more able to use quality cues in inference processes with respect to experience attributes than in inference processes with respect to credence attributes. The reason is that credence attributes cannot be ascertained after consumption and that, therefore, the consumer has less opportuni-

[1] For the sake of clarity we shall use the term 'quality attributes' instead of 'quality dimensions' although the empirical study employs quality dimensions, i.e. linear combinations of the quality attributes.

ty to learn/modify beliefs about the inferential relationships between those attributes and quality cues.
The relevance of the predictive value/confidence value/intrinsic-extrinsic framework for explaining cue importance in the formation of perceived quality judgments was explored. The results are not unequivocal. Partial support is found for the hypothesis that the higher the predictive value of a cue, the more important that cue is in the formation of perceived quality judgments. The hypothesis stating that the importance of a cue in the formation of perceived quality judgments is positively influenced by the confidence value of that cue is rejected. It appears that the measures proposed in the literature to estimate cue predictive value and cue confidence value are of questionable validity (see also below). The hypothesis that intrinsic cues are more important than extrinsic cues in the formation of perceived quality judgments is largely supported. In some cases, however, an extrinsic cue will be more important.
No support is found for the hypothesis that the intervening role of quality attributes is greater for consumers having much experience with the product in question than for less experienced consumers. An explanation might be that subjects did not differ enough in experience. This is caused by the sampling procedure adopted. The hypothesis that the intervening role of the quality attributes is greater for quality-conscious consumers than for consumers who are less quality-conscious is supported.
It was hypothesized that consumers experiencing high risk in evaluating the quality of the product alternatives have used fewer cues in the quality perception process than consumers experiencing low quality risk. The hypothesis is weakly supported. This result is probably due to the unreliability of the quality risk measure used. The hypotheses stating that higher-educated consumers use more cues and exhibit more cue interactions than lower-educated consumers are supported for saveloy, but not for gammon.

Implications of the proposed model of the quality perception process
The model of the quality perception process is of theoretical as well as of managerial importance. It also has implications for public policy.
The model gives a deeper insight into the quality perception process. The model allows the researcher to explain cue effects on perceived quality in terms of the intervening role of the quality attributes. Previous studies were not well able to explain the cue effects found. For example, some studies reported a significant effect of packaging on overall perceived quality but failed to explain *why* this effect occurred. With the present approach, we are able to explain the effect of packaging through the intervening role of the quality attributes sensory perception and keepability. In this way it is possible to go beyond the simple cue effects found and to explore the causes of these effects. The distinction between quality cues and quality attributes, and the further distinction between intrinsic and extrinsic cues, and between experience and credence attributes is important because it enhances our understanding of the way quality perceptions are formed. The model also highlights the influence of variables such as quality-consciousness and perceived quality risk on the quality perception process.
The model serves as a frame of reference in which future research could be integrated. In this way the results of a particular study are more easily general-

ized to other products and situations. The model has considerable heuristic potential because it is based upon theories and concepts from the literature and integrates these theoretical elements. Numerous hypotheses can be developed on the basis of the model. Many hypotheses are proposed and some are tested in the present study.

This distinction between quality cues and quality attributes is also relevant to the marketing manager. It is instrumental in closing the quality perception gap between the company/marketing manager's perspective and the consumer's view on quality. Further, it assists the marketing manager in developing a marketing strategy based on quality. The model can be used to investigate which quality cues predict which benefits or attributes to consumers. Advertising could concentrate on those cues on which the brand rates favorably *and* that predict important quality attributes. The message content should be developed in terms of the favorable cue(s) and the attribute(s) they predict. An empirical investigation based on this model can also provide information that is relevant to product development. The results of such a study can be used to identify the quality cues that are prime candidates for modification to enhance the quality image of the brand. It is also possible to identify those quality cues that are not used by consumers, and hence can be modified to reduce costs. Further, the results need not only be used as input for product and communication strategies. The importance of the place of purchase as quality cue in the formation of quality perceptions can be quantified and the results can be used for developing a distribution strategy. It assists the marketing manager in developing a pricing strategy, especially when information is also obtained about price-perceived quality tradeoffs in consumer choices.

The potential of the model is illustrated by the results obtained in our empirical study.[2] Let us consider the possibilities for a firm that produces ovate gammon of a variegated pink and red color with little gloss. Shape is the most important quality cue for sensory perception. Ovate gammon rates much higher on sensory perception than rectangular gammon. The color of the gammon is an important quality cue for perceived fatness. Variegated pink and red gammon rates considerably higher on fatness than pink gammon. Gloss has no sigificant effect on any of the quality attributes. Given these results the firm, in view of the quality of its product, should stress the shape of its gammon. In advertisements, the ovate shape should be linked to superior sensory characteristics. Since sensory perception plays a prominent role in perceived quality judgments, such an advertising campaign will enhance the quality image of the product.

The quality image can be further enhanced by product modification. Variegated pink and red gammon is perceived to be fatter than pink gammon and rates lower on sensory perception as well. Since perceived fatness has a negative effect on perceived quality, it might be advantageous to modify this cue. Ovate gammon of a pink color has a better quality image. Such a product modification should be communicated to consumers.

Possibilities for cost reduction also exist. The quality cue gloss is hardly used by

[2] The recommendations are based on the empirical results for gammon obtained by pooling the data across the usage goals 'sandwiches' and 'dinner'. This enables us to provide a concise picture.

consumers in the quality perception process. The extent of gloss is positively related to the percentage of brine in gammon. Brine is inversely related to costs since more brine means less meat per unit of weight. The firm could save costs by using more brine in its gammon. This recommendation is supported by the results of a sensory experiment. About 50% of the subjects prefer gammon with a relatively large percentage of brine (30%) because of its hearty taste.
The results of the empirical study show that the place of purchase is of limited importance in the quality perception process for gammon. The butcher's shop rates only slightly higher than the supermarket. This implies that the firm can sell its gammon through both types of outlets without serious loss of quality image. Such a broad distribution will have a positive effect on sales.
As might be expected, a high price contributes to the quality image of gammon. In addition, research on the relative importance of perceived quality vis-à-vis price in consumer decision-making indicates that quality is considerably more important than price (see below). This suggests that the firm can sell its (modified) gammon at a high price (more specifically, in our study, at about Dfl. 2.70 per 100 grams).
This example illustrates the potential of the proposed model of the quality perception process to provide marketing managers with concrete recommendations about which marketing actions could be taken. The model also draws attention to the influence of consumer characteristics on the quality perception process. Variables such as level of education and quality-consciousness (these were found to influence the quality perception process; see above) can be used for market segmentation. Currently, quality-consciousness is being used together with other variables to segment the market for meat.
The model also has implications for public policy. Credence attribute perceptions are more uncertain than experience attribute perceptions. Further, it was found that people have relatively much difficulty in inferring credence attribute perceptions. Thus, consumers have difficulties in forming 'complete' quality judgments, i.e., judgments based on both short-term and long-term benefits. This situation is undesirable from a public policy point of view. Ideally, it could be remedied by making available cues that provide direct information about the credence attributes. An example is nutritional information. A problem with this kind of cues is that they frequently have little impact on the quality perception process because they are often pallid and ill-understood, or perceived to be untrustworthy in case the information is provided by the manufacturer. Another possibility is to impose minimum quality standards with respect to credence attributes for some products. The question emerges for which products minimum quality standards would be socially desirable. Economic theory (Leland 1979) suggests that minimum quality standards increase social welfare for products exibiting high demand sensitivity to quality variation, low price elasticity of demand, low marginal cost of providing quality, and/or a low willingness to pay for low-quality brands.

Price-perceived quality tradeoffs

In a study about product quality, it is in place to give some attention to the importance of quality in consumer decision-making. Information about the importance of perceived quality in the formation of purchase intentions or

choice is relevant to marketing managers since it assists them in developing a marketing strategy. Is a high-quality strategy more profitable or is it advantageous to offer a low-quality/low-priced brand?
In this study, the attention is limited to the tradeoff between perceived quality and price. Two investigations were carried out employing different methodologies to explore the way consumers trade off perceived quality against price and to quantify the relative importance of perceived quality vis-à-vis price. The dependent variable in both studies is purchase intention. The first study investigates price-perceived quality tradeoffs for saveloy and gammon, using the correlational approach. The second study explores price-perceived quality tradeoffs for gammon using the information integration approach.
It was found that price and perceived quality are integrated in an additive way in the formation of purchase intentions. As might be expected, perceived quality has a positive effect on purchase intention and price has a negative effect. Perceived quality is considerably more important than price. This finding supports the importance of perceived quality as a decision variable in consumer behavior. A disproportionately large increase in purchase intention is found when quality increases from below average to above average. This suggests that it might be particularly profitable to a firm to market a product of above-average quality. This finding supports the drive for quality that can be observed in many markets.
The influence of five possible determinants of the relative importance of perceived quality vis-à-vis price were investigated: budget of the household, quality-consciousness, perceived quality risk, the product in question (gammon or saveloy), and the usage goal for which the product is purchased. Quality-consciousness is the only variable with a significant effect on the relative importance of perceived quality. Subjects who are more quality-conscious attach more importance to perceived quality than subjects who are less quality-conscious. The budget of the household has an indirect effect on the relative importance of perceived quality. Subjects with a larger budget are more quality-conscious, and hence attach more importance to quality.

The relationship between price and quality in the marketplace
The economic approach to quality assumes that price and quality are strongly correlated, and research in the perceived quality approach has shown that consumers frequently use price as quality cue. Thus, it seems appropriate to devote some attention to the veridicality of price as market signal of quality. Are price and quality strongly correlated as suggested by economic theory, and can consumers hence use price as quality cue? To obtain insight into this normative issue we need a measure of objective quality, i.e., quality as measured by standardized techniques and experts. Such a measure is provided by the product test data published by consumer magazines. The data set consisted of 413 product tests involving 6580 brands published in the Dutch consumer magazine *Consumentengids* over the ten year period 1977-1986.
It is found that for 81.4% of the products price and objective quality are positively correlated. The relationship however is in general rather weak. Mean Spearman's rho between price and quality is only .29 (median .32).
Price-quality correlations vary over time. Correlations are lower when the

inflation rate is rather high. Further, correlations are higher for durable products than for nondurables. The correlation between price and quality in a product test is positively related to the degree of price variation between the brands for that product. The hypothesized curvilinear relationship between the number of available brands and the strength of the price-quality relationships is not found.

In sum, price is a poor market signal of quality for most products. Although consumers' evaluations of product quality might differ from objective quality, even if consumers would be perfectly informed, due to differences in importance attached to the quality attributes etc., these findings indicate that it will often be a suboptimal strategy to evaluate quality on the basis of price.

Suggestions for future research

This work is concluded with some suggestions for future research in the area of perceived quality.

To obtain more knowledge of the quality perception process, we should move from exploratory studies, whose generalizability is limited, to testing of explicitly formulated hypotheses. In this work, a number of such hypotheses are proposed, and others could be developed. It is important that hypotheses are tested within the context of an explicitly formulated model of the quality perception process, such as the one proposed in this work, so that research findings from different studies can be more easily integrated.

In our empirical study, all subjects were presented the same list of quality attributes. It is implicitly assumed that all these attributes are relevant to the quality perception of each individual, that the set of attributes is exhaustive for each person (i.e., each person only uses these attributes), and that all subjects attach the same meaning to a particular attribute.

The first assumption can be relaxed by allowing the subject to chose from a list of attributes the attributes that are relevant to him/her. Subsequently, s/he rates the product alternatives only on these attributes. Computer interactive techniques such as Adaptive Perceptual Mapping (*Sawtooth* 1987) can be very helpful in data collection and analysis.

One can even go further by relaxing all three assumptions. In that case the subject formulates his/her own attributes and rates the product alternatives on these attributes only. Generalized Procrustes analysis (Gower 1975) can be used to construct a common perceptual space on the basis of the completely individualized data. Individual differences are retained in this technique. This procedure has been employed successfully by Steenkamp and Van Trijp (1988b).

Another issue for future research is the development of better measures for cue predictive value and cue confidence value. Previous research as well as the present study have, for the most part, yielded disappointing results with respect to the ability of these concepts to explain cue importance in the quality perception process. It appears that the questions concerning cue predictive value and cue confidence value are ill-understood by subjects. A possible solution might be to let subjects rate the predictive value and the confidence value of each cue level employed in the study separately. The difference between the highest and the lowest predictive value/confidence value rating could be used as a measure

of the predictive value/confidence value of that cue. Such a procedure makes these concepts more vivid for the subject. Research on this issue is urgently needed, given the theoretical potential of cue predictive value and cue confidence value in understanding the quality perception process.

In this study two measures of perceived quality risk are used, quality risk measured by a modified version of Cunningham's model and quality risk measured by Bettman's model. These are the two most influential models of risk in the marketing literature. It is found that the reliability of both models was unacceptably low. The quality risk ratings as computed on the basis of each of the models are weakly correlated. It is important to investigate whether this is a coincidence or that new or modified models of quality risk must be developed.

Future research could also expand on the role perceived quality plays in consumer decision-making. The effect of other variables, along with price and perceived quality, in the formation of purchase intention and choice might be explored. An issue especially interesting for consumer research is the relationship between perceived quality and attitude.

Another research issue is 'quality guidance', i.e., the integration of the perceived quality approach and the production management approach. Companies are increasingly making adjustments in the physical product and marketing strategies to improve the quality image of the product. A key issue is the selection of the appropriate physical product characteristics. For which physical product characteristics is the consumers' tolerance for deviations from the optimal level the lowest and which ones should be modified to enhance consumers' perceptions of quality? This requires insight into the linkage of physical product characteristics to quality perceptions. Only when the company has knowledge about these relationships it is able to select the appropriate features. Otherwise, it might modify features that have no linkage to quality perceptions and hence will incur costs without obtaining the desired improvement in the quality image. We believe that in the future quality guidance will become an important issue in marketing.

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SUBJECT INDEX

SAMENVATTING

Kwaliteit is zowel voor producenten als voor consumenten belangrijk produktaspect. Veel ondernemingen concurreren op kwaliteit in plaats van op prijs. Empirische studies hebben uitgewezen dat kwaliteit vaak een positief effect heeft op het marktaandeel en de winstgevendheid. Voor consumenten is de kwaliteit van de produktalternatieven een zeer belangrijke factor in het keuzegedrag.
Het doel van deze dissertatie is drieledig. Ten eerste, het bespreken van de literatuur over kwaliteit vanuit verschillende gezichtshoeken (hoofdstukken 2 t/m 4). Ten tweede, het ontwikkelen van een model dat de wijze waarop consumenten zich een oordeel vormen over de kwaliteit van produkten beschrijft (hoofdstuk 5). Ten derde, het empirisch toetsen van dit model (hoofdstukken 6 t/m 9). Verder komen twee aspecten die nauw gerelateerd zijn aan produktkwaliteit aan de orde, te weten de afweging die consumenten maken tussen prijs en gepercipieerde kwaliteit bij de keuze van produkten (hoofdstukken 10 en 11) en de relatie tussen prijs en objectieve kwaliteit (hoofdstuk 12).

Vier benaderingen met betrekking tot het concept 'produktkwaliteit' zijn besproken: de metafysische benadering (hoofdstuk 2), de produktie management benadering (hoofdstuk 2), de economische benadering (hoofdstuk 3) en de kwaliteitsperceptie benadering (hoofdstuk 4). Laatstgenoemde twee benaderingen zijn het meest relevant voor deze studie.
De *metafysische* benadering houdt zich bezig met het wezen van kwaliteit. In deze benadering wordt kwaliteit vaak gezien als innerlijke excellentie van een produkt en is in wezen niet analyseerbaar. Personen kunnen slechts door ervaring leren om kwaliteit te herkennen. Mensen verschillen in hun kwaliteitsoordeel, niet omdat kwaliteit persoonsafhankelijk is maar omdat ze verschillen in ervaring.
De *produktie management* benadering beschouwt kwaliteit als een objectief meetbare grootheid. De kwaliteit van een produkt is de mate waaraan dit produkt voldoet aan zijn technische specificaties. Deze benadering houdt zich bezig met het produceren van een produkt van een 'a priori' vastgesteld kwaliteitsniveau. De belangrijkste recente ontwikkeling in de produktie management benadering is de filosofie dat 'quality is free': het streven naar een steeds lager uitvalpercentage hoeft niet gepaard te gaan met hogere kosten. Deze filosofie, ook wel de 'Japanse filosofie' genoemd, heeft een revolutionaire invloed op het denken over kwaliteit binnen ondernemingen.
In de *economische* benadering wordt de rol van kwaliteit in het economische

verkeer bestudeerd. Belangrijke aandachtsvelden zijn de rol die kwaliteit speelt in de concurrentie tussen ondernemingen, de hedonistische benadering en de rol van kwaliteit in het consumentengedrag, zowel als de consument perfect geïnformeerd is over de markt als wanneer hij/zij imperfect geïnformeerd is. Opmerkelijk is dat de verschillende aandachtsvelden zich vrij onafhankelijk van elkaar ontwikkelen. Uitzonderingen zijn de grote invloed van Lancaster's concept van een produkt als een bundel karakteristieken en de toenemende aandacht binnen de verschillende aandachtsvelden van de economische theorie voor het feit dat consumenten imperfect geïnformeerd zijn.
Een overeenkomst tussen de produktie management benadering en de economische benadering is dat beide kwaliteit beschouwen als een variabele die objectief meetbaar is. Een overeenkomst tussen bovengenoemde drie benaderingen is dat kwaliteit een objectieve grootheid is, inherent aan een bepaald produkt.
De *kwaliteitsperceptie* benadering daarentegen beschouwt kwaliteit noch als een absolute noch als een objectieve grootheid. In deze benadering is kwaliteit een subjectief concept, afhankelijk van de percepties, motieven en doeleinden van de consument in kwestie. Een van de uitgangspunten is dat de consument onvolledig geïnformeerd is over de kwaliteit van de produktalternatieven. Consumenten gebruiken indicatoren om zich een beeld te vormen over de kwaliteit. Aangezien deze indicatoren doorgaans geen volledig beeld geven van de kwaliteit zullen consumenten kwaliteitsrisico ervaren. De kwaliteitsperceptie benadering gaat er vanuit dat het kwaliteitsperceptieproces beïnvloed wordt persoonlijke en situationele factoren. Over de rol van deze factoren is echter weinig bekend. Het is opmerkelijk dat binnen de kwaliteitsperceptie benadering weinig modellen zijn ontwikkeld over de wijze waarop consumenten zich een oordeel vormen over de kwaliteit.
Een ontwikkeling binnen het consumentengedragsonderzoek die relevant is voor de kwaliteitsperceptie benadering is de toenemende aandacht voor 'kleinere' modellen die empirisch toetsbaar zijn. Deze modellen zijn een alternatief voor de integrale modellen die meer een kapstok-functie hebben.
Er kan niet worden gesteld dat de ene benadering van produktkwaliteit 'beter' is dan enige andere. Alle vier benaderingen zijn waardevol. De bruikbaarheid van een bepaalde benadering is afhankelijk van de onderzoeksvraag in kwestie. De produktie management benadering is bijvoorbeeld het meest geschikt om een bepaald kwaliteitsniveau aan afnemers te garanderen.
De vier benaderingen met betrekking tot produktkwaliteit hebben zich vrijwel onafhankelijk van elkaar ontwikkeld. Dit betekent echter niet dat er geen relaties tussen de verschillende benaderingen kunnen worden gelegd. De resultaten van een onderzoek waarin de kwaliteitsperceptie benadering is gebruikt, kunnen gebruikt worden om de technische produktspecificaties te ontwikkelen ten behoeve van de produktie management benadering. De economische, produktie management en kwaliteitsperceptie benaderingen kunnen tezamen worden gebruikt om het kwaliteitsniveau te kiezen dat de onderneming de hoogste winst of het grootste marktaandeel oplevert.

In de dissertatie is de aandacht met name gericht op de kwaliteitsperceptie benadering. In hoofdstuk 5 is een model van het kwaliteitsperceptie proces

ontwikkeld dat concepten uit de informatieverwerkingstheorie, sociale en cognitieve psychologie en economie integreert. Het model is gebaseerd op een definitie van kwaliteit die door de auteur is ontwikkeld binnen de context van het concept 'waarde'. De belangrijkste aspecten van deze definitie zijn dat gepercipieerde kwaliteit (1) een waarde oordeel is over de geschiktheid voor consumptie, d.w.z. gebruik, bezit of appreciatie, van een produkt, (2) een subject-object interactie betreft en (3) relatief is in de zin dat gepercipieerde kwaliteit een comparatief, persoonlijk en situationeel oordeel is.
In het model is een onderscheid gemaakt tussen *kwaliteitsindicatoren* en *kwaliteitsattributen*. Kwaliteitsindicatoren kunnen worden waargenomen met de zintuigen *voor* de consumptie van het produkt. Kwaliteitsattributen zijn nutgenererende produktaspecten en kunnen voor consumptie niet worden waargenomen. Het kwaliteitsoordeel is gebaseerd op de perceptie van de kwaliteitsattributen. Kwaliteitsindicatoren zijn van belang omdat ze naar de mening van de consument inzicht geven in de score van een produkt op de kwaliteitsattributen. Een consument gebruikt bij de aankoop van een produkt kwaliteitsindicatoren, aangezien directe informatie met betrekking tot de kwaliteitsattributen doorgaans niet beschikbaar is.
De kwaliteitsindicatoren kunnen worden onderverdeeld in *intrinsieke* en *extrinsieke* indicatoren. Intrinsieke indicatoren zijn een onderdeel van het fysieke produkt. Extrinsieke indicatoren zijn naar de mening van de consument gerelateerd aan het produkt, maar zijn geen onderdeel van het fysieke produkt. Verder is een onderscheid gemaakt tussen *experience* attributen en *credence* attributen. Experience attributen zijn waarneembaar na consumptie van het produkt (e.g. benzine verbruik). Credence attributen kunnen zelfs na consumptie van het produkt niet worden waargenomen (e.g. duurzaamheid). Deze attributen zullen zich doorgaans pas na lange tijd openbaren.
Het belangrijkste psychologische proces met betrekking tot het gebruik van kwaliteitsindicatoren in de vorming van percepties op de experience- en credence attributen is het proces van *inferentiële perceptievorming* ('inferential belief information'). Consumenten leiden de attribuutpercepties af op basis van de indicatoren die ze gebruiken. Er is gehypothetiseerd dat de grootte van het effect van een bepaalde indicator in het proces van inferentiële perceptievorming (1) positief beïnvloed wordt door de sterkte van de gepercipieerde relatie tussen deze indicator en het betreffende kwaliteitsattribuut; dit wordt de *voorspellende waarde* van een indicator met betrekking tot een attribuut genoemd, (2) positief beïnvloed wordt door de mate waarin de consument vertrouwen heeft in zijn/haar bekwaamheid om de betreffende indicator te begrijpen; dit wordt de *vertrouwenswaarde* van een indicator genoemd en (3) groter is voor intrinsieke indicatoren dan voor extrinsieke indicatoren. De vertrouwenswaarde van een indicator en of de indicator intrinsiek of extrinsiek is, is onafhankelijk van het attribuut in kwestie.
Persoonlijke en situationele factoren beïnvloeden het kwaliteitsperceptie proces. De persoonlijke variabelen 'ervaring met de produktcategorie', 'opleidingsniveau', 'kwaliteitsoriëntatie' en 'gepercipieerd kwaliteitsrisico' en de situationele variabelen 'gebruiksdoel waarvoor het produkt wordt gekocht', 'fysieke omgeving waarbinnen de aankoop plaatsvindt', 'sociale omgeving waarbinnen het produkt wordt geconsumeerd' en 'tijdsdruk bij de aankoop'

lijken met name relevant. *Kwaliteitsoriëntatie* is een 'nieuw' concept dat is ontwikkeld in deze studie. Het is gedefinieerd als een mentale predispositie om op een consistente manier te reageren op aspecten gerelateerd aan produktkwaliteit welke is aangeleerd en het gedrag beïnvloedt.

Het model van het kwaliteitsperceptie proces is empirisch getoetst voor twee vleeswarensoorten, cervelaatworst en achterham (hoofdstukken 6 t/m 9). Voor iedere vleeswarensoort werden twee gebruiksdoelen gespecificeerd. Voor cervelaatworst waren de gebruiksdoelen 'gebruik op de boterham' en 'gebruik als snack/tussendoortje' en voor achterham 'gebruik op de boterham' en 'gebruik in of bij de warme maaltijd'. Het model is apart getoetst voor deze vier verschillende combinaties van vleeswaren en gebruiksdoelen. Een experimentele opzet werd ontworpen om de relaties tussen kwaliteitsindicatoren, kwaliteitsattributen en overall gepercipieerde kwaliteit te kwantificeren (hoofdstuk 6). In de empirische studie werden echte produkten gebruikt in plaats van verbale produktomschrijvingen. De produkten werden factorieel samengesteld uit een set van intrinsieke en extrinsieke kwaliteitsindicatoren en werden speciaal gemaakt door een grote vleeswarenonderneming. Een steekproef van 600 respondenten werd getrokken uit het consumentenpanel van een Nederlands marktonderzoekbureau. In ieder van de vier experimentele condities (d.w.z. cervelaatworst op de boterham of als snack/tussendoortje en achterham op de boterham of in/bij de warme maaltijd) participeerden 120 respondenten. De overige 120 respondenten namen deel aan een informatie-integratie experiment met betrekking tot de afweging tussen prijs en gepercipieerde kwaliteit (zie hieronder). In de hoofdstukken 7 en 8 zijn de resultaten van de modeltoetsing weergegeven.
De belangrijkste hypothese van het model, te weten dat kwaliteitsattributen optreden als interveniërende variabelen tussen de kwaliteitsindicatoren en overall gepercipieerde kwaliteit krijgt duidelijke empirische ondersteuning. Voor de meeste kwaliteitsindicatoren zijn de indirecte effecten op overall gepercipieerde kwaliteit (d.w.z. de effecten via de kwaliteitsattributen) groter dan het directe effect. In overeenstemming met dit resultaat is gevonden dat de overall kwaliteitsperceptie voornamelijk gebaseerd is op de percepties op de kwaliteitsattributen. De kwaliteitsindicatoren dragen weinig bij tot het verklaren van de overall kwaliteitsperceptie indien de kwaliteitsattributen in de analyses zijn opgenomen. *Kwaliteitsindicatoren ontlenen hun waarde dus aan het feit dat ze naar de mening van consumenten kunnen worden gebruikt bij de vorming van de percepties op de kwaliteitsattributen.*
Het effect van het gebruiksdoel waarvoor de vleeswarensoort wordt gekocht op het kwaliteitsperceptie proces is gering.
Een aantal andere hypothesen met betrekking tot specifieke aspecten van het kwaliteitsperceptie proces zijn eveneens getoetst (hoofdstuk 9).
De hypothese dat experience attributen belangrijker zijn in de vorming van overall kwaliteitsoordelen dan credence attributen is in algemene zin ondersteund. Een uitzondering is gevonden wanneer het credence attribuut gerelateerd is aan zeer centrale waarden van de respondent (i.c. gezondheid).
Conform de hypothese is gevonden dat de respondenten beter in staat zijn om kwaliteitsindicatoren te gebruiken in inferentiële perceptievorming met be-

trekking tot experience attributen dan met betrekking tot credence attributen. De hypothese dat het belang van een indicator in het kwaliteitsperceptie proces positief wordt beïnvloed door de voorspellende waarde van de indicator is ondersteund voor cervelaatworst en verworpen voor achterham. Een soortgelijke hypothese voor de vertrouwenswaarde van de indicator is voor beide produkten verworpen. De hypothese dat intrinsieke indicatoren belangrijker zijn in het kwaliteitsperceptie proces dan extrinsieke indicatoren is in zijn algemeenheid aangenomen. Enkele uitzonderingen zijn echter gevonden.
De hypothese dat de interveniërende rol van de kwaliteitsattributen in het kwaliteitsperceptie proces groter is voor ervaren consumenten dan voor minder ervaren consumenten is verworpen. Een soortgelijke hypothese voor kwaliteitsoriëntatie is ondersteund. De interveniërende rol van kwaliteitsattributen is groter voor meer kwaliteitsgeoriënteerde personen dan voor minder kwaliteitsgeoriënteerden.
De hypothese dat consumenten die veel kwaliteitsrisico ervaren in het beoordelen van produktalternatieven minder indicatoren gebruiken in het kwaliteitsperceptie proces dan consumenten die weinig kwaliteitsrisico ervaren is slechts in zeer beperkte mate ondersteund. De hypothesen dat hoger opgeleide consumenten meer kwaliteitsindicatoren gebruiken en meer interacties tussen de indicatoren vertonen dan lager opgeleiden is ondersteund voor cervelaatworst, maar verworpen voor achterham.
De implicaties van het model van het kwaliteitsperceptie proces en van de resultaten van de empirische toetsing voor de theorie van de kwaliteitsperceptie benadering, voor het marketing beleid en voor het overheidsbeleid zijn aan de orde gekomen.

Voor het ontwikkelen van een op kwaliteit gebaseerde strategie is het voor ondernemingen relevant om inzicht te hebben in het relatieve belang van de gepercipieerde kwaliteit ten opzichte van de prijs in het keuzegedrag van consumenten. Twee empirische studies zijn uitgevoerd, waarin verschillende onderzoeksmethoden zijn gebruikt. Het doel van deze studies was om het proces van afweging tussen prijs en gepercipieerde kwaliteit te onderzoeken en het relatieve belang van de beide aankoopcriteria te kwantificeren. In beide studies was koopintentie de afhankelijke variabele. De eerste studie onderzocht de afweging tussen prijs en gepercipieerde kwaliteit voor cervelaatworst en achterham met behulp van de correlatiemethode (hoofdstuk 10). In de tweede studie is de afweging tussen prijs en gepercipieerde kwaliteit voor achterham onderzocht met behulp van de informatie-integratie methode (hoofdstuk 11).
In beide studies is gevonden dat prijs en gepercipieerde kwaliteit op een *additieve* manier worden geïntegreerd. Zoals verwacht heeft gepercipieerde kwaliteit een positief effect en prijs een negatief effect op de koopintentie. Naarmate de gepercipieerde kwaliteit beter is, des te hoger de koopintentie en hoe hoger de prijs, des te lager de koopintentie. Het effect van de gepercipieerde kwaliteit is beduidend groter dan het effect van de prijs. Dit resultaat is in overeenstemming met het hierboven reeds genoemde grote belang van gepercipieerde kwaliteit als aankoopcriterium voor consumenten. De toename in koopintentie is met name erg groot als gepercipieerde kwaliteit toenam van

slechter dan gemiddeld naar beter dan gemiddeld. Dit suggereert dat het aantrekkelijk is voor ondernemingen om een produkt van beter dan gemiddelde kwaliteit aan te bieden. Deze bevinding ondersteunt het recente streven van veel ondernemingen om de kwaliteit van hun produkten te verbeteren.
De invloed van vijf potentiële determinanten van het relatieve belang van gepercipieerde kwaliteit ten opzichte van de prijs is onderzocht. Deze determinanten waren het financiële budget van het huishouden, de kwaliteitsoriëntatie van de respondent, het gepercipieerd kwaliteitsrisico, het produkt in kwestie (in dit geval cervelaatworst of achterham) en het gebruiksdoel waarvoor het produkt is gekocht. Kwaliteitsoriëntatie is de enige variabele die een significant effect heeft op het relatieve belang van gepercipieerde kwaliteit ten opzichte van de prijs. Kwaliteitsgeoriënteerde respondenten hechten meer belang aan gepercipieerde kwaliteit dan minder kwaliteitsgeoriënteerde personen. Het financiële budget heeft een indirect effect op het relatieve belang van gepercipieerde kwaliteit. Personen met een groter financieel budget zijn over het algemeen meer kwaliteitsgeoriënteerd en hechten daarom meer belang aan de gepercipieerde kwaliteit van de produktalternatieven bij het vormen van koopintenties.

De economische benadering van kwaliteit gaat er vanuit dat prijs en objectieve kwaliteit sterk gecorreleerd zijn; een kwalitatief beter produkt is duurder dan een kwalitatief slechter produkt. Verder is in onderzoek met betrekking tot de kwaliteitsperceptie benadering gevonden dat ook veel consumenten veronderstellen dat deze relatie bestaat aangezien prijs vaak als kwaliteitsindicator wordt gebruikt. Vanuit dit perspectief is het dan ook relevant om aandacht te besteden aan de vraag of consumenten er 'verstandig' aan doen om de prijs te hanteren als kwaliteitsindex. Met andere woorden, hoe sterk is de relatie tussen prijs en objectieve kwaliteit? Deze vraag kan alleen beantwoord worden wanneer we de beschikking hebben over een maatstaf voor de objectieve kwaliteit. Een dergelijke maatstaf wordt geleverd door het vergelijkend warenonderzoek dat gepubliceerd wordt in de Consumentengids. Data zijn verzameld voor 413 vergelijkende warenonderzoekers die gepubliceerd zijn in de Consumentengids in de periode 1977-1986. De dataset omvatte 6580 merken (hoofdstuk 12). Voor 81,4% van de produkt tests is een positieve correlatie tussen prijs en objectieve kwaliteit gevonden. *Over het algemeen is de relatie tussen prijs en objectieve kwaliteit echter zwak.* De gemiddelde waarde voor Spearman's rangcorrelatiecoëfficiënt tussen prijs en objectieve kwaliteit is 0.29. De mediaan is 0.32.
De correlatiecoëfficient tussen prijs en objectieve kwaliteit varieert over de jaren. Gemiddeld genomen is de correlatie lager in jaren met een relatief hoge inflatie. Verder is de correlatie over het algemeen hoger voor duurzame consumptiegoederen dan voor niet-duurzame consumptiegoederen. De hoogte van de correlatiecoëfficiënt is positief gerelateerd aan de mate van variatie in de prijzen van de merken voor een bepaald produkt. Naarmate de prijsvariatie groter is, is de correlatie tussen prijs en objectieve kwaliteit hoger. Het gehypothetiseerde parabolische verband tussen het aantal merken in een produkt test en de hoogte van de correlatie tussen prijs en objectieve kwaliteit is niet gevonden.

Er kan dus geconcludeerd worden dat voor de meeste produkten prijs en objectieve kwaliteit niet sterk met elkaar samenhangen. Hoewel het consumentenoordeel over de kwaliteit kan afwijken van objectieve kwaliteit wijzen de resultaten van dit onderzoek erop dat het beoordelen van de kwaliteit op basis van de prijs in veel gevallen een suboptimale strategie is. De wijsheid van het gezegde 'goedkoop is duurkoop' wordt niet bevestigd door deze empirische resultaten.

CURRICULUM VITAE

Johannes Evangelista Benedictus Maria Steenkamp werd geboren op 12 juni 1959 te Amsterdam. In 1977 behaalde hij het diploma Atheneum-B aan het Eckart College te Eindhoven. In datzelfde jaar begon hij met de studie Economie aan de Landbouwuniversiteit (toendertijd: Landbouwhogeschool). De studie Economie werd in september 1983 afgerond (met lof) met als afstudeervakken de Marktkunde en het Marktonderzoek en de Industriële Bedrijfskunde. Vanaf september 1983 is hij als universitair docent verbonden aan de vakgroep Marktkunde en Marktonderzoek van de Landbouwuniversiteit. Naast produktkwaliteit liggen zijn onderzoeksinteresses met name op quality guidance, produktpositionering, informatieverwerking en multivariate technieken in het marktonderzoek.