Simone Dobbelsteen

Intrahousehold Allocation of Resources; a Microeconometric Analysis

STELLINGEN

behorend bij het proefschrift van Simone Dobbelsteen
Intrahousehold Allocation of Resources; a Microeconometric Analysis

1.
Verschillende voedselcategorieën worden in geval van een hoog voedselbudget als noodzakelijke of inferieure goederen beschouwd, en bij een lager voedselbudget als luxe goederen. Een dergelijk patroon kan niet worden gevonden bij gebruik van de traditionele Working-Leser Engelcurves.
(dit proefschrift)

2.
Door de wens van veel Nederlandse ouders voor zowel een zoon als een dochter (de zogeheten 'rijkeluiswens'), zal de mogelijkheid van geslachtskeuze bij het krijgen van kinderen noch de sekse-ratio bij de geboorte verstoren, noch de bevolkingsomvang doen afnemen.
(dit proefschrift)

3.
Bij de organisatie van financiën binnen huishoudens in het Verenigd Koninkrijk lijkt het verwerven van invloed op het bestedingspatroon een grotere rol te spelen dan overwegingen met betrekking tot een efficiënte verdeling van taken.
(dit proefschrift)

4.
Akerlof's conclusie in 'The market for lemons' dat er geen handel plaatsvindt op markten met asymmetrische informatie is afhankelijk van de veronderstellingen van zijn model. Indien er voldoende grote verschillen bestaan tussen nutsfunkties van potentiële kopers en verkopers is wel degelijk handel mogelijk.

G. Akerlof (1970), 'The market for lemons: quality, uncertainty, and the market mechanism.' *Quarterly Journal of Economics*, 84: 488-500.

5.
Voor de betrouwbaarheid van de overheid is het wenselijk dat zij zoveel mogelijk het door haar aangekondigde beleid uitvoert, ook al is dat op korte termijn niet altijd optimaal.

S. Fischer (1980), 'Dynamic inconsistency, cooperation and the benevolent dissembling government.' *Journal of Economic Dynamics and Control*, 2: 93-107.

6.
Bij veel huishoudleden blijkt een verschil te bestaan tussen het gewenste aantal arbeidsuren en het werkelijk aantal arbeidsuren. In een bepaalde tak van de economische literatuur wordt dit verschil toegeschreven aan marktrestricties, in een andere tak aan verschillende preferenties van partners in een huishouden. De waarheid ligt waarschijnlijk in het midden.

W.T. Dickens en S.J. Lundberg (1993), 'Hours restrictions and labor supply.' *International Economic Review*, 34(1): 169-192.
P. Kooreman en A. Kapteyn (1990), 'On the empirical implementation of some game theoretic models of household labor supply.' *Journal of Human Resources*, 25(4): 585-598.

7.
In het licht van het toegenomen aantal tweeverdieners kan de term 'kostwinnaar' aan de Nederlandse woordenschat worden toegevoegd.

8.
De voordelen van werken op projectbasis worden met name verkondigd door personen met een vast contract.

9.
Don't mind your make-up, you'd better make your mind up.
(F. Zappa)

Simone Dobbelsteen

INTRAHOUSEHOLD ALLOCATION OF RESOURCES; A MICROECONOMETRIC ANALYSIS

Promotor: dr. P. Kooreman
voormalig hoogleraar in de
Economie van het Huishouden

Simone Dobbelsteen

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Contents

Acknowledgements

Four and a half years ago I started my research into the intrahousehold allocation of resources. It is difficult to recall afterwards what my exact starting position was, but when I think of all the courses I have followed since, the meetings I have attended, the discussions I have participated in, and the papers I have read and written, I have to conclude that I must have been very ignorant then. My only baggage for the journey into science I was about to start was my completed study in econometrics, my working experience as a research assistant at the University of Tilburg and at the Central Planning Bureau, and a thesis proposal written by Peter Kooreman. By all means I remember that I started with a lot of questions, a full measure of enthusiasm and the firm intention to contribute to the improvement of science.

After more than four years I must conclude that the number of questions has increased more than the answers I could provide, and that I have benefitted much more from science than science from me. Still, I very much enjoyed contributing my own modest share to the field of the economics of the household, and I consider my doctoral research as a very valuable experience. This thesis can be seen as a record of my learning process during the past four years.

Many people have contributed to this thesis and I would like to thank them here.

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In spite of the variety of households I investigated in the past years, the one of my parents is still by far the most special to me. My explicit thanks go to them for their unconditional love and support. I proudly dedicate this thesis to both of them, and I am very grateful that we can celebrate the completion of it together. Special thanks also go to my sisters and my friends who were always of great help by just being there.

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Simone Dobbelsteen
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1 Introduction

1.1 Why study intrahousehold allocation of resources?

For a long time microeconomic theory has considered the *household* as synonymous with the *individual*. In models of household behaviour the family was treated as a homogeneous unit, and no attention was paid to the division of household resources between members. However, over the past decades a growing body of literature has begun to question whether resources within households are distributed equally over various members.

Research into the intrahousehold allocation of resources concerns the question of how commodities are allocated between different members of the same household. Various studies have demonstrated the weakness of the assumption of an equal intrahousehold distribution, presenting evidence on intrahousehold, sex- and age-biased differences in food consumption, undernutrition, and mortality, and in the distribution of resources such as health care, money and time. Most studies in the literature on intrahousehold allocation concentrate on the assessment of intrahousehold inequality in developing countries, and its possible implications for foreign aid programmes. Haddad and Kanbur (1990) show, using calorie adequacy ratios as a measure of individual well-being, that ignoring intrahousehold inequality could lead to errors of about 30 per cent or more in assessing levels of inequality and poverty in the rural Philippines. In most of these countries, the position of women and girls is of particular concern. Using a rural south Indian sample, Behrman and Deolalikar (1990) find that the nutritional burden of rising food prices falls disproportionately on female household members. Senauer, Garcia and Jacinto (1988) conclude that girls in the rural Philippines receive a significantly smaller relative calorie allocation than boys. Their empirical results also show that the relative calorie allocation to children decreases with a rise in their father's wage, in contrast with the significantly positive effect of the mother's wage rate. Another link with income under each parent's control is presented by Thomas (1990), who finds that in Brazil unearned income in hands of the mother has an (about) twenty times bigger effect on child survival probabilities than income attributed to the father.

In literature, two possible explanations for the observed (unequal) resource flows within the household are suggested. Firstly, inequality may result from discrimination, for instance

if parents prefer one child to the other. Thomas (1990) finds some evidence that mothers prefer to devote resources to daughters and fathers to sons. Secondly, inequality may be caused by efficiency considerations. Rosenzweig and Schultz (1982) conclude that the allocation of resources to rural Indian children responds to changes in their expected earnings opportunities as adults. Better economic opportunities for girls increase the share of family resources allocated to them. A similar conclusion, based on data from Bangladesh, is found in Pitt, Rosenzweig and Hassan (1990). However, they suggest that the higher participation of men in energy-intensive activities is responsible for the higher level of calorie consumption by adult men compared to adult women. Consequently, they claim that possible benefits of better labour-force opportunities for women will be tempered by the increased level of energy-intensive activity associated with the greater calorie consumption.

While empirical studies on intrahousehold allocation in *developing countries* mainly concentrate on calorie consumption and survival probabilities of various household members, for *developed nations* evidence of intrahousehold inequality is principally found in the division of labour and economic responsibilities, and in the distribution of income. For instance, Antonides and Hagenaars (1992) use a Dutch dataset to show that the intrafamily distribution of welfare depends on perceived resources of the individual members, particularly working hours, education and personal income of the wife. Charles and Kerr (1987) is one of the few studies that analyze 'who gets what' for a developed country. They find gender and age differences in food consumption in Britain.

The social importance of studying intrahousehold allocation of resources is demonstrated by its policy implications, both in developed and developing countries. For instance, in developed countries, the debate on whether child benefit should be paid to the mother or to the father has basically been about the perceived allocation of intrahousehold resources (e.g. Lundberg and Pollak, 1993). And in developing countries, the discussion about supplementary feeding programs for specific individuals who are at high nutritional risk, such as children and pregnant and lactating women, essentially concentrates on whether or not extra calories at the feeding station means fewer calories received by the individual at home.

While most studies on intrahousehold allocation discuss the measurement of possible intrahousehold inequality and its implications for economic policy, others explicitly focus on methodological issues, such as identification and testing of models of household decision making. In the next section we will discuss the development of microeconomic models of

household behaviour, and more specifically the neoclassical versus the bargaining approach to analyzing household decision making. Furthermore, in section 1.3 the increased data requirements of empirical intrahousehold research are considered, as the specification of more advanced models requires more specific information on households to be gathered.

In this thesis we have chosen to elaborate on various aspects of intrahousehold allocation. We investigate possible boy-girl discrimination in the intrahousehold allocation of food in Peru, we examine parental preferences for the sex of their children in the Netherlands, and we analyze how partners organize and divide household finances in Great Britain. The emphasis in these studies is on the empirical implementation of models of intrahousehold allocation and related issues; various models will be estimated and various types of data will be used. In section 1.4 we briefly discuss the issues addressed in the following chapters of this thesis, and how they relate to the present state of affairs in the modelling of intrahousehold decision making.

1.2 The evolution of models of household behaviour

Most models in microeconomic theory deal with *individual* consumers making decisions on how to allocate their time and money so as to maximize their utility subject to budget constraints. The question of what happens in households with two or more individuals trying to maximize their utility jointly is not easy to answer. Two aspects of intrahousehold decision making deserve attention: 'who decides?', as there may be more than one decision maker, and 'who gets what to consume?' (e.g. Engel, Blackwell and Miniard, 1987).

In the last decades, economists have gradually opened the 'black box' of the household. In the first place, with the development of the 'New Home Economics', intrahousehold production and consumption were analysed. For instance, attention was paid to time allocation patterns of individual household members (Becker, 1965 and 1981; Gronau, 1973 and 1977), human capital investments of individuals in the family (Mincer and Polachek, 1974), theories of marriage using individual utilities (Becker, 1973 and 1974), and the demand for 'quality' and 'quantity' of children in combination with the labour supply of wives (Willis, 1974). Still, in all these studies the household is considered as a unique decision unit: household members' resources are pooled, all commodities, either produced within the household or purchased in the marketplace, are jointly consumed, and a joint household utility function is maximized. This approach is often referred to as the 'neoclassical' model, the 'common preference'

model, or simply the 'household utility function' model.

Samuelson (1956) is one of the first studies that elaborate on the existence of a common household utility function. He specifies the household's utility function as a social welfare function, having the utility functions of all individual members as its arguments. He shows that under certain conditions this social welfare function has the same properties as an individual utility function. Several years later, Becker (1974 and 1981) states that a household can be treated as a single utility maximizing unit if one altruistic individual controls the distribution of resources within the household (a benevolent dictator).

An alternative approach was suggested by Manser and Brown (1980) and by McElroy and Horney (1981). They model intrahousehold allocation of resources within a bargaining framework. The bargaining approach explicitly considers the individual household members and their possibly heterogeneous preferences. Gains to being part of a household exist if individuals can attain higher welfare levels within a household than remaining single. The welfare level that is finally realized by the household depends on the behaviour of the individual members. Some researchers assume non-cooperative behaviour between partners, while others state that household members are likely to behave cooperatively. A crucial assumption of non-cooperative games is that the players are unable to make binding agreements. In a household environment this may raise some questions, as gains to being part of a household normally require some kind of cooperative behaviour. The main problem of non-cooperative games is that the resulting equilibrium points are generally not Pareto optimal, so both partners can gain by making agreements. For this reason, Manser and Brown (1980) argue that a cooperative game approach seems more appropriate.

Cooperative games yield Pareto-optimal outcomes and provide an internal distribution which depends on the bargaining power of the household members. The game is described by the set of all feasible payoffs to members and by the outcome in case of disagreement, the so-called threat point. As the player who would loose more in case of disagreement is more likely to make concessions, disagreement can be used as a 'threat' in the bargaining process in order to gain the most favourable distribution. It is not totally clear which outcome should be used as a threat point. McElroy and Horney (1981) define the threat point as the utility vector resulting if both partners would be single. Others suggest to use a non-cooperative equilibrium within marriage as a threat point (e.g. Lundberg and Pollak, 1993; Kooreman and Kapteyn, 1990).

A number of studies have concentrated on testing the cooperative game theoretic model against the neoclassical model. Manser and Brown (1980) remark that Becker's altruist model is actually a bargaining game, with a very restrictive bargaining rule: the household members all agree on the fact that only the altruist's utility function is maximized. McElroy (1990) mentions two issues that separate neoclassical from cooperative bargaining models. The first is the treatment of income; while in neoclassical models only pooled household income matters, in the bargaining framework the question who has control over the various income sources is important. Consequently, some studies have suggested to use the equality of coefficients of non-labour income of both spouses as a test on the neoclassical model (Horney and McElroy, 1988; Thomas, 1990; Schultz, 1990). The second issue is the opportunity cost of cooperation, which is equal to the utility a member can achieve behaving non-cooperatively. This so-called threat point matters for the intrahousehold distribution of resources and therefore for the household demands in the bargaining model; in the neoclassical model it does not matter. McElroy (1990) mentions several variables that may shift the threat points in the bargaining model, such as competitiveness in the marriage market, parents' wealth, and tax changes due to leaving the household, and may help to discriminate between the neoclassical and the cooperative game theoretic model. Kapteyn and Kooreman (1992) discuss the various tests applied in literature to distinguish between both models. They conclude that the models are empirically indistinguishable from each other as long as one only uses data on household consumption, household non-labour income, and wages and hours worked by family members. Extra information on both players' *preferences* is needed to discriminate between both models. The possibilities of using subjective information, in particular about both spouses' desired labour supply, are explored in Kooreman and Kapteyn (1990).

1.3 Data requirements

The evolution of the models used to analyze household decision making also had its consequences for the data requirements in empirical household research. Naturally, as long as households were viewed as homogeneous decision and consumption units, available data on the household level were sufficient. Only when researchers started to investigate intrahousehold issues, the gathering of data on consumption of individual family members became important. Several years later, the introduction of bargaining models of household

decision making required even more detailed information on households, for instance on the resources under each partner's control, and on the preferences of individual members.

A serious problem of empirical research into intrahousehold allocation is, that many of the available sets of data only report expenditure and consumption at the household level and not how these expenditures are allocated to the individual members. Moreover, it will always remain difficult to observe who gets what in the household, because a number of goods and services are consumed jointly. Some empirical studies on intrahousehold allocation have concentrated on individual time use data (Becker, 1965; Gronau, 1977) and on expenditures on goods that can be ascribed to certain members in the household, for instance 'adult goods' like alcohol and tobacco (Deaton, 1989; Gronau, 1991). Rosenzweig and Schultz (1982) use sex-specific child survival data to investigate the allocation of (unobserved) household resources between children. Others have used individual food consumption data, collected by 24-hour recalls by the mother (Haddad and Kanbur, 1990) or by using a food-weighing method (Senauer et al., 1988). Data on food consumption are also used in combination with anthropometric measures of the nutritional status of individual household members, such as weight conditional on height and height conditional on age (Pitt et al., 1990). In other studies, however, the lack of information at the individual level leads to identification problems; see Kooreman and Kapteyn (1990) for a discussion.

In addition to the distinction between household and individual level data, another dichotomy in information on intrahousehold allocation is discussed by Smith (1991). He states that 'empirical evidence on the extent to which the household can be regarded as a single unit may be obtained from two sources. "Process evidence" relates to the way in which households make decisions, and describes the processes or transactions between household members. "Outcome evidence" is concerned with the effects that different underlying processes or behavioural patterns within the household might be expected to have on observable outcomes (expenditures, labour supply decisions, etc.) and tries to infer from the observed outcomes the nature of the intrahousehold processes which generated them.' Although process information may provide more specific information on each of the members' roles in the household, most economic studies of intrahousehold allocation are based on outcome evidence. An application of process evidence is a study by Pahl (1989), who describes various systems used by couples in managing individual and family expenditures.

1.4 Issues addressed in this thesis

As may have become clear from the previous sections, the research field of intrahousehold allocation of resources covers a whole range of research topics. In this thesis we have chosen to elaborate on various aspects of modelling intrahousehold allocation and related issues. The emphasis will be on the empirical estimation and testing of models. As the various issues studied require specific data, we have used three datasets from three different countries, Peru, the Netherlands, and Great Britain. Therefore, the results presented in the various chapters and their possible policy implications should be interpreted taking the social and cultural background of the country involved into account.

We will briefly summarize the topics addressed in the following chapters, and indicate how they relate to the present state of affairs in the modelling of intrahousehold decision making. In chapter 2, intrahousehold allocation to children is discussed, and particularly allocation of foods. For our study we use a dataset of Peru, which contains household expenditures on 30 different food categories. A difficulty with this dataset is that it only reports household expenditures and not how these expenditures are allocated to the individuals in the household. However, following a procedure set forth in Deaton (1989) the data can nevertheless be used to investigate the effect of the presence of children on household expenditures, and in particular the question 'do boys have a different effect than girls?'. Central in this procedure are expenditures on goods that are *not* consumed by children, so-called 'adult goods'.

In the chapters 3 and 4 we investigate if parents have a preference for the sex of their children, by studying fertility behaviour of couples. Sex preferences and intrahousehold allocation are logically connected with each other, since the existence of parental sex preferences could provide an explanation for boy-girl differences in the allocation of goods within households (e.g. Chen, Huq and D'Souza, 1981; Kishor, 1993). Moreover, if sex preferences affect family size, they partly determine the number of persons over which the household's resources have to be shared. In spite of the varied and extensive literature on the effects of sex preferences on fertility behaviour of couples, there is still a lot to improve on current methods. We will discuss several methods of testing for sex preferences, using various types of information, and apply them to a Dutch data set. Chapter 3 presents an adapted version of the Parity Progression Ratio (PPR) method, reduced form Probit and 2SLS equations of the decision to have a sterilization, and a hazard analysis of birth intervals. By

including various dummy variables representing the sex composition of the household we test for various kind of sex preferences. Next, in chapter 4, a structural model of parental preferences for the number and sex of their children is formulated and estimated.

Chapters 5 and 6 present a study of how couples manage individual and family expenditures. Information on how partners organize household money is an example of what Smith (1991) called "process evidence" of household decision making. It may give us some insight in each of the members' roles in the household, and the extent to which the household can be regarded as a single unit. To investigate this, we use the typology of household financial management systems introduced by Pahl (1989). The systems differ in how authority over household money is divided between partners, varying from totally separate to joint spheres of decision making. For our study we use data from the British Household Panel Survey. In chapter 5 we first discuss respondents' reports on how household finances are organized, and how Pahl's management systems are linked to other parts of household financial decision making. Moreover, as most questions are answered by both partners separately, we address the problem of non-corresponding partners' answers. In chapter 6, we then concentrate on theoretical models that can explain the type of financial management used by households. On the one hand, we formulate a (neoclassical) household production model, in which the type of financial management results from efficiency considerations. On the other hand, we present a bargaining model of household decision making, in which the financial management reflects the relative bargaining positions of both partners. The different effects various socio-economic variables should theoretically have in both models enable us to test the models empirically, and help us to interprete the various systems of financial management in households.

In chapter 7 the results presented in this thesis are summarized and evaluated.

2 Inter- and intra-household allocation of food: a case study of Peru

2.1 Introduction

While analyzing consumption patterns *across* households has been the central theme of demand analysis for many decades, it is the allocation of expenditures *within* the household that has recently received a considerable amount of interest. Especially for food, obtaining insight into intrahousehold allocation is not only of academic, but also of social importance. For example, there is some evidence that an inappropriate allocation of food within the household may exacerbate the effect of an inadequate household food supply on certain household members. For South Asia evidence has been found that boys tend to be favoured over girls in the intrahousehold distribution of nutrients: e.g. Senauer, Garcia, and Jacinto (1988) for the Philippines, Behrman and Deolalikar (1990) for India, and Chen, Huq, and D'Souza (1981) for Bangladesh. Thomas (1990) finds evidence for gender bias in Brazil, in the sense that mothers prefer to devote resources to daughters and fathers to sons. For a more extensive survey of examples see Behrman (1990).

Efforts to investigate intrahousehold allocation of resources encounter the difficulty that most of the available sets of data only report household expenditures and not how these expenditures are allocated to the individuals in the household. Moreover, it will always be extremely difficult to observe who gets what in the household, both because direct observation is likely to affect the behaviour of the observed household, and because a number of goods and services are consumed jointly. However, applying certain methods even household level data can inform us on the intrahousehold allocation. Deaton (1989) presents a procedure to investigate boy-girl discrimination based on household-level expenditure data. Starting point are expenditures on goods that are not consumed by children, so-called 'adult goods'. The presence of children will only have a negative 'income' effect on the expenses on these goods. If, for example, an additional boy induces a larger decrease in expenditures on adult goods than an additional girl, this could point at discrimination against girls.

In the present chapter, we investigate the allocation of food expenditures over various

food categories. In particular, we want to study the effects of household characteristics like demographic composition, education, age, and type of residence on expenditures on various food categories. We use a dataset of Peru, which contains household expenditures on 30 different food categories during a certain number of days between July 1985 and July 1986. To investigate the effect of the presence of children on household expenditures, and in particular the question 'do boys have a different effect than girls', we follow the procedure set forth in Deaton (1989).

Although our paper is similar in spirit to the one by Deaton, it is at the same time different in a number of respects. First of all, we explicitly deal with a distinguishing characteristic of detailed expenditure data, which is that a large number of households make no purchases at all in certain categories. It is well-known that in case of a substantial proportion of zero expenditures applying OLS to all observations, as in Deaton (1989), generally yields biased and inconsistent estimates. We therefore use censored regression methods. Secondly, we want to allow for sufficient flexibility of the demand system. Most popular models of demand are of rank two, i.e. have expenditure share Engel curves that are linear in the logarithm of total expenditure. In recent years, however, a number of empirical studies have suggested that a more flexible specification for expenditures is required (see e.g. Banks et al., 1992). This permits a good to be a necessity at some expenditure levels and a luxury or inferior good at others. In our expenditure share equations we include a quadratic logarithmic expenditure term, which allows for a rank three Engel curve. In the third place, the present paper focuses on the allocation of food conditional on a predetermined food budget. Although this requires a separability assumption, it allows us to take a much more detailed look at food allocation and to distinguish a much larger number of food categories than is usually done in demand analysis.

In the following section, we discuss the data. In the third section, we briefly describe our method of analysis. The main empirical results are presented in section four. And finally, in the fifth section, we give a summary of our conclusions.

2.2 Data: the Peruvian Living Standards Survey

The data used in this study are drawn from the 1985 Peruvian Living Standards Survey (PLSS). This survey provides detailed socio-economic information on over 5,000 households and 27,000 individuals.

For our analysis we used the section of the PLSS concerning food expen[illegible] household has reported its expenditures on or the value of self-supply of 30 different food categories, e.g. rice, flour, meats, fruits, vegetables, etcetera. From these expenditures we derived for each household the shares of the various food categories in total food expenditures of the household, which were used to estimate an expenditure share system. For the estimations we used 4794 observations of the PLSS.

Table 2.1: Household food expenditures

Food Category	percentage of observations > 0	mean share of category
1. Rice	85.6	0.093
2. Corn, Maize	34.4	0.016
3. Wheat	37.2	0.016
4. Barley	14.0	0.006
5. Quinua	19.3	0.005
6. Bread	91.7	0.095
7. Cookies, cakes, etc.	38.8	0.011
8. Noodles	81.0	0.067
9. Red meats	55.4	0.077
10. Poultry meats	46.8	0.045
11. Meat's by-products	16.4	0.005
12. Fish and sea food	60.7	0.037
13. Milk	55.3	0.042
14. Yogourt, butter, cheese, etc.	48.0	0.016
15. Eggs	52.8	0.018
16. Oils, margarine, etc.	86.6	0.079
17. Seasonings	83.9	0.026
18. Tubercles & roots	68.8	0.050
19. Dried vegetables	48.8	0.021
20. Fresh vegetables	77.7	0.051
21. Fresh fruits	70.3	0.041
22. Frozen, canned vegetables	1.0	0.000
23. Frozen, dried, canned fruits	6.7	0.002
24. Sugar	90.8	0.062
25. Coffee, tea, cacao, herbs	68.4	0.023
26. Candies, honey, etc.	28.2	0.007
27. Ready to serve food	17.1	0.016
28. Alcoholic beverages	26.0	0.035
29. Soft drinks	45.6	0.018
30. Other food	58.3	0.022

Table 2.1 presents for each food category the percentage of households reporting expenditures on that category, and the average share of the category in total food expenditures. As can be seen, on 8 categories expenditures were reported by less than 30 percent of the households,

two of which even by less than 7 percent. Appendix 2A reports some sample statistics of the explanatory variables used in our estimations.

It should be noted that Peru is in various respects a very heterogeneous country. Social inequality becomes visible in the numerous economic, political, social and cultural patterns in Peru, which are deeply rooted in the historical and geographic dimensions of the country. According to a study by Amat y León and Curonisy (1987), consumption patterns in Peru can differ considerably, according to type of residence and social status. Habit and tradition on the one hand, and level of income and type of occupation on the other are important factors that influence patterns of expenditures and demand. Therefore, studies into these patterns should take these variations and differences between the various regions into account. Other factors that can influence consumption of households, according to Amat y León and Curonisy, are household size and composition with respect to age and sex, and education.

2.3 Methodology

For our analysis we used the following specification:

$$w_i = \alpha_i + \beta_i \ln x + \gamma_i (\ln x)^2 + \delta_i \ln n + \sum_{j=1}^{10} \theta_{ij} n_j + \kappa_i z + u_i \qquad (2.1)$$

where w_i is the share of food category i in total food expenditures of the household, x is total household food expenditure per day, n is the number of household members, z is a vector of other household characteristics, and u_i is an error term. The variables n_j, which denote the number of children in a certain age and sex category, characterize the demographic composition of the household. Ten demographic child categories are distinguished: the number of boys and girls in each of the five age groups, younger than 1 year, 1-3 years, 4-6 years, 7-12 years, and 13-17 years.

By choosing specification (2.1), making w_i dependent on food expenditures and not on total expenditures or income, we assume that food expenditures are weakly separable from other expenditures. This means that the conditional ordering of various food categories in the 'foods group' is independent of consumption levels outside the 'foods group'.

We explicitly deal with the problem of the large number of zero records in our data by using Tobit censored regressions for estimation. The interpretation of the zero records is a

bit complicated, however. On the one hand they can be the result of a household's decision not to consume a certain category, but on the other hand they can be caused by the occurrence of infrequency of purchase. In the latter case, the category is regularly consumed by the household, but is not bought in the period covered by the survey. The same holds, of course, also for non-zero records; it is possible that the expenditures recorded in a certain period are higher or lower than average expenditures of a household. We expect that the longer the period a household has reported its expenditures, the larger the share of infrequently purchased food categories will be.[1] To investigate this hypothesis we added the length of the survey period as an explanatory variable in our share equations. The period over which households reported their expenditures varies from 6 to 68 days, but the most frequent period length is 15 days.

The coefficients Θ_{ij} give us the effect of a child in category j on household expenditures on food category i. An additional child can have a negative income-like effect on the consumption of other household members, as adding people means that there is less for each. But there will also be a positive substitution-like effect, because the additional children also have a demand for food. It is possible, therefore, that we can not find a significant coefficient for a certain category, because the 'substitution' effect is compensated by the 'income' effect. It can also be that we find equal coefficients for boys and girls, while the separate 'income' and 'substitution' components for both sexes differ. So, although the effects of additional children on individual consumption can be much larger than the estimated coefficients show, we *can* determine if expenditures on a certain food category are influenced by the presence

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[1] Let p be the probability that on an arbitrary day a household spends some fixed amount x on an infrequently purchased food category. Let d denote the number of days of observation of the household, y_0 the frequent per day expenditures. Let k be the number of days at which the food category has been purchased. Thus k follows a binomial distribution with parameters d and p. Then k.x is the amount purchased of the considered food category in d days. The expected budget share of this category after d days of observation is given by:

$$E(w_n) = E\left(\frac{k.x}{d.y_o+k.x}\right) = E(g(k))$$

Since g(k) is concave, Jensen's inequality implies that:

$$E(g(k)) = E\left(\frac{k.x}{d.y_0+k.x}\right) \leq \frac{x.E(k)}{d.y_0+x.E(k)} = \frac{x.p}{y_0+x.p} = g(E(k))$$

because E(k) = d.p. As g(k) becomes 'less concave' with increasing d, E(g(k)) approaches g(E(k)) if d increases. This makes it plausible that Ew_n increases with d.

and gender of children.

However, if a good is consumed by adults only, an additional child will only have a negative income-like effect on the consumption of this good. In this case, comparison of the coefficients for boys and girls, or dimension-less π-ratios as Deaton (1989) calculated, clearly shows us if there is any boy-girl discrimination. In the present data set, the only good that can safely be assumed to be an adult good is alcoholic beverages.

2.4 Empirical Results

For each food category we estimated the share equations as specified in equation (2.1). Some variables describing characteristics of the head of the household, like sex, age, and years of schooling, were added. Dummy variables for location (department and type of residence) and month of interrogation, and interaction terms of sex of the head of the household and the ten child categories were also included. And, as already mentioned before, we also added a variable for the length of the survey period.

Appendix 2B reports all the estimation results. For almost all 30 food categories we find significant coefficients for the quadratic logarithmic expenditure terms. Most categories appear to be luxuries at relatively low expenditure levels and necessities at higher levels. This illustrates the importance of allowing for more flexibility in total expenditure, since such a pattern is not possible with the traditional Working/Leser Engel curves. The budget elasticities can be calculated by:

$$e_i = \frac{\beta_i}{w_i} + \frac{2.\gamma_i}{w_i}.\ln x + 1 \qquad (2.2)$$

To facilitate the interpretation of our estimation results, we have drawn Engel curves for all categories. Appendix 2C presents figures for an average household. For these figures we calculated q_i^* by:[2]

[2] Please note that q_i^* should be interpreted as a latent utility-maximizing amount of expenditures on food category i. If q_i^* is negative, the observed amount of expenditure q_i is zero.

$$q_i^* = x \,.\, (\hat{\alpha}_i + \hat{\beta}_i.\ln x + \hat{\gamma}_i.(\ln x)^2 + \hat{\delta}_i.\ln \bar{n} + \sum_{j=1}^{10} \hat{\theta}_{ij}.\bar{n}_j + \hat{\kappa}_i.\bar{z}) \qquad (2.3)$$

with $\bar{z}$, $\bar{n}$, and $\bar{n}_j$ being the mean values of z, n, and n_j respectively in the sample. The range of x considered in these figures excludes 0.13 percent of outliers in the right tail of the distribution of x.

According to these figures four categories can be considered as necessary goods at low values of x: 'Rice', 'Bread', 'Oils, margarine, etc.', and 'Sugar'. The first three of these become inferior goods for higher expenditure levels. Some categories appear to be luxuries over the whole range of x: 'Red meats', 'Fish and sea food', 'Yogourt, cheese, etc.', 'Eggs', 'Seasonings', 'Fresh fruits' and 'Soft drinks'. Others show to be luxuries at lower total expenditure levels, and become necessary or even inferior goods at higher expenditure levels: 'Noodles', 'Poultry meats', 'Milk', 'Tubercles & roots', 'Dried vegetables', 'Fresh vegetables' and 'Coffee, tea, cacao, herbs'. Yet another group of categories, 'Corn, maize', 'Cookies, cakes, etc.', 'Candies, etc.', 'Alcoholic beverages', and 'Other food', are luxury goods showing positive expenditures only for higher values of total expenditure. Seven categories show negative expenditures for all total expenditure levels; these are apparently not consumed by an average household.

The coefficient of the period length is significantly positive for half the number of categories, and significantly negative for only three categories, namely 'Bread', 'Oils', and 'Sugar'. It is striking that these three categories are all considered as necessary or inferior goods. This indicates that luxury goods are bought less frequently than necessary and inferior goods.
The age of the head of the household has hardly any impact on expenditures. Education, however, shows a significant coefficient for most categories. Households with a more educated head spend more on 'Bread', 'Cookies, etc.', meats, milk and milk products, eggs, fruits, 'Candies, etc.', and 'Soft drinks'. It should be noted, however, that to the extent that education acts as a proxy for total household income, these results may simply reflect that these categories are luxuries.

The sex of the household head also seems to influence household food expenditures. Female heads of household cause their households to spend more on 'Wheat', 'Meats', 'Eggs', 'Seasonings', 'Tubercles and roots', and 'Vegetables', but less on 'Alcohol', 'Soft

drinks' and 'Other food categories'.

In rural areas, more is spent on 'Rice', 'Noodles', 'Oils', 'Seasonings', 'Sugar', and 'Alcohol'. This is probably caused by the worse economic situation of rural households, and by some food categories being less available in remote rural villages.

The various child categories show to have an effect on some food expenditures. The coefficients differ in all cases for boys and girls, except for the category 'Milk', where the two youngest age categories of both sexes have a positive effect. Also the interaction terms of the child categories with female household heads are significant for a number of categories, and of different size for boys and girls. To see whether these differences between boys and girls are significant, we have performed a Likelihood Ratio test. For only two food categories, namely 'Meat's by-products' and 'Candies', we find significant differences between the effects of boys and girls[3]. As explained before, the interpretation of the differences is a bit complicated in the case of non-adult goods. For example, for the category 'Candies' we find a positive coefficient for girls of four to six years old, and a negative coefficient for boys under one as well as for boys older than twelve years. We could conclude from this that girls are given more candies than boys (which would mean discrimination of boys), but we could also conclude that parents are more prepared to economize on their own candy consumption for sons than for daughters, e.g. to be able to buy other foods or goods for their sons and daughters (which would mean discrimination of girls).

For the only adult good, 'Alcoholic beverages', we find no significant differences between the effects of boys and girls on consumption. The result remains unchanged if we take all five child-age categories together. The coefficients for both boys and girls have the expected negative sign in this case, while their joint effect is significantly different from zero, as expected. Thus we conclude that the present data do not show any evidence of boy-girl discrimination.

2.5 Conclusions

In this paper we investigated the allocation of food expenditures over various food categories. One of our goals was to examine the impact of additional children of different sex and age

[3] Value of LR: 19.76 (cat 11) and 19.63 (cat 26)
Value of $\chi^2_{(10)}$: 5.99 (α=0.10) or 18.31 (α=0.05)

groups on food expenditures. It appears that for the only adult-good in our data set, alcoholic beverages, the effect of boys on expenditures is not significantly different from the effect of girls. This implies that the present data show no evidence of boy-girl discrimination.

Another purpose of our research was to investigate a more flexible specification for food expenditures than the traditional Working/Leser curves, by including a quadratic logarithmic expenditure term. This term appears to be significant for all but five food categories. At higher total food expenditure levels much more categories are considered necessary or inferior goods than at lower expenditure levels, a pattern that is excluded a priori when the traditional Working-Leser Engel curves are used.

The department in which the household lives and the month in which it is interrogated significantly affect the budget shares of almost all categories. This points at a varying availability of the different food categories over regions and seasons.

Appendix 2A: Variables used in regressions

Definition of variables used in regressions

Variable name:	Definition:
lnscatpd	logarithm of total household food expenditures per day
lnscatsq	$(\text{lnscatpd})^2$
daysbtw	number of days over which household reported expenditures
lnhhsize	logarithm of number of household members
agehhhyr	age of head of household
agehhhsq	$(\text{agehhhyr})^2$
yrschhh	years of schooling of head of household
resid	type of residence (1=rural, 0=urban)
femhhh	sex of head of household (1=female, 0=male)
chldctf1	number of female children of 0 years old
chldctf2	number of female children between 1 and 3 years old
chldctf3	number of female children between 4 and 6 years old
chldctf4	number of female children between 7 and 12 years old
chldctf5	number of female children between 13 and 17 years old
chldctm1	number of male children of 0 years old
chldctm2	number of male children between 1 and 3 years old
chldctm3	number of male children between 4 and 6 years old
chldctm4	number of male childrenbetween 7 and 12 years old
chldctm5	number of male children between 13 and 17 years old
fhchf1,..., fhchf5	femhhh * chldctf1,..., femhhh * chldctf5
fhchm1,..., fhchm5	femhhh * chldctm1,..., femhhh * chldctm5

Appendix 2A, continued

Table 2A1: Sample statistics of explanatory variables

Explanatory Variables	Mean	Std.Dev.	Min.	Max.
lnscatpd	3.062	1.128	-2.639	6.533
daysbtw	15.449	2.933	6	68
lnhhsize	1.498	0.580	0	3.178
agehhhyr	47.361	14.472	14	99
yrschhh	5.399	4.430	0	19
resid	0.443	0.497	0	1
femhhh	0.172	0.377	0	1
chldctf1	0.063	0.247	0	2
chldctf2	0.201	0.447	0	3
chldctf3	0.201	0.446	0	3
chldctf4	0.419	0.680	0	4
chldctf5	0.311	0.592	0	4
chldctm1	0.069	0.256	0	2
chldctm2	0.202	0.438	0	3
chldctm3	0.221	0.460	0	3
chldctm4	0.443	0.697	0	5
chldctm5	0.308	0.587	0	4
fhchf1	0.004	0.064	0	1
fhchf2	0.021	0.151	0	2
fhchf3	0.019	0.153	0	3
fhchf4	0.051	0.264	0	3
fhchf5	0.047	0.245	0	3
fhchm1	0.006	0.080	0	1
fhchm2	0.019	0.149	0	2
fhchm3	0.020	0.151	0	2
fhchm4	0.052	0.265	0	4
fhchm5	0.049	0.249	0	2

Appendix 2B: Estimation results

Tabel 2B1: Estimated coefficients for category 1 to 5 (t-values in parentheses)

	Rice	Corn, Maize	Wheat	Barley	Quinua
Constant	0.046 (1.92)	-0.285 (-7.89)	-0.349 (-9.97)	-0.485 (-7.48)	-0.317 (-8.30)
lnscatpd	0.041 (8.30)	0.079 (7.39)	0.084 (8.45)	0.090 (5.74)	0.071 (6.52)
lnscatsq	-0.009 (-9.67)	-0.005 (-3.12)	-0.008 (-5.23)	-0.007 (-3.01)	-0.006 (-3.89)
daysbtw	-0.000 (-1.75)	0.002 (3.18)	0.002 (2.99)	-0.000 (-0.01)	0.001 (3.15)
lnhhsize	0.032 (6.42)	-0.010 (-1.49)	-0.002 (-0.25)	-0.022 (-2.48)	-0.011 (-2.23)
agehhhyr	-0.000 (-0.79)	-0.001 (-0.83)	0.001 (1.13)	0.003 (2.61)	0.002 (2.20)
agehhhsq	0.000 (0.51)	0.000 (0.55)	-0.000 (-0.86)	-0.000 (-2.48)	-0.000 (-2.52)
yrschhh	-0.002 (-4.84)	-0.001 (-2.61)	-0.001 (-1.33)	-0.003 (-3.64)	-0.001 (-1.39)
resid	0.026 (5.71)	-0.003 (-0.45)	0.006 (1.02)	0.011 (1.35)	-0.023 (-5.13)
femhhh	0.008 (1.30)	0.013 (1.64)	0.017 (2.22)	0.006 (0.61)	0.004 (0.61)
chldctf1	0.002 (0.34)	0.006 (0.72)	-0.013 (-1.56)	0.009 (0.77)	0.010 (1.65)
chldctf2	-0.004 (-0.93)	-0.000 (-0.03)	0.003 (0.68)	-0.002 (-0.27)	-0.000 (-0.02)
chldctf3	-0.002 (-0.61)	0.006 (1.21)	0.001 (0.18)	0.011 (1.72)	-0.002 (-0.45)
chldctf4	0.004 (1.73)	0.001 (0.26)	0.001 (0.20)	0.008 (1.87)	0.001 (0.42)
chldctf5	0.001 (0.45)	0.002 (0.52)	0.002 (0.48)	-0.009 (-1.62)	-0.000 (-0.14)
chldctm1	-0.003 (-0.42)	0.009 (1.13)	0.013 (1.77)	-0.002 (-0.21)	0.000 (0.07)
chldctm2	-0.010 (-2.58)	0.003 (0.63)	0.008 (1.75)	0.007 (1.08)	0.003 (0.86)
chldctm3	0.004 (1.10)	0.007 (1.43)	-0.003 (-0.67)	0.010 (1.53)	0.002 (0.54)
chldctm4	-0.001 (-0.40)	-0.005 (-1.47)	-0.000 (-0.12)	0.001 (0.23)	-0.002 (-0.91)
chldctm5	-0.004 (-1.45)	-0.000 (-0.12)	0.002 (0.64)	-0.008 (-1.47)	-0.001 (-0.37)
fhchf1	-0.002 (-0.07)	-0.071 (-2.00)	-0.027 (-0.79)	-0.002 (-0.05)	0.020 (0.92)
fhchf2	-0.002 (-0.21)	0.020 (1.41)	-0.002 (-0.15)	0.019 (1.01)	0.006 (0.61)
fhchf3	-0.030 (-2.60)	-0.002 (-0.17)	0.006 (0.41)	-0.060 (-2.47)	0.007 (0.68)
fhchf4	0.003 (0.49)	0.001 (0.07)	-0.003 (-0.34)	0.013 (1.09)	0.002 (0.31)
fhchf5	-0.002 (-0.24)	-0.001 (-0.07)	-0.006 (-0.70)	0.009 (0.67)	-0.004 (-0.59)
fhchm1	-0.004 (-0.18)	0.048 (2.05)	-0.005 (-0.21)	-0.003 (-0.09)	0.004 (0.20)
fhchm2	-0.003 (-0.28)	0.005 (0.37)	0.015 (1.10)	-0.009 (-0.42)	-0.025 (-1.79)
fhchm3	-0.023 (-2.01)	-0.003 (-0.24)	-0.012 (-0.81)	0.008 (0.43)	0.014 (1.29)
fhchm4	0.005 (0.67)	-0.007 (-0.78)	-0.005 (-0.59)	-0.000 (-0.03)	-0.001 (-0.22)
fhchm5	0.006 (0.87)	0.002 (0.19)	-0.014 (-1,56)	0.006 (0.50)	-0.006 (-0.84)

Appendix 2B, continued

Table 2B2: Estimated coefficients for category 6 to 10 (t-values in parentheses)

	Bread	Cookies, cakes, etc.	Noodles	Red meats	Poultry meats
Constant	0.184 (8.83)	-0.032 (2.14)	-0.002 (-0.10)	-0.490(-11.58)	-0.395(-10.73)
lnscatpd	-0.016 (-4.16)	0.007 (1.92)	0.077 (15.95)	0.208 (12.69)	0.189 (12.72)
lnscatsq	-0.002 (-2.53)	0.001 (2.26)	-0.012(-14.51)	-0.018 (-7.33)	-0.020 (-9.51)
daysbtw	-0.001 (-3.03)	0.001 (2.43)	-0.000 (-0.06)	0.004 (4.91)	0.001 (2.31)
lnhhsize	0.007 (1.56)	-0.013 (-4.44)	0.011 (2.73)	-0.023 (-3.37)	-0.010 (-1.90)
agehhhyr	-0.001 (-0.98)	-0.001 (-1.63)	-0.001 (-2.32)	0.001 (0.74)	-0.002 (-2.16)
agehhhsq	0.000 (1.67)	0.000 (0.55)	0.000 (2.29)	-0.000 (-0.20)	0.000 (2.15)
yrschhh	0.001 (2.44)	0.001 (3.96)	-0.002 (-6.74)	0.003 (4.36)	0.001 (2.35)
resid	-0.032 (-8.22)	0.002 (0.57)	0.033 (9.24)	-0.029 (-4.81)	-0.048(-10.48)
femhhh	-0.004 (-0.79)	-0.006 (-1.48)	0.008 (1.68)	0.017 (2.05)	0.017 (2.73)
chldctf1	-0.005 (-0.84)	0.006 (1.61)	0.005 (0.89)	-0.021 (-2.26)	-0.013 (-1.91)
chldctf2	-0.002 (-0.47)	0.003 (1.21)	0.001 (0.36)	-0.005 (-0.98)	-0.002 (-0.57)
chldctf3	0.004 (1.11)	0.001 (0.34)	0.000 (0.06)	0.003 (0.61)	-0.006 (-1.57)
chldctf4	0.002 (0.90)	-0.001 (-0.37)	-0.000 (-0.02)	-0.006 (-1.78)	0.001 (0.20)
chldctf5	0.004 (1.34)	-0.003 (-1.80)	0.004 (1.86)	-0.003 (-0.87)	-0.003 (-0.93)
chldctm1	0.004 (0.76)	0.005 (1.27)	-0.007 (-1.39)	-0.012 (-1.39)	0.001 (0.14)
chldctm2	0.003 (0.75)	0.004 (1.48)	0.001 (0.45)	-0.004 (-0.66)	-0.010 (-2.35)
chldctm3	0.003 (0.78)	0.001 (0.56)	0.000 (0.09)	0.001 (0.20)	-0.009 (-2.41)
chldctm4	0.002 (0.99)	-0.002 (-1.11)	0.001 (0.73)	0.004 (1.06)	-0.002 (-0.64)
chldctm5	0.010 (3.77)	-0.002 (-0.99)	-0.002 (-0.69)	-0.004 (-1.01)	-0.007 (-2.29)
fhchf1	0.011 (0.53)	-0.019 (-1.17)	-0.006 (-0.32)	0.040 (1.19)	0.002 (0.09)
fhchf2	-0.010 (-0.96)	0.009 (1.24)	-0.005 (-0.52)	0.011 (0.70)	0.003 (0.28)
fhchf3	0.005 (0.46)	0.006 (0.93)	-0.008 (-0.85)	-0.011 (-0.68)	0.021 (1.92)
fhchf4	-0.007 (-1.11)	-0.003 (-0.57)	0.001 (0.25)	0.008 (0.84)	-0.013 (-1.79)
fhchf5	0.004 (0.58)	0.004 (0.99)	-0.008 (-1.31)	-0.005 (-0.48)	-0.011 (-1.48)
fhchm1	0.005 (0.30)	0.012 (1.01)	0.007 (0.41)	-0.013 (-0.48)	-0.000 (-0.00)
fhchm2	-0.004 (-0.44)	0.011 (1.58)	0.009 (1.00)	-0.007 (-0.45)	0.008 (0.66)
fhchm3	0.016 (1.61)	0.014 (2.03)	-0.016 (-1.71)	-0.025 (-1.57)	0.020 (1.69)
fhchm4	0.011 (1.76)	0.004 (1.04)	-0.015 (-2.61)	-0.011 (-1.10)	-0.005 (-0.65)
fhchm5	0.004 (0.59)	-0.002 (-0.42)	-0.002 (-0.41)	-0.005 (-0.49)	-0.004 (-0.50)

Appendix 2B, continued

Table 2B3: Estimated coefficients for category 11 to 15 (t-values in parentheses)

	Meat's by-products	Fish and sea food	Milk	Yogourt, butter, etc.	Eggs
Constant	-0.402 (-0.21)	-0.110 (-5.46)	-0.083 (-3.56)	-0.050 (-3.24)	-0.063 (-5.59)
lnscatpd	0.010 (1.08)	0.039 (7.85)	0.074 (9.88)	0.009 (2.55)	0.026 (7.94)
lnscatsq	0.003 (2.58)	-0.003 (-3.83)	-0.008 (-6.87)	0.001 (1.82)	-0.002 (-4.38)
daysbtw	0.002 (4.80)	0.000 (1.01)	0.001 (1.20)	0.001 (2.78)	0.001 (3.50)
lnhhsize	-0.014 (-2.72)	0.005 (1.19)	-0.018 (-4.21)	-0.013 (-4.36)	-0.008 (-4.07)
agehhhyr	0.001 (1.29)	0.001 (1.92)	-0.001 (-2.18)	-0.000 (-0.76)	0.000 (0.68)
agehhhsq	-0.000 (-1.50)	-0.000 (-1.93)	0.000 (1.93)	0.000 (0.74)	-0.000 (-0.86)
yrschhh	0.002 (5.19)	-0.000 (-0.18)	0.003 (9.21)	0.001 (5.06)	0.001 (4.97)
resid	-0.026 (-4.50)	-0.007 (-1.96)	-0.053(-13.74)	-0.024 (-9.06)	-0.026(-13.84)
femhhh	-0.004 (-0.62)	-0.000 (-0.03)	0.005 (0.96)	0.006 (1.73)	0.006 (2.58)
chldctf1	-0.004 (-0.52)	-0.002 (-0.37)	0.027 (4.83)	-0.004 (-0.86)	-0.003 (-0.93)
chldctf2	-0.014 (-3.25)	-0.002 (-0.80)	0.010 (3.18)	-0.001 (-0.43)	0.000 (0.16)
chldctf3	-0.006 (-1.37)	-0.006 (-1.84)	-0.002 (-0.63)	-0.001 (-0.58)	-0.000 (-0.29)
chldctf4	0.001 (0.21)	0.001 (0.49)	-0.003 (-1.19)	0.000 (0.30)	0.000 (0.28)
chldctf5	-0.001 (-0.46)	-0.004 (-1.59)	-0.002 (-0.76)	0.002 (0.92)	-0.001 (-0.44)
chldctm1	-0.010 (-1.28)	0.001 (0.26)	0.032 (5.90)	-0.001 (-0.16)	0.002 (0.82)
chldctm2	0.001 (0.25)	-0.002 (-0.51)	0.011 (3.11)	0.001 (0.21)	-0.001 (-0.42)
chldctm3	-0.003 (-0.82)	-0.003 (-1.05)	0.000 (0.13)	-0.005 (-2.11)	-0.003 (-1.83)
chldctm4	-0.006 (-2.36)	0.003 (1.42)	-0.004 (-1.94)	0.000 (0.17)	0.001 (0.62)
chldctm5	-0.001 (-0.44)	-0.002 (-0.95)	-0.001 (-0.45)	0.001 (0.62)	-0.001 (-0.71)
fhchf1	-0.030 (-0.74)	-0.016 (-0.82)	0.045 (2.22)	0.013 (0.89)	0.023 (2.29)
fhchf2	0.020 (1.52)	-0.001 (-0.07)	0.004 (0.41)	-0.015 (-1.96)	-0.001 (-0.21)
fhchf3	0.005 (0.39)	-0.002 (-0.19)	-0.008 (-0.81)	0.002 (0.35)	-0.003 (-0.51)
fhchf4	0.004 (0.45)	-0.002 (-0.41)	-0.007 (-1.18)	-0.002 (-0.57)	-0.004 (-1.41)
fhchf5	-0.001 (-0.14)	0.005 (0.80)	0.002 (0.32)	0.001 (0.16)	0.003 (1.04)
fhchm1	0.045 (2.11)	-0.010 (-0.63)	0.006 (0.34)	0.001 (0.07)	-0.010 (-1.12)
fhchm2	-0.011 (-0.73)	0.005 (0.56)	0.021 (2.06)	-0.010 (-1.33)	-0.005 (1.11)
fhchm3	-0.009 (-0.56)	-0.008 (-0.89)	0.007 (0.69)	0.011 (1.63)	-0.001 (-0.19)
fhchm4	-0.004 (-0.42)	0.004 (0.64)	-0.001 (-0.18)	-0.004 (-0.85)	-0.001 (-0.22)
fhchm5	-0.023 (-2.35)	0.002 (0.34)	-0.004 (-0.62)	-0.003 (-0.61)	-0.001 (-0.29)

Appendix 2B, continued

Table 2B4: Estimated coefficients for category 16 to 20 (t-values in parentheses)

	Oils, margarine, etc.	Seasonings	Tubercles & roots	Dried vegetables	Fresh vegetables
Constant	0.099 (4.37)	0.067 (6.05)	-0.037 (-1.76)	-0.167 (-8.66)	-0.035 (-2.57)
lnscatpd	0.002 (0.36)	-0.037(-17.89)	0.071 (12.54)	0.089 (12.07)	0.033 (10.05)
lnscatsq	-0.004 (-4.56)	0.006 (15.65)	-0.008 (-8.45)	-0.009 (-8.58)	-0.004 (-6.36)
daysbtw	-0.002 (-3.02)	-0.000 (-1.62)	0.001 (1.97)	0.001 (1.68)	-0.001 (-1.75)
lnhhsize	0.015 (3.26)	0.010 (4.42)	-0.009 (-2.20)	0.007 (2.11)	0.010 (3.69)
agehhhyr	0.001 (1.94)	-0.000 (-0.01)	-0.000 (-0.37)	0.000 (0.32)	0.000 (0.12)
agehhhsq	-0.000 (-1.57)	-0.000 (-0.56)	0.000 (0.60)	-0.000 (-0.35)	0.000 (0.15)
yrschhh	-0.001 (-2.13)	-0.001 (-3.22)	-0.002 (-6.14)	-0.000 (-0.77)	0.000 (0.87)
resid	0.035 (8.25)	0.010 (4.51)	-0.034 (-9.13)	-0.008 (-2.67)	-0.015 (-6.17)
femhhh	-0.002 (-0.37)	0.006 (2.03)	0.011 (2.08)	0.004 (1.05)	0.006 (1.91)
chldctf1	-0.000 (-0.03)	-0.005 (-1.67)	0.007 (1.27)	-0.007 (-1.66)	-0.003 (-0.79)
chldctf2	-0.003 (-0.93)	-0.000 (-0.24)	0.005 (1.58)	-0.001 (-0.28)	0.001 (0.41)
chldctf3	-0.001 (-0.33)	0.000 (0.14)	0.001 (0.24)	0.000 (0.01)	-0.004 (-1.83)
chldctf4	-0.001 (-0.25)	-0.002 (-1.93)	0.001 (0.46)	-0.000 (-0.29)	-0.002 (-1.66)
chldctf5	-0.004 (-1.53)	0.000 (0.21)	0.003 (1.14)	-0.001 (-0.42)	-0.003 (-1.84)
chldctm1	-0.013 (-2.07)	-0.003 (-0.98)	-0.001 (-0.16)	-0.002 (-0.52)	-0.003 (-0.88)
chldctm2	-0.001 (-0.17)	-0.003 (-1.15)	0.006 (1.86)	0.001 (0.25)	-0.000 (-0.07)
chldctm3	-0.001 (-0.32)	-0.003 (-1.82)	0.003 (0.97)	-0.002 (-0.97)	-0.006 (-2.98)
chldctm4	-0.001 (-0.22)	-0.002 (-1.66)	0.002 (1.00)	-0.000 (-0.23)	-0.000 (-0.31)
chldctm5	-0.005 (-1.59)	-0.001 (0.94)	0.006 (2.51)	-0.001 (-0.51)	-0.003 (-1.68)
fhchf1	0.014 (0.62)	-0.001 (-0.05)	-0.014 (-0.67)	-0.005 (-0.31)	-0.000 (-0.01)
fhchf2	-0.003 (-0.29)	0.003 (0.62)	-0.001 (-0.09)	0.003 (0.43)	0.003 (0.48)
fhchf3	0.006 (0.57)	-0.003 (-0.57)	0.012 (1.25)	-0.005 (-0.67)	-0.005 (-0.74)
fhchf4	-0.002 (-0.31)	-0.006 (-1.88)	-0.006 (-0.94)	0.003 (0.63)	-0.001 (-0.24)
fhchf5	0.009 (1.25)	-0.002 (-0.56)	-0.010 (-1.55)	-0.004 (-0.80)	0.004 (1.08)
fhchm1	-0.018 (-0.92)	-0.005 (-0.52)	-0.027 (-1.53)	-0.016 (-1.23)	-0.025 (-2.09)
fhchm2	-0.018 (-1.64)	0.005 (0.94)	-0.006 (-0.59)	-0.005 (-0.70)	-0.003 (-0.39)
fhchm3	-0.002 (-0.18)	0.006 (1.14)	-0.002 (-0.17)	-0.000 (-0.06)	0.003 (0.48)
fhchm4	-0.007 (-1.10)	-0.004 (-1.22)	0.004 (0.69)	-0.003 (-0.60)	-0.002 (-0.49)
fhchm5	0.002 (0.24)	-0.001 (-0.41)	-0.005 (-0.77)	-0.003 (-0.66)	0.000 (0.11)

Appendix 2B, continued

Table 2B5: Estimated coefficients for category 21 to 25 (t-values in parentheses)

	Fresh fruits	Frozen, canned vegetables	Frozen, dried, canned fruits	Sugar	Coffee, tea, cacao, herbs
Constant	-0.070 (-4.24)	-0.510 (-0.23)	-0.405 (-0.28)	0.133 (7.67)	-0.014 (-1.22)
lnscatpd	0.009 (2.65)	0.047 (1.15)	0.054 (2.90)	-0.054(-17.05)	0.024 (8.53)
lnscatsq	0.001 (0.83)	-0.000 (-0.02)	-0.002 (-0.88)	0.004 (7.09)	-0.003 (-6.43)
daysbtw	0.001 (3.11)	0.003 (2.99)	0.002 (4.47)	-0.001 (-2.58)	0.001 (2.71)
lnhhsize	-0.007 (-2.18)	0.039 (2.08)	-0.014 (-2.74)	0.016 (4.53)	-0.005 (-2.21)
agehhhyr	0.001 (1.58)	-0.003 (-1.30)	-0.000 (-0.64)	0.001 (2.30)	-0.000 (-1.55)
agehhhsq	-0.000 (-2.20)	0.000 (0.67)	0.000 (0.80)	-0.000 (-2.26)	0.000 (2.21)
yrschhh	0.002 (5.70)	0.001 (0.66)	0.002 (4.15)	-0.001 (-2.45)	0.000 (0.77)
resid	-0.019 (-6.39)	-0.015 (-0.99)	0.010 (0.17)	0.014 (4.20)	-0.007 (-3.26)
femhhh	-0.000 (-0.07)	0.044 (2.11)	0.014 (2.25)	0.006 (1.28)	0.001 (0.31)
chldctf1	-0.004 (-0.92)	0.013 (0.82)	-0.001 (-0.15)	0.006 (1.23)	-0.001 (-0.36)
chldctf2	0.003 (1.39)	-0.038 (-2.37)	0.001 (0.15)	-0.000 (-0.13)	-0.001 (-0.75)
chldctf3	-0.002 (-0.87)	0.001 (0.07)	0.000 (0.06)	0.004 (1.34)	-0.001 (-0.33)
chldctf4	-0.002 (-0.93)	-0.017 (-1.88)	-0.007 (-2.29)	-0.001 (-0.29)	0.000 (0.29)
chldctf5	0.001 (0.37)	-0.004 (-0.45)	0.000 (0.08)	-0.000 (-0.12)	0.001 (0.70)
chldctm1	0.001 (0.30)	-0.026 (-1.14)	-0.000 (-0.04)	-0.005 (-1.16)	0.004 (1.26)
chldctm2	-0.000 (-0.03)	-0.015 (-1.17)	-0.004 (-0.87)	-0.003 (-0.99)	-0.001 (-0.66)
chldctm3	0.000 (0.15)	-0.018 (-1.47)	0.001 (0.21)	0.008 (2.80)	0.002 (1.10)
chldctm4	0.000 (0.06)	0.001 (0.11)	0.003 (1.23)	-0.001 (-0.55)	-0.000 (-0.19)
chldctm5	-0.005 (-2.36)	-0.012 (-1.24)	-0.001 (-0.34)	0.001 (0.31)	0.001 (0.82)
fhchf1	-0.010 (-0.63)	-0.218 (-0.05)	-0.006 (-0.21)	-0.031 (-1.73)	0.003 (0.24)
fhchf2	-0.000 (-0.04)	0.060 (1.59)	-0.013 (-0.86)	-0.007 (-0.81)	0.005 (0.90)
fhchf3	0.013 (1.80)	-0.042 (-0.77)	-0.018 (-1.07)	-0.003 (-0.35)	0.004 (0.83)
fhchf4	-0.000 (-0.08)	0.032 (1.34)	-0.002 (-0.23)	0.002 (0.36)	0.003 (0.86)
fhchf5	-0.001 (-0.20)	-0.060 (-1.47)	0.003 (0.45)	-0.001 (-0.22)	-0.000 (-0.11)
fhchm1	0.010 (0.72)	-0.175 (-0.05)	-0.163 (-0.07)	0.026 (1.73)	0.007 (0.74)
fhchm2	0.014 (1.88)	-0.209 (-0.11)	0.009 (0.71)	-0.008 (-1.01)	0.000 (0.09)
fhchm3	-0.005 (-0.67)	-0.014 (-0.36)	0.018 (1.56)	-0.011 (-1.32)	-0.004 (-0.78)
fhchm4	0.003 (0.55)	-0.270 (-0.25)	-0.009 (-1.14)	-0.001 (-0.15)	-0.006 (-1.68)
fhchm5	0.003 (0.68)	-0.029 (-0.91)	-0.004 (-0.51)	-0.007 (-1.24)	-0.001 (-0.39)

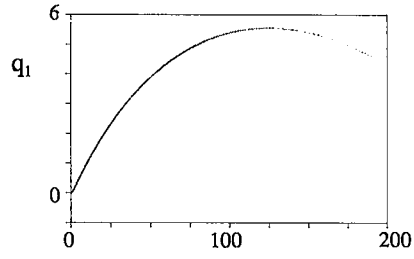
Appendix 2B, continued

Table 2B6: Estimated coefficients for category 26 to 30 (t-values in parentheses)

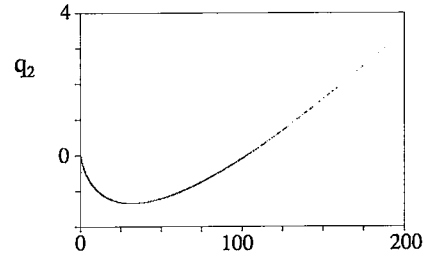
	Candies, honey, etc.	Ready to serve food	Alcoholic beverages	Soft drinks	Other food
Constant	-0.011 (-0.70)	-0.408 (-3.84)	-0.321 (-4.76)	-0.063 (-3.24)	0.009 (0.51)
lnscatpd	0.007 (1.73)	0.028 (1.07)	0.000 (0.03)	0.021 (4.38)	-0.012 (-3.47)
lnscatsq	0.002 (2.32)	0.013 (3.10)	0.010 (4.03)	-0.000 (-0.01)	0.002 (3.31)
daysbtw	0.001 (1.71)	0.004 (2.44)	0.006 (4.00)	0.000 (0.98)	-0.000 (-0.12)
lnhhsize	-0.002 (-0.47)	-0.075 (-4.42)	-0.022 (-1.58)	-0.011 (-3.03)	-0.001 (-0.24)
agehhhyr	-0.001 (-2.04)	-0.003 (-1.04)	-0.001 (-0.79)	-0.001 (-1.37)	-0.000 (-0.49)
agehhhsq	0.000 (1.51)	0.000 (0.62)	0.000 (0.26)	0.000 (0.42)	0.000 (0.72)
yrschhh	0.001 (2.50)	-0.001 (-0.40)	-0.001 (-0.47)	0.001 (2.93)	-0.001 (-1.57)
resid	-0.004 (-1.43)	-0.141 (-8.06)	0.082 (6.41)	-0.015 (-4.67)	0.004 (1.08)
femhhh	-0.002 (-0.56)	0.033 (1.60)	-0.179 (-8.49)	-0.013 (-2.70)	-0.012 (-2.58)
chldctf1	-0.006 (-1.47)	-0.002 (-0.08)	0.004 (0.26)	0.004 (0.86)	0.001 (0.12)
chldctf2	0.003 (1.30)	-0.028 (-1.94)	-0.000 (-0.04)	-0.002 (-0.67)	0.002 (0.64)
chldctf3	0.005 (2.09)	-0.004 (-0.27)	-0.010 (-0.98)	-0.003 (-1.14)	-0.000 (-0.08)
chldctf4	0.001 (0.34)	0.011 (1.18)	-0.011 (-1.55)	-0.005 (-2.56)	0.001 (0.71)
chldctf5	-0.001 (-0.47)	0.004 (0.43)	-0.001 (-0.07)	0.000 (0.10)	-0.000 (-0.02)
chldctm1	-0.012 (-2.69)	0.013 (0.53)	0.016 (0.99)	-0.003 (-0.53)	-0.001 (-0.28)
chldctm2	0.000 (0.10)	0.008 (0.56)	-0.009 (-0.87)	-0.003 (-0.98)	-0.000 (-0.16)
chldctm3	0.002 (0.73)	-0.002 (-0.18)	0.007 (0.71)	-0.006 (-2.23)	0.000 (0.03)
chldctm4	0.003 (1.66)	-0.003 (-0.33)	-0.006 (-0.92)	-0.003 (-1.50)	0.001 (0.34)
chldctm5	-0.007 (-3.39)	0.000 (0.04)	-0.008 (-1.00)	0.002 (1.01)	0.003 (1.10)
fhchf1	-0.004 (-0.25)	-0.068 (-0.68)	0.088 (1.25)	0.006 (0.30)	-0.019 (-0.97)
fhchf2	0.000 (0.04)	0.039 (0.97)	0.052 (1.50)	-0.001 (-0.09)	0.002 (0.26)
fhchf3	-0.006 (-0.75)	-0.002 (-0.06)	-0.022 (-0.57)	0.009 (1.02)	0.007 (0.78)
fhchf4	0.006 (1.32)	-0.003 (-0.15)	0.031 (1.39)	-0.003 (-0.61)	0.007 (1.17)
fhchf5	0.007 (1.37)	-0.007 (-0.29)	0.016 (0.63)	0.007 (1.34)	0.005 (0.79)
fhchm1	0.014 (1.02)	0.019 (0.29)	0.023 (0.37)	0.029 (2.00)	-0.012 (-0.73)
fhchm2	-0.006 (-0.73)	-0.002 (-0.05)	0.034 (0.94)	0.003 (0.36)	0.014 (1.58)
fhchm3	-0.008 (-0.95)	-0.013 (-0.31)	0.001 (0.04)	0.013 (1.48)	-0.005 (-0.50)
fhchm4	0.005 (1.07)	0.024 (1.06)	-0.008 (-0.33)	0.003 (0.58)	-0.006 (-1.09)
fhchm5	-0.008 (-1.49)	0.019 (0.79)	0.053 (2.28)	-0.005 (-0.84)	0.006 (1.07)

Appendix 2C: Engel curves

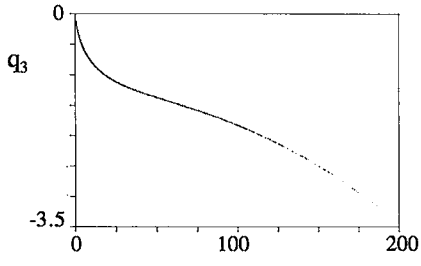
Engel curves for all 30 food categories, for an average household



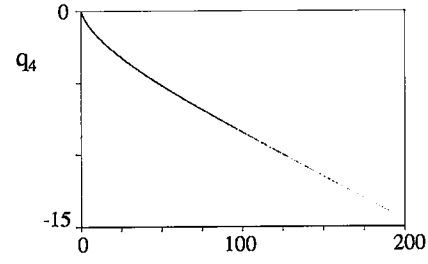
1. Rice



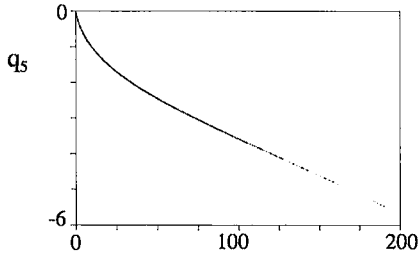
2. Corn, Maize



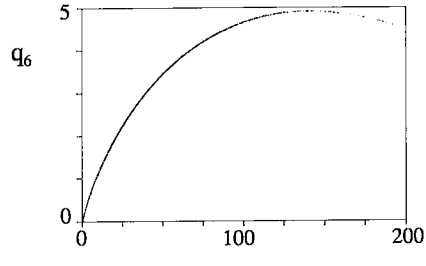
3. Wheat



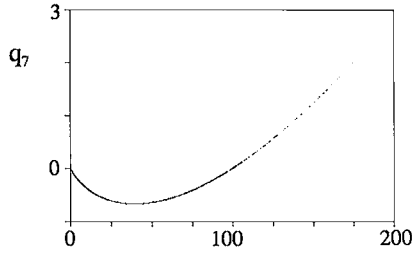
4. Barley



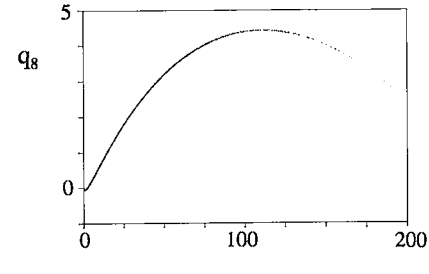
5. Quinua



6. Bread



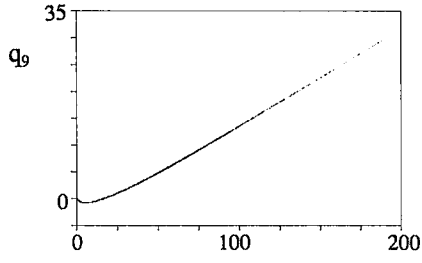
7. Cookies, cakes, etc.



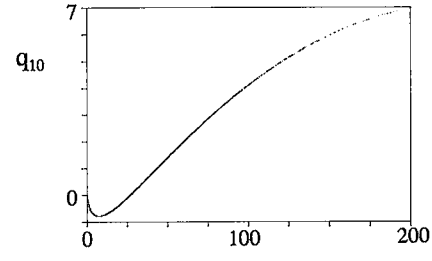
8. Noodles

Appendix 2C, continued

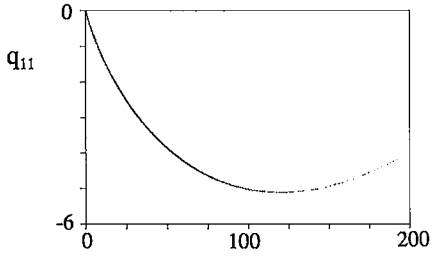
Engel curves for various food categories, for an average household



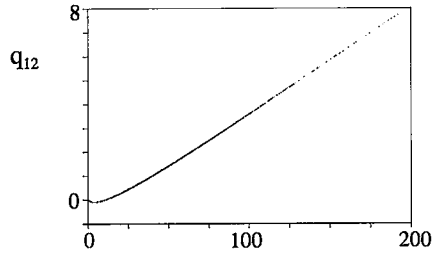
9. Red meats



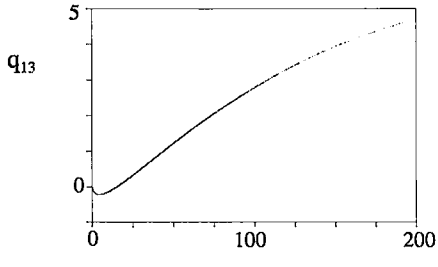
10. Poultry meats



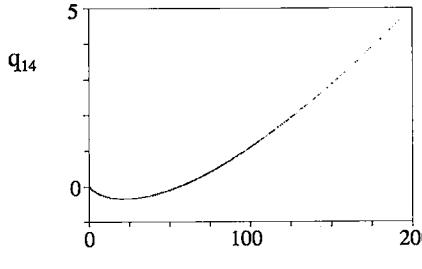
11. Meat's by-products



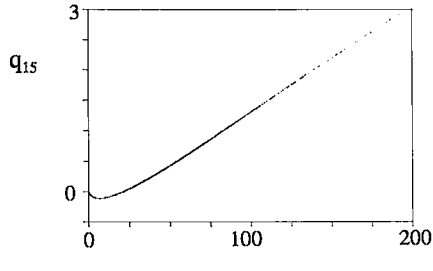
12. Fish and sea food



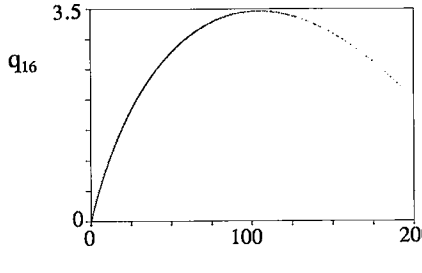
13. Milk



14. Yogourt, cheese, etc.



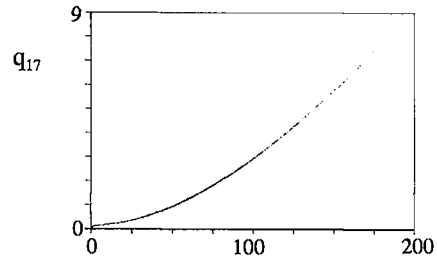
15. Eggs



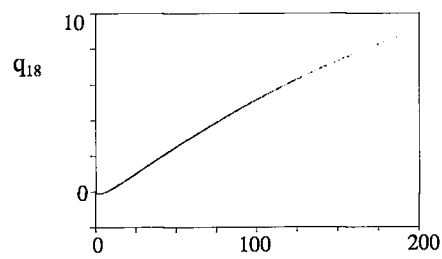
16. Oils, margarine, etc.

Appendix 2C, continued

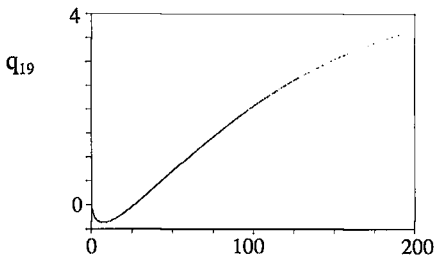
Engel curves for various food categories, for an average household



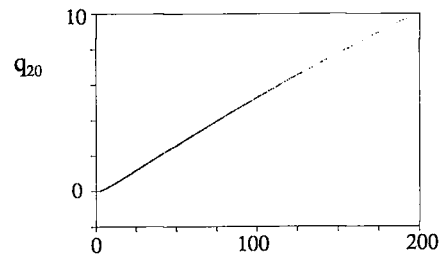
17. Seasonings



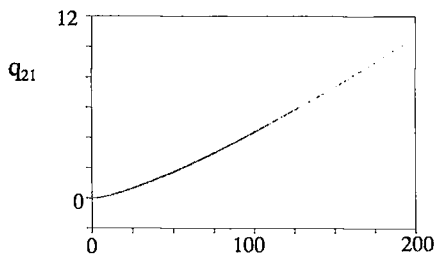
18. Tubercles & roots



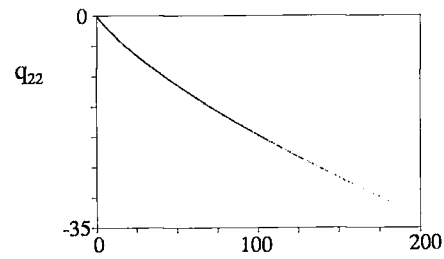
19. Dried vegetables



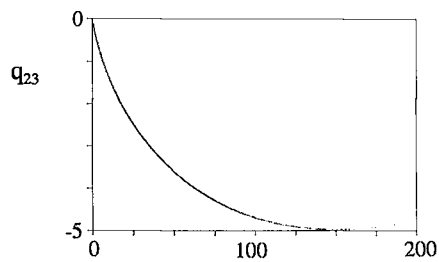
20. Fresh vegetables



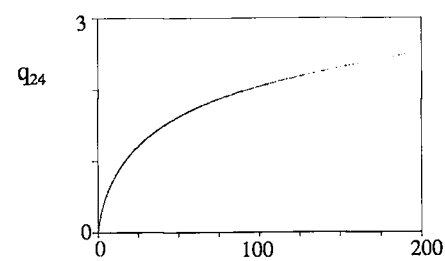
21. Fresh fruits



22. Frozen/canned vegetables



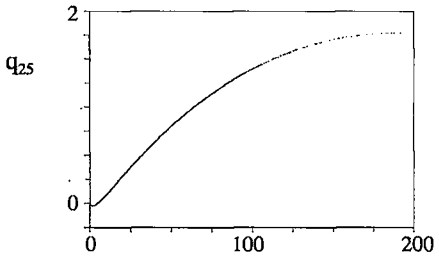
23. Frozen/dried/canned fruits



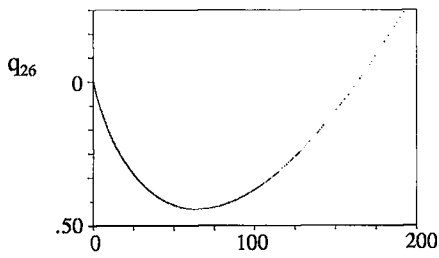
24. Sugar

Appendix 2C, continued

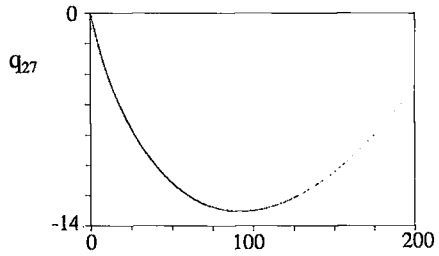
Engel curves for various food categories, for an average household



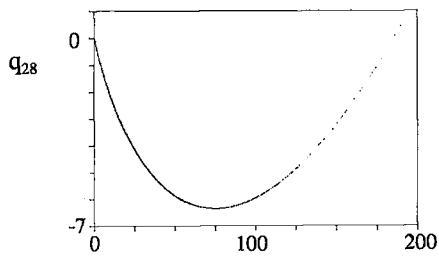
25. Coffee, tea, cacao, herbs



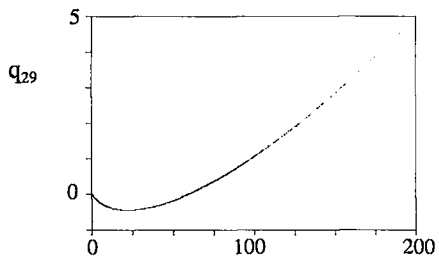
26. Candies, honey, etc.



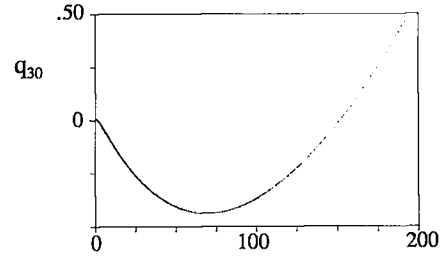
27. Ready to serve food



28. Alcoholic beverages



29. Soft drinks



30. Other food

3 Parental sex preferences and fertility decisions

3.1 Introduction

In the previous chapter, one of our goals was to examine boy-girl discrimination within the family. A question that may arise in this kind of research is if parents have an overall preference for the gender of their children. If they do, this preference may not only influence intrahousehold allocation of goods, but it may also affect fertility decisions of couples. Several studies have already concentrated on fertility behaviour of couples to investigate parental preferences for the gender of their children. In spite of the varied and extensive literature on this subject, however, there is still a lot to improve on current methods to investigate it. In this chapter we will discuss and apply various methods of testing for parental sex preferences.

Analyses of sex preferences are motivated by various reasons. First, as we already mentioned, their existence could provide an explanation for boy-girl differences with regard to intrahousehold allocation of goods, morbidity and mortality (e.g. Chen, Huq and D'Souza (1981), and Kishor (1993)). Secondly, for policy makers it will be important to know whether sex preferences will influence the effectiveness of family planning programmes (e.g. Bairagi (1993)). Moreover, if sex preferences exist, the future availability of sex preselection techniques may have a substantial impact on fertility.

Most studies of parental sex preferences concentrate on developing countries, as issues like gender preferences and family planning programmes are considered most relevant for these countries. However, for a developed country like the Netherlands, where third and higher order births are of high importance for the current birth level of about 1.5 per woman, insight in preferences of parents for additional children is desirable as well. In our opinion, the possibility that sex preferences play a role in the decision for third and higher order births should not be ignored. Moreover, it is of interest to know how fertility will change if parents become able to select the sex of their children in the (near) future.[1] The birth level per

[1] Recently, in the Netherlands a 'gender clinic' was opened, i.e. a clinic that treats parents to obtain a child of a certain sex. Although the technique used is scientifically still unproved, already 100 couples have applied. In a recent interview in a daily journal (*Trouw*, October 17th 1995) the chief executive of the clinic stated that

woman might decrease or increase, or the number of male births compared to female births might change. Even small changes in birth levels can have serious consequences for the demographic development of a country. The most likely consequences of introducing sex preselection techniques will become clear as soon as we know how parental sex preferences influence fertility (e.g. Leung (1994)). The central question we will address in this chapter is, therefore, whether sex preferences play a role in the decision for children in the Netherlands.

Before we can test for sex preferences, we have to define precisely what kind of preference we are interested in. For example, a vague indication like 'son preference' is insufficient, as it cannot differentiate between preferences for 'only sons', 'at least one son', or 'more sons than daughters'. In our study for the Netherlands we will concentrate on three possible sex preferences: 'at least one son', 'at least one daughter', and 'a mixture of sexes, i.e. at least one of each sex'. To test for these preferences we include dummy variables for the presence of 'at least one son (MB_k)', 'at least one daughter (MG_k)', and 'a mixture of sexes (MS_k)' after birth k, in our estimations. If the estimated coefficients of these dummies appear to be significant in explaining birth k+1, we conclude that the corresponding preferences influence fertility decisions. Note that these dummies cannot be included all three simultaneously, because of a linear dependency between them in case of at least one child, namely: $MB_k + MG_k - 1 = MS_k$. This linear relationship implies a simple test for a 'mixture of sexes' preference. If there is a preference for a 'mixture of sexes', then the coefficients of MB and MG should be equal and nonzero.

In this chapter, we analyze parental sex preferences from various angles using three different reduced form methods. Unlike most fertility studies, we will not only use data on past births, but also information about sterilization. We interpret the decision to have oneself or one's partner sterilized as a preference for no more children. The first method we present is an adaptation of the conventional Parity Progression Ratio (PPR) method. While the conventional method only provides a lower boundary of the 'true PPR', we will also calculate an upper boundary. Secondly, we perform a test based on a hazard analysis of birth intervals. This method was suggested by Leung (1988), who included the number of boys in a hazard model of fertility to investigate son preference in Malaysia. While Leung's emphasis on son

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most registered couples already have two sons and now want to have a daughter. The government has strongly criticized the clinic, and has resolved to "forbid it as soon as an urgent reason occurs".

preference was associated with the cultural setting of his analysis, we will also look at other forms of sex preferences by including various dummy variables representing the sex composition of the household. Finally, we estimate some reduced form equations of the decision for a sterilization, and use it as a test for sex preferences. Only in chapter 4 we will present a simple structural analysis of fertility decisions.

This chapter is organized as follows. In the next section we review the role of sex preferences in the existing fertility literature. The data we use for our estimations are described in section 3. In section 4 we discuss the adapted PPR calculations; the estimation results of the reduced form models are presented in section 5 and 6, respectively. Section 7 concludes.

3.2 Review of some literature

Recently, a number of authors have estimated econometric models of fertility; see e.g. Heckman, Hotz and Walker (1985), Heckman and Walker (1990), Hotz and Miller (1988), Wolpin (1984). These models have typically not included the sex of existing children as explanatory variables. An exception is the article by Leung (1988) who included the number of boys in a hazard model of fertility in Malaysia.

In demographic literature, the relationship between sex preferences and fertility decisions has received ample attention. Williamson (1976) presents a survey of research on these preferences in various cultures. Sex preferences are shown to vary from strong son preference in rural Egypt, Algeria, Tunesia, and some regions in India, to strong daughter preference in specific societies of New Guinea and Peru, while parents in other regions have a preference for a balance of both sons and daughters. Preferences appear to be influenced by certain characteristics like social class, level of innovativeness, ethnic group, perceived cost of raising boys or girls, education, religion, and sex of the respondent.

A major distinction between the various methods of investigating sex preferences is the type of information used. A first group of studies concentrates on *stated* preferences of parents for the sex of their children. For instance, in Coombs et al. (1975) respondents are asked to rank 16 possible family compositions (all combinations of 0 to 3 boys and 0 to 3 girls) according to their preferences. These data are used to calculate individual preference scales for number and sex of children. In order to assess if size or sex dominates fertility decisions, McClelland (1979) proposes to combine the preference scales with a stopping rule

measure, i.e. ask respondents to indicate at which family compositions no additional children would be desired. Widmer et al. (1981) apply this method to stated preferences of university students in Colorado. They find that for 32% of (consistent) respondents sex preferences increase projected fertility relative to the first choice family size, and for 19% the net effect is to decrease fertility. Arnold and Kuo (1984) apply both preference scales, and respondents' opinion on the percentage of boys in an ideal family, to examine the degree of son preference in seven Asian countries and the United States. Both measures indicate some preference for sons in all countries; the strongest preference is found in Korea and Taiwan, the weakest in Indonesia and the Phillipines.

A second group of studies, into which our present paper can be classified, searches for *revealed* sex preferences by comparing reproductive behaviour of couples with different family compositions. For instance, in Bairagi (1993) the use of contraceptives by women in Bangladesh is related to the sex of their children. The results show that the percentage of women within each parity using contraceptives was lowest for women who did not have any living son, and was usually highest for those women who had sons and a daughter. Using Indian data, Das (1987) shows that at all parities couples with no sons more often got an additional child than those who already had one or more sons, except when all living children are sons, and also that contraceptive use increased with the number of sons.

The two alternative methods mentioned above may lead to different conclusions about sex preferences. For instance, if people are not able to control their fertility, they may state to have a certain sex preference but their preference cannot be revealed by their reproductive behaviour. For this reason Chowdhury and Bairagi (1990) suggest that the effect of sex preferences on fertility will be more pronounced in populations with a high use of contraceptives. Moreover, if sex preferences of various couples are very heterogeneous, their revealed effects on the 'average fertility' of a sample may be much smaller than their effects on individual reproductive behaviour. So sex preferences may be more difficult to discover using the second method than using the first. Alternatively, the information used by the second method may be more reliable. Respondents may be less able or willing to state their preferences regarding the sex of their children, than to provide information on facts like past births and contraceptive use. In the following study we focus exclusively on the investigation of *revealed* sex preferences.

Some studies in literature have compared results of both methods of investigating sex

preferences. Coombs and Sun (1978) and Coombs (1979) show that stated preferences for number and sex of children correspond to past fertility behaviour, to current use of contraception, and to actual subsequent fertility of respondents in Taiwan. Cleland et al (1983) use both a stated preference, namely the preferred sex of the next child, and revealed preferences, like comparing the use of contraceptives and the rate of fertility of couples with various family compositions, to investigate sex preferences in 28 developing countries in Africa, Asia and America. Their study shows that the various types of information can suggest sex preferences of different strength. Overall they conclude that son preference is not universal in developing countries and is often tempered by the desire for at least one daughter.

Although sex preferences are mostly associated with and typically investigated in developing countries, they appear to be present in European countries as well. In a study of Swedish women, Hoem (1993) finds that the absence of a son significantly increases the hazard of having a third birth. For the Netherlands Moors et al. (1980) find evidence of a preference for one child of each sex, using both stated attitudes and parity progression rates.

3.3 Data: the Dutch ORIN survey

The empirical analysis of this chapter is based on the Dutch ORIN survey ('Onderzoek Relatievorming in Nederland', i.e. Research into the formation of relationships in the Netherlands), which was held in 1984. It comprises 1600 respondents, both men and women between 18 and 54 years old, in various living arrangements.

In contrast with most studies, we do not restrict our analysis to married respondents only. We include individuals living in various types of household structure, such as unmarried cohabitors, married and remarried persons, one-parent families and singles. It should be noted that we only use information on present type of household structure. The fact that a person lives as a single at present does not exclude the possibility that he/she has been married or living with a partner previously. So the household structure may define a more heterogeneous group than expected at first sight. We include dummies for the various types of household structure in the set of variables influencing fertility, because certain household structures may limit the number of children. For instance, the death of a parent may cause the surviving partner, now living in a one-parent household, to have no more children. Moreover, a person that wants to have children but prefers to raise them on his/her own may be inclined to

choose a smaller number of children than a two parent household. By including a dummy for one-parent households this reducing effect will be absorbed in the coefficient of this dummy and will not blur the coefficients of the other variables. Inclusion of the dummies may also raise some difficulties, as the household structure may not be exogenous. Certain living arrangements may simply reflect that the respondent has not yet gotten so far to have children. However, in the reduced form analyses of this chapter we consider only households with at least one child. So notwithstanding their present household structure all included respondents have had the opportunity to obtain at least one child. We therefore treat the dummies for household structure as exogenous explanatory variables in our estimations.

For our research we excluded respondents with adopted, fostered or step-children, since in those cases it is unclear to what extent the gender and the number of the children is a choice variable. Respondents who have become sterile by an accident or illness and inconsistent observations were excluded as well. After this, about 1450 cases remain, of which about 650 with children. Moreover, for households with children from more than one marriage, we used information about the children from the first marriage only. The households in our sample have not all completed their fertilities. Particularly respondents in the 18-24 and 25-34 age groups, may continue (or start) childbearing after the moment of survey.[2] In the next section we will discuss this problem of right censoring in the data. In appendix 3A some descriptive statistics of the variables used in our estimations are listed.

3.4 Parity Progression Ratio's

As a preliminary analysis of the fertility data we apply a widely used measure to test for sex preferences: the Parity Progression Ratio (PPR). The PPR-method calculates the proportion of couples of a given parity who go on to a higher parity. If couples with a certain sex composition are more likely to have additional children than other couples, the PPR will differ for households with various sex compositions. The problem with this method, however, is that it ignores right censoring in the data; couples with no additional children at the time of survey are assumed to stay at that parity, which is clearly a very strong assumption. As

[2] For instance, 12.7 per cent of the males between 25 and 34 years old and 10.2 per cent of the females of this age in our sample, report that they intend to have an additional child within two years after the moment of survey.

a result, the conventional PPR is just a lower boundary of the 'true PPR', i.e. the PPR that would result when using completed fertility spells (e.g. Leung, 1988).

To analyze the biasing effect of censoring, we use information about the ability of couples to have additional children, for instance if they have had a sterilization or if they have passed the age of childbearing. This enables us to calculate an adapted PPR, namely the proportion of couples of a given parity who are still able to obtain an additional child. Note that this adapted PPR forms an upper boundary of the 'true PPR'. The PPR-boundaries calculated from our data are listed in the last two columns of table 3.1.

Table 3.1: Parity Progression Ratio's

number of children (k)	number of boys	number of hhs with at least k children	number of hhs with at least k+1 children	number of hhs with exactly k children	number of hhs with exactly k children, no longer fertile	number of hhs with exactly k children, still fertile.	Lower boundary PPR [1]	Upper boundary PPR [2]
1	0	320	234	86	15	71	0.731	0.953
	1	334	239	95	13	82	0.716	0.961
2	0	126	59	67	26	41	0.468	0.794
	1	224	76	148	64	84	0.339	0.714
	2	123	55	68	28	40	0.447	0.772
3	0	23	9	14	9	5	0.391	0.609
	1	76	30	46	27	19	0.395	0.645
	2	63	23	40	22	18	0.365	0.651
	3	28	8	20	10	10	0.286	0.643
4	0	5	2	3	1	2	0.400	0.800
	1	20	9	11	6	5	0.450	0.700
	2	30	12	18	6	12	0.400	0.800
	3	12	4	8	4	4	0.333	0.667
	4	3	2	1	1	0	0.667	0.667

1) Lower boundary of PPR = (# hhs with at least k+1 children) / (# hhs with at least k children)
2) Upper boundary of PPR = (# hhs still able to obtain (k+1)st child) / (# hhs with at least k children)

As can be seen from the table, at parity 2 both colums show a lower PPR in case of a 'mixture of sexes' in the household, compared with the PPRs of families with only sons and only daughters. We execute Chi-square tests for the hypothesis that the PPRs are independent of the sex composition of the children, i.e that the calculated PPRs for various number of boys are not significantly different from each other. At parity 2, a test based on the upper

boundary of the PPR does not reject the null hypothesis at a 10% significance level (p-value is 0.21), while a test based on the lower boundary of the PPR (i.e. the conventional PPR test) rejects the null hypothesis at the 5% significance level (p-value is 0.03). At the other parities the null hypothesis is not rejected.

So, the conventional PPR method (i.e. the lower boundary) suggests that there is some evidence for a 'mixture of sexes' preference at parity two. However, given the considerable gap between the lower and upper PPR bounds, we must conclude that they are uninformative about whether the true PPR varies with sex composition.

3.5 Hazard analysis of birth intervals

An alternative method to analyze parental sex preferences, suggested by Leung (1988), is by means of a hazard analysis of birth intervals. The idea of this method is that couples who are less satisfied at a certain parity, for instance because they have no 'mixture of sexes', will have a higher probability of leaving that parity, and thus will tend to have shorter subsequent birth intervals, than couples who are more satisfied. We choose a Cox proportional hazard model, which specifies the hazard rate[3] as follows:

$$\lambda_{ik}(t,x) = \lambda_k(t).\exp(\beta_k' x_{ik}) \qquad (3.1)$$

where x_i includes variables that can influence fertility decisions of parents, like education of parent, age, labour force participation, sex of present children, and importance of religion. To estimate Cox's proportional hazard at a certain parity, we include all couples that have once achieved that parity. For couples who have left to a higher parity we use the closed birth intervals, and for couples who have not left (censored observations) we use the information that their birth interval will be longer than the time already spent in the present parity. The advantage of Cox's model is that it allows the hazard to change over time, without having to specify the time dependent part of the hazard rate $\lambda(t)$ for the estimation of ß, i.e. the vector of coefficients of individual characteristics that influence the hazard rate.

In table 3.2 estimation results for various parities are presented. For definitions of the variables used in our estimations, the reader is referred to the appendix of this chapter.

[3] The hazard rate denotes the probability that an individual i leaves parity k at time t, conditional on not having left the parity before t.

Table 3.2: Estimation results hazard analysis of birth intervals (t-values in parentheses)

	2 → 3 (k = 2)	**3 → 4 (k = 3)**	**4 → 5 (k = 4)**	**2 → 3 (k = 2)**
education of respondent	-0.126 (-1.65) *	-0.004 (-0.03)	-0.025 (-0.10)	-0.119 (-1.55)
more than full time job	-0.271 (-0.44)	-0.156 (-0.19)	-0.281 (-0.22)	-0.304 (-0.49)
full time job	-0.234 (-0.99)	-0.019 (-0.05)	-2.238 (-2.29) **	-0.233 (-0.98)
part time job	-0.303 (-1.37)	-0.276 (-0.62)	-0.081 (-0.11)	-0.309 (-1.39)
religion 'very important'	0.671 (3.36) **	0.639 (1.68) *	-0.069 (-0.12)	0.686 (3.42) **
religion 'not very important'	0.179 (0.93)	0.397 (1.03)	0.675 (1.18)	0.179 (0.93)
votes 'right-wing'	-0.149 (-0.68)	0.933 (2.81) **	0.714 (1.09)	-0.160 (-0.73)
votes 'left-wing'	-0.059 (-0.34)	0.284 (0.84)	1.076 (1.97) **	-0.064 (-0.37)
male respondent, aged 18-24	-10.954 (-0.03)	-	-	-10.935 (-0.03)
female respondent, aged 18-24	-11.448 (-0.05)	-	-	-11.457 (-0.05)
male respondent, aged 25-34	-1.247 (-2.01) **	1.363 (1.21)	-6.223 (-0.03)	-1.197 (-1.92) *
female respondent, aged 25-34	-1.299 (-3.22) **	-10.886 (-0.06)	-	-1.313 (-3.26) **
male respondent, aged 35-44	-0.303 (-1.09)	-0.117 (-0.23)	1.862 (1.43)	-0.312 (-1.12)
female respondent, aged 35-44	-0.266 (-1.30)	0.062 (0.16)	-0.008 (-0.01)	-0.254 (-1.24)
male respondent, aged 45-54	0.110 (0.45)	0.886 (2.31) **	1.463 (2.09) **	0.122 (0.50)
mixture of sexes at parity k	-0.295 (-1.94) *	0.252 (0.84)	-0.743 (-1.17)	-
at least one boy at parity k	-	-	-	-0.385 (-2.12) **
at least one girl at parity k	-	-	-	-0.211 (-1.16)

* = significant at 10% critical level
** = significant at 5% critical level

We find evidence for a 'mixture of sexes' preference at parity two. The estimate presented in the first column implies that the presence of a mixture of sexes at parity two reduces the baseline hazard rate of the transition to parity three by one quarter. We also find that the dummy for 'great importance of religion' has a positive and education has a negative effect on the hazard for a third child. For the other variables we find no significant coefficients, except for two of the age-sex categories. Both male and female respondents in the youngest age category are less likely to leave parity two. Dummies for type of household structure of the respondent are all insignificant and not reported in table 3.2.

For parity two, we also estimate an equation including dummies for 'at least one son' (MB_2) and 'at least one daughter' (MG_2) instead of the 'mixture of sexes'-dummy. Our estimation results (see column 4) show negative coefficients for both variables, although the MG-coefficient is not significantly different from zero. However, a Likelihood Ratio test on equality of both coefficients gives a test statistic of 0.762 (p-value is 0.38), so the hypothesis of equality is *not* rejected. Testing the hypothesis of both coefficients being zero results in a test statistic of 4.594 (p-value is 0.10), so it is just rejected at a 10% significance level. In addition we want to remark that a test on both coefficients being zero *given* both being equal, i.e. a test on $MS_2=0$, gives a test statistic of 3.832 (p-value is 0.05). All tests point to some extent at a preference for a 'mixture of sexes' at parity two.

The estimation results for higher parities are presented in the second and third column. Male respondents in the age category of 45 to 54 appear to have a higher probability of leaving both parity three and four. Furthermore, having a full-time job significantly reduces the probability of having a fifth child. Voting behaviour also appears to have some influence in fertility behaviour. More importantly, the 'mixture of sexes'-dummy is not significant at both parities.

Note that the variables for labour force participation (part time, full time, or more than full time), and for education of the respondent do not show a very strong influence at the various parities, while in other studies these variables appear to influence birth intervals (see e.g. Heckman, Hotz and Walker('85); Wolpin('84) and Ahn ('94) include education only). We should note in this context that our sample of respondents contains both mothers and fathers, while the effects of the mentioned variables can be different for mothers than for fathers. However, if we estimate the same hazard equations based on the subsample of female respondents only, we do not find significant coefficients for the intended variables either.

Another possible explanation may be that labour force participation and education are endogenous, as a result of which our estimates of these coefficients can be obscured.

3.6 Analysis of the decision for sterilization

In our previous analysis we used birth intervals as a measure for the eagerness of couples to have additional children. Another variable in our dataset that could inform us on this, is if the couple has decided to have a sterilization. We can interpret the decision for a sterilization as a preference for no more children. But then, if parents have a preference for a mixture of sexes, couples who have achieved this desired sex composition will be more likely to have a sterilization than couples who have only sons or only daughters.

To examine the influence of sex preferences on the decision to have oneself or one's partner sterilized, we perform a Probit analysis on a dummy for sterilization. We exclude households with no children at all, so that the linear dependency between MB_k, MG_k and MS_k (see section 3.1) holds for all cases used. We include the same explanatory variables as in the hazard estimation, plus the number of children the couple already has. Note that this probit analysis only uses information available at the moment of survey; couples can have a sterilization or additional children after the moment of survey. The estimated coefficients are listed in the first two columns of table 3.3.

Again we find some evidence for a 'mixture of sexes' preference: the estimated coefficient of the 'mixture of sexes'-dummy is positive, and has a t-ratio of 1.69 ($p=0.09$). Furthermore, we find significant coefficients for the dummy for 'great importance of religion', the dummy for having a full time job, and some of the age and sex dummies, all with plausible signs. The negative coefficient of education level may reflect the postponing of childbirths by higher educated persons. Alternatively, education may, as a proxy for income, increase the preferred number of children and therefore reduce the probability of having a sterilization. Some of the dummies for household structure appear significant as well. Respondents that are remarried, or are presently living as a single or in a one-parent family, are less likely to have chosen for a sterilization than married respondents[4].

[4] The significantly negative coefficient for remarried respondents may be caused by our way of data selection. For remarried respondents, we chose to use information of the first marriage only. Consequently, of a remarried respondent a smaller part of 'history' is considered than for a married one, which may decrease his/her probability of being sterilized.

Table 3.3: Estimation results analysis of sterilization decision (t-values in parentheses)

	Results Probit		Results 2SLS	
	MS_k included	MB_k & MG_k included	MS_k included	MB_k & MG_k included
constant	-0.381 (-1.26)	-0.628 (-1.86) *	1.480 (2.53) **	0.895 (2.90) **
education of respondent	-0.117 (-1.83) *	-0.118 (-1.83) *	-0.073 (-2.10) **	-0.073 (-2.11) **
more than full time job	0.369 (0.59)	0.363 (0.58)	0.198 (0.85)	0.199 (0.85)
full time job	0.345 (1.79) *	0.345 (1.80) *	-0.059 (-0.60)	-0.059 (-0.60)
part time job	0.217 (1.23)	0.220 (1.24)	-0.088 (-0.92)	-0.089 (-0.93)
votes 'right-wing'	-0.050 (-0.25)	-0.052 (-0.25)	0.027 (0.32)	0.026 (0.32)
votes 'left-wing'	0.039 (0.29)	0.041 (0.30)	0.045 (0.82)	0.044 (0.81)
religion 'very important'	-0.379 (-2.11) **	-0.378 (-2.11) **	0.079 (0.68)	0.079 (0.69)
religion 'not very important'	-0.170 (-1.18)	-0.169 (-1.17)	0.045 (0.61)	0.045 (0.62)
remarried	-0.973 (-4.65) **	-0.973 (-4.64) **	-0.195 (-2.18) **	-0.196 (-2.18) **
child in one-parent family	-3.995 (-0.03)	-3.997 (-0.03)	-0.454 (-1.05)	-0.452 (-1.04)
head of one-parent family	-0.569 (-3.73) **	-0.571 (-3.73) **	-0.122 (-1.86) *	-0.122 (-1.86) *
single	-0.693 (-3.12) **	-0.697 (-3.13) **	-0.341 (-3.20) **	-0.341 (-3.19) **
unmarried cohabitation	-0.120 (-0.44)	-0.127 (-0.46)	-0.040 (-0.31)	-0.039 (-0.30)
no steady partner	0.158 (0.20)	0.172 (0.22)	0.302 (0.72)	0.301 (0.71)
male respondent, aged 18-24	-4.274 (-0.09)	-4.281 (-0.09)	-0.781 (-2.58) **	-0.781 (-2.58) **
female respondent, aged 18-24	-1.034 (-2.09) **	-1.035 (-2.09) **	-0.694 (-2.37) **	-0.695 (-2.37) **
male respondent, aged 25-34	-0.216 (-0.71)	-0.218 (-0.72)	-0.400 (-1.98) **	-0.401 (-2.00) **
female respondent, aged 25-34	-0.103 (-0.41)	-0.102 (-0.41)	-0.392 (-2.03) **	-0.393 (-2.04) **
male respondent, aged 35-44	0.322 (1.37)	0.322 (1.37)	-0.027 (-0.27)	-0.028 (-0.27)
female respondent, aged 35-44	0.846 (4.49) **	0.845 (4.49) **	0.165 (1.87) *	0.165 (1.86) *
male respondent, aged 45-54	-0.045 (-0.18)	-0.045 (-0.19)	0.118 (1.03)	0.118 (1.03)
number of children k	-0.038 (-0.54)	-0.039 (-0.54)	-0.537 (-1.92) *	-0.539 (-1.93) *
mixture of sexes at parity k	0.245 (1.69) *	-	0.587 (1.95) *	-
at least one boy at parity k	-	0.267 (1.53)	-	0.586 (1.93) *
at least one girl at parity k	-	0.226 (1.35)	-	0.592 (1.98) **

* = significant at 10% critical level ** = significant at 5% critical level

We also estimated a specification with dummies for 'at least one son' and 'at least one daughter' included. Both coefficients have the expected sign but are not significant. A LR-test on equality of the coefficients of these two dummies does not reject equality (test-statistic is 0.05, p-value is 0.82). The hypothesis that both coefficients are zero is not rejected (test-statistic is 2.9042, p-value is 0.23), while the hypothesis that both coefficients are zero *given* both being equal is rejected at the 10% significance level (statistic is 2.85, p=0.09).

We are somewhat surprised that the number of children appears to have no significant effect on the decision to have a sterilization. This result may be due to endogeneity of the number of children k: the number of children may influence the sterilization decision, but a sterilization also limits the number of children. To investigate this possibility, we apply an instrumental variable procedure (2SLS) to the same sterilization data. As instrumental variables we use the income class of both partners, because income is likely to be related to the number of children but not to the (costless) sterilization decision. The results of this 2SLS procedure are presented in the last two columns of table 3.3.

The results now show a larger influence of number of children on the decision to have a sterilization. The significantly negative coefficient of k implies that especially couples with a small number of children choose to have a sterilization. Possibly, the strong preference for a small family of some couples causes them to have a sterilization. Other couples, who prefer to have larger families, may be less willing to limit their fertility by a definite measure like sterilization. Furthermore, we see that religion looses its importance and that more age-sex categories have become significantly negative: respondents under 35 are less likely to have had a sterilization than elder persons. More importantly, the coefficient for 'mixture of sexes' gains in significance and still has the expected sign. Estimation of a specification including dummies for 'at least one son' (MB_k) and 'at least one daughter' (MG_k) (column four) gives very much the same results as the one including a dummy for a 'mixture of sexes' (column three). A Likelihood Ratio test on equality of the coefficients of MB_k and MG_k gives a test statistic of 1.137 (p-value is 0.29), so the hypothesis of equality is not rejected. Moreover, a test on the coefficient of MS_k being zero results in a test statistic of 98.4 (p-value is about zero), so this hypothesis is strongly rejected.[5]

Although the exact relation between number of children, sex preferences and the

[5] In the specification without any dummy for sex composition, the t-value of number of children is -1.78, so the coefficient is still significant at a 10% critical level.

sterilization decision remains very complicated, in our opinion the instrumental variable estimations provide evidence of the existence of a preference for a 'mixture of sexes' in the Netherlands. A more thorough examination of how sex preferences, number of children and sterilization successively influence each other requires structural modelling of the fertility behaviour of couples. In the next chapter, a simple structural model of parental preferences for the number and sex of their children will be presented.

3.7 Conclusions

In this chapter we investigated whether parental sex preferences play a role in fertility decisions of couples in the Netherlands. We applied various methods and used different types of data, in order to check the robustness of our results. The Parity Progression Ratio method was found to be less useful for the present purposes. For both other methods we obtained evidence of a parental preference for a mixture of sexes. The hazard analysis of birth intervals shows that, at parity two, couples with a son and a daughter are less likely to have an additional child than couples with only sons or only daughters. Furthermore, the 2SLS analysis shows that couples with children of both sexes are more likely to have a sterilization than other couples.

An interesting issue for further research is to estimate how fertility will change if parents obtain the possibility of (costlessly) choosing the sex of their children. This would require estimation of preference parameters in a structural fertility model. Given the parental 'mixture of sexes'-preference we found in the previous sections, we expect two opposite effects. On the one hand, couples with one child will be more likely to bear a second child in the new situation than in the old. This results from the fact that in the former case parents can achieve their desired sex composition (and the corresponding gain in utility) with certainty at parity two, while in the latter case this will only happen with a probability of one half. On the other hand, some couples that will bear more than two children in the old situation trying to obtain a mixture of sexes, can achieve this sex composition at a lower parity in the new situation. Whether the first or the second effect will dominate is an empirical matter.

Appendix 3A: Variables used in regressions

Only respondents with at least one child included. Number of observations: 654

Variable	Meaning	mean	S.D.	skew.	kurt.	min	max
K	Number of (own) children of resp.	2.31	1.22	1.47	6.21	1	9
EDUC	Education level of resp.	2.61	1.03	0.26	2.71	1	5
DOR:	Dummies for type of household structure of respondent:						
DOR1	married, still together	0.34	0.48	0.66	1.44	0	1
DOR2	remarried	0.15	0.35	2.00	4.98	0	1
DOR3	child living at home	0.00	0.00	0.00	0.00	0	0
DOR4	child living in 1-parent family	0.00	0.06	17.99	****	0	1
DOR5	head of one-parent family	0.34	0.47	0.69	1.47	0	1
DOR6	single	0.12	0.32	2.35	6.51	0	1
DOR7	unmarried cohabitation	0.05	0.21	4.34	19.82	0	1
DOR8	not married, no steady partner	0.01	0.07	14.65	****	0	1
DMTJ	Resp. more than full time employed	0.01	0.11	8.87	79.64	0	1
DFTJ	Resp. in full time employment	0.32	0.47	0.78	1.61	0	1
DPTJ	Resp. in part time employment	0.16	0.37	1.83	4.36	0	1
DRG1	Religion is important in life of resp.	0.27	0.44	1.04	2.08	0	1
DRG2	Religion not very important to resp.	0.32	0.47	0.77	1.59	0	1
DVBR	Resp. votes right wing (CDA, SGP, RPF, GPV)	0.15	0.36	1.96	4.84	0	1
DVBL	Resp. votes left wing (PvdA, PPR, PSP, CPN)	0.42	0.49	0.33	1.11	0	1
DASC:	Age and sex category of resp.:						
DASC1	men, aged 18-24	0.03	0.16	5.95	36.44	0	1
DASC2	women, aged 18-24	0.06	0.24	3.66	14.39	0	1
DASC3	men, aged 25-34	0.08	0.27	3.07	10.41	0	1
DASC4	women, aged 25-34	0.11	0.31	2.49	7.20	0	1
DASC5	men, aged 35-44	0.18	0.39	1.65	3.71	0	1
DASC6	women, aged 35-44	0.19	0.39	1.60	3.54	0	1
DASC7	men, aged 45-54	0.15	0.36	1.98	4.91	0	1
DASC8	women, aged 45-54	0.20	0.40	1.47	3.17	0	1
DSTER	Resp. or partner has had a sterilization	0.20	0.40	1.50	3.24	0	1
DMS_k	Presence 'mixture of sexes' at parity k						
DMB_k	Presence 'at least one boy' at parity k						
DMG_k	Presence 'at least one girl' at parity k						

In our estimations, the following dummy-categories are used as reference group:

DOR1	Married	DRG3	Religion has no importance in life of respondent
DASC8	Women, aged 45-54	DVBO	Votes for other party, neither right nor left wing
DNJ	Not employed		

4 A structural analysis of parental sex preferences

4.1 Introduction

In the previous chapter we used information on either birth intervals or sterilization decisions to investigate the satisfaction of parents with children of a certain number and sex. With the hazard analysis and the PPR-method we could only investigate if sex preferences play a role at a certain parity; Heckman and Walker ('90) demonstrate the dangers of the piecemeal approach. Our analyses of the sterilization decision also treat the interrelationship between number and sex of children in a very rough way. Actually, none of the reduced form methods clarifies how parents weigh a sex preference against a preferred parity.

For example, suppose a couple wants to have three children, but also prefers to have a son. Then, only after three children sex preferences may become visible: if the desired sex composition is not achieved by then, the couple will have to decide whether the expected benefit from a more desired sex composition outweighs the costs of a less desired fourth child. Note that this implies that couples with equal sex preferences but a different number of desired children can face different fertility decisions. Moreover, estimated effects of sex preselection techniques on fertility will be different if one considers only sex preferences than if one considers sex preferences in combination with preferences for the number of children.[1]

To investigate parental preferences for both the sex and the number of their children simultaneously, a structural approach is required. In this chapter a simple structural model of fertility decisions is presented and estimated using the same dataset as in the previous chapter. Given the cross-section nature of our data, the absence of information on (female) work histories and the absence of information on the use of contraceptives other than sterilization, the model is not meant to be a full structural representation of fertility decisions. Rather it allows us to analyze the interrelationship between desired number of children and desired sex composition in a relatively simple way. In view of the results of the previous chapter, in this chapter we exclusively concentrate on a parental preference for a mixture of

[1] For instance, assume that sex preselection techniques are introduced in a country where parents have a preference for a mixture of sexes. If preferences for the number of children are ignored, all couples will have exactly two children, one son and one daughter, and the sex of the second child will always be preselected. But if couples choose different numbers of children, only the last child will be preselected, iff the former children are all of the same sex.

sexes. Other possible forms of sex preferences are ignored.

In the next section we present a structural model of fertility decisions of households. In section 4.3 we briefly discuss the implications of heterogeneity of parental sex preferences for our model. Next, in section 4.4, the empirical results of the model of section 4.2 are presented. And in section 4.5 we investigate how fertility will change if sex preselection techniques become available and parents can choose the sex of their children. Section 4.6 concludes.

4.2 A simple structural model of parental sex preferences

Assuming sequential decision making of couples, the fact that a certain couple has three children, for example, tells us that they prefer one child over no children, two over one, and three over two children. We postulate that parents have the following utility function:

$$v(K,MS_K) = a.K^2 + b.K + d.MS_K.\exp(c.K) \qquad (4.1)$$

where K denotes the number of children they have, and MS_K is a dummy that takes the value 1 if there is a 'mixture of sexes' after K children, and 0 if all K children are of the same sex. Note that this specification allows the influence of MS_K to vary over K; in case of a negative (positive) c, MS_K becomes less (more) important at higher parities, while for c equal to zero the influence of MS_K is the same at all parities. Further note that the specification ensures that v(K,1)-v(K,0) has the same sign for all K>0. Equation (4.1) is neither a direct nor an indirect utility function, but rather a convenient hybrid. It can be thought of as a direct utility function with K, MS_K and other goods as arguments, where the latter has been substituted out using the budget constraint. Thus income and prices (which are unobserved in the present data set), as well as other variables that affect utility, are absorbed in the parameters a, b, c, and d. It follows that:

$$\begin{aligned} v(0,0) &= 0 \\ v(1,0) &= a + b \\ v(n,MS_n) &= a.n^2 + b.n + d.MS_n.\exp(c.n)\ , \quad n>1\ . \end{aligned} \qquad (4.2)$$

We assume that b varies across households as follows,

$$b_i = \beta_0 + x_i'\beta_1 + \epsilon_i, \qquad (4.3)$$

where x_i includes various household characteristics like we used in sections 3.5 and 3.6, and $\epsilon_i \sim N(0,\sigma^2)$. Given the ordinal nature of (4.1), a normalization on the parameters is required. We choose to fix σ at 1 (an alternative normalization is to fix a and estimate σ). We further assume perfect birth control, i.e. all parents can achieve their desired number of children, and that the perceived probability of a male birth is ½. Then, for a household with one child we know that:

$v_i(0,0) < v_i(1,0)$, so $\epsilon_i > -a - \beta_0 - x_i'\beta_1$.

In the same way we can derive that for a household with two children:

$v_i(1,0) < E\{v_i(2,MS_2)\} = v_i(2,E\{MS_2\})$, so $\epsilon_i > -3.a - \beta_0 - x_i'\beta_1 - ½.d.\exp(2c)$.

And for a household with n children:

$v_i(n-1,MS_{n-1}) < v_i(n,E\{MS_n|MS_{n-1}\})$,

so $\epsilon_i > -(2n-1).a - \beta_0 - x_i'\beta_1 - ½.d.(1+MS_{n-1}).\exp(c.n) + d.MS_{n-1}.\exp(c.(n-1))$.

Based on this information on the present number of children in the household only, the likelihood contributions for households with 1 child or with n children respectively would be:

$$l = \Phi\left(\frac{a + \beta_0 + x_i'\beta_1}{\sigma} \right)$$

and **(4.4)**

$$l = \Phi\left(\frac{(2n-1).a + \beta_0 + x_i'\beta_1 + \frac{1}{2}d.(1+MS_{n-1}).e^{c.n} - d.MS_{n-1}.e^{c.(n-1)}}{\sigma} \right) .$$

It can be shown that the likelihood function based on (4.4) does not identify the model, since it only uses information on lower bounds of the ϵ_i's. We achieve identification by using extra information on the probability that households have already achieved their preferred number of children at the time of the survey.

Let us define K^* to be the number of children a respondent prefers to have, and let K denote the number of children present at the time of survey. As we assume that people only get 'wanted' children, we know that $K^* \geq K$. Let us define P_v as the probability that a respondent already has had the chance to realize its preferred number of children. If $P_v=1$ we know for certain that K will not increase anymore, so that $K^*=K$. However, as long as $P_v<1$ K can still increase further, so we only know that $K^* \geq K$. It seems plausible that P_v depends on the age of the parent and on a possible sterilization of the respondent or his/her partner. We assume that P_v increases linearly with age, from 0 at the age of 17 to 1 at the

age of 42. Moreover, for couples that have undergone a sterilization we set P_v to 1 and thus $K^*=K$, as we know with certainty that they do not want any additional children. In other words, P_v is defined as:

$$P_v = \max\ [D_{si}\ ,\ \min[(age-17)*0.04\ ,\ 1]\ ] \tag{4.5}$$

where D_{si} is a dummy that takes the value 1 if respondent i or his/her partner has had a sterilization, and 0 otherwise. Now, the probability that a respondent included in our sample has n children equals the probability that this individual's preferred number of children $K^*=n$ *plus* the probability that he/she will have additional children in the future, i.e. $K^*>n$. In formula:

$$P(K=n) = P(K^*=n) + (1-P_v).P(K^*>n) \tag{4.6}$$

or:

$$P(K=n) = P_v.P(K^*=n) + (1-P_v).P(K^*\geq n) \tag{4.7}$$

We can now derive the likelihood contributions of households given their present number of children K, and their probability P_v of having completed their fertility. For instance, the likelihood contribution of a respondent with no children (K=0) is:

$$\begin{aligned} P(K=0) &= P_v.P(K^*=0) + (1-P_v).P(K^*\geq 0) \\ &= P_v.P(\epsilon_i < -a-\beta_0-x_i'\beta_1) + (1-P_v).1 \\ &= P_v.\Phi\left(\frac{-a-\beta_0-x_i'\beta_1}{\sigma}\right) + (1-P_v)\ , \end{aligned} \tag{4.8}$$

for a respondent with 1 child (K=1) it is:

$$\begin{aligned} P(K=1) &= P_v.P(K^*=1) + (1-P_v).P(K^*\geq 1) \\ &= \Phi\left(\frac{a+\beta_0+x_i'\beta_1}{\sigma}\right) - P_v.\Phi\left(\frac{3.a+\beta_0+x_i'\beta_1+\frac{1}{2}d.e^{2c}}{\sigma}\right)\ , \end{aligned} \tag{4.9}$$

and for a respondent with K=n, with n>1, it is:

$$P(K=n) = P_v.P(K^*=n) + (1-P_v).P(K^*\geq n)$$

$$= \Phi\left(\frac{(2n-1).a + \beta_0 + x_i'\beta_1 + \frac{1}{2}d.(1+MS_{n-1}).e^{c.n} - d.MS_{n-1}.e^{c.(n-1)}}{\sigma} \right) \qquad \textbf{(4.10)}$$

$$- P_v.\Phi\left(\frac{(2n+1).a + \beta_0 + x_i'\beta_1 + \frac{1}{2}d.(1+MS_n).e^{c.(n+1)} - d.MS_n.e^{c.n}}{\sigma} \right) .$$

In section 4.3 we estimate this model using a maximum likelihood procedure.

4.3 Empirical results

As expounded in the previous section we assume that the preferred number of children varies across households through the parameter b in the household's utility function. We specify b_i in (4.3) as a function of various household characteristics like we used in our hazard and probit analyses in the previous chapter. In the vector x_i we include education level of the respondent, dummies for voting behaviour, importance of religion, type of job, and age category.

In sections 3.5 and 3.6 we also included dummies for type of household structure. The inclusion of these dummies in our structural model requires a bit more discussion. In section 3.3 we already mentioned that the household structure may not be exogenous. For instance, a couple living in an unmarried cohabitation may decide to marry as soon as they feel ready to have children. In this case, the wish for children determines the household structure and not the other way round. Moreover, the type of household structure of the respondent, just like completed fertility, can depend on age. For instance, children living at home have probably not yet considered to have children. Note that both of these difficulties arise especially in our structural model. After all, in the reduced form analyses, we considered only households with children, so all included respondents have had the opportunity to obtain at least one child. However, for the estimation of our structural model we also include respondents with zero children. It does not seem realistic to lump together all childless 18-year-old singles with childless married respondents of 50 years old. In order to meet these objections we chose to exclude some respondents from our analysis. As can be seen in the table in appendix 3A respondents without steady partner (dor8) and children living at home

(dor3 and dor4) very rarely report to have any children. In our estimations we therefore exclude respondents with dor3, dor4 or dor8 (1200 observations remain). For all other respondents we include dummies for their type of household structure, so that we can investigate their influence on the number of children obtained.

In table 4.1 we present estimation results of a maximum likelihood procedure using the likelihood contributions presented in (4.8) to (4.10). The positive value for d implies that achieving a mixture of sexes raises parental utility, while the negative c indicates that this sex preference is less important at higher parities (in accordance with the results of the reduced form estimations in chapter 3). Although the coefficient d is not significant according to the t-statistic, a likelihood ratio test decisively rejects the hypothesis $d=0$, with $\chi^2_{(2)}=62.30$. The two degrees of freedom of this χ^2-statistic result from the fact that parameter c is not identified if d is zero.

For the other variables in our specification a positive (negative) coefficient means that the preferred number of children increases (decreases) with an increase in this variable. We get a significant positive coefficient for the dummy for importance of religion, and significant negative coefficients for the dummy of having a full time or part time job. Note that having a full time job has a stronger negative effect on the number of children preferred than a part time job. We also find a negative coefficient for the respondent's level of education. So more religious respondents tend to have more children, while having a job and a higher education lower the preferred number of children. Furthermore, older generations appear to have a preference for more children than younger generations. This corresponds to the generally known fact that in the past decades the number of children per couple has declined considerably[2], probably due to the emancipation of women, and secularization and individualization trends. We also find significantly negative effects for singles and unmarried cohabitants. Apparently, respondents in these type of households on average prefer less children or no children at all.

[2] In the Netherlands the total fertility rate (TFR) declined from 3.04 in 1965 to 1.66 in 1975. The TFR is the average number of children a woman will bear, if the age-specific fertility rates observed in a certain year apply during her entire life. (Source: Dutch Central Bureau of Statistics)

Table 4.1: Estimation results structural model

	Estimated coefficients (t-values in parentheses) Normalization: $\sigma=1$
constant	1.688 (3.85)**
education of respondent	-0.084 (- 2.02)**
votes 'right-wing'	0.003 (0.02)
votes 'left-wing'	0.071 (0.75)
religion 'very important'	0.273 (2.42)**
religion 'not very important'	0.018 (0.17)
(more than) full time job	-0.452 (- 4.46)**
part time job	-0.382 (- 2.70)**
d	5.101 (1.39)
c	-1.160 (- 2.87)**
a	-0.382 (-30.27)**
25-34 years	0.204 (0.45)
35-44 years	0.601 (1.40)
45-54 years	0.963 (2.25)**
remarried	-0.207 (- 1.40)
head of one-parent family	-0.050 (- 0.35)
single	-1.790 (-14.13)**
unmarried cohabitation	-1.575 (- 9.68)**
loglikelihood	-1021.142

4.4 Predicting the effects of sex preselection techniques

We can use the estimation results of the previous section to predict how fertility will change if parents obtain the possibility of (costlessly) choosing the sex of their children. For convenience, we call the case with sex preselection techniques available the new situation, and the case with no sex preselection techniques available the old situation.

Let us first roughly sketch what we expect to be the impact of introducing sex preselection techniques, given the parental 'mixture of sexes'-preference we found in the previous section. On the one hand, couples with one child will be more likely to bear a second child in the new situation than in the old. This results from the fact that in the former case parents can achieve their desired sex composition (and the corresponding gain in utility) with certainty at parity two, while in the latter case this will only happen with a probability of one half. On the other hand, some couples that will bear more than two children in the old situation trying to obtain a mixture of sexes, can achieve this sex composition at a lower parity in the new situation. We therefore expect two effects of sex preselection techniques on fertility: more second order births, and less third and higher order births. The resulting total effect on fertility is ambiguous a priori.

We will now calculate the effect of introducing sex preselection techniques on completed fertilities of all respondents in our sample. Remember that we specified parental utility of children for household i as:

$$v_i(K,MS_K) = a.K^2 + b_i.K + d.MS_K.\exp(c.K)$$
$$b_i = \beta_0 + x_i'\beta_1 + \epsilon_i \quad . \qquad \textbf{(4.11)}$$

In the old situation, parents will choose an additional child given a certain parity n if and only if $v(n+1,E\{MS_{n+1}|MS_n\}) - v(n,MS_n)$ exceeds zero. For n=0, this becomes:

$v(1,0) - v(0,0) = a + b_i = -0.382 + b_i$

and for n>0:

$v(n+1,E\{MS_{n+1}|MS_n\}) - v(n,MS_n) = -0.382(2n+1) + \frac{1}{2}d.(1+MS_n).\exp(c.(n+1)) - d.MS_n.\exp(c.n) + b_i$.

The deterministic part of each household's b_i can be calculated as $x_i'\hat{\beta}$ with $\hat{\beta}$ the estimated coefficients listed in table 4.1 (except for the estimates of d, c, and a). Making use of the assumption that the random part, ϵ_i, is normally distributed, the probability of having a certain number of children can then be derived. For instance, for household i the probability that having 1 child is optimal is:

$P\{v_0<v_1<E(v_2)\} = P\{0.38<b_i<0.90\}$ (Note: $0.90 = -3*a - 0.5*d*\exp(2*c)$) .

The probability that bearing 2 children is optimal is:

$(P\{E(v_2)>v_1 \wedge (E(v_3)<v_2|MS_2=0)\} * P\{MS_2=0\}) + (P\{E(v_2)>v_1 \wedge (E(v_3)<v_2|MS_2=1)\} * P\{MS_2=1\})$
$= \frac{1}{2}.P\{0.90<b_i<1.91\} + \frac{1}{2}.P\{0.90<b_i<2.25\}$.

And the probability that bearing n children is optimal is:

$(P\{(E(v_n)>v_{n-1}|MS_{n-1}=0) \wedge (E(v_{n+1})<v_n|MS_n=0)\} * P\{MS_{n-1}=0 \wedge MS_n=0\})$
$+ (P\{(E(v_n)>v_{n-1}|MS_{n-1}=0) \wedge (E(v_{n+1})<v_n|MS_n=1)\} * P\{MS_{n-1}=0 \wedge MS_n=1\})$
$+ (P\{(E(v_n)>v_{n-1}|MS_{n-1}=1) \wedge (E(v_{n+1})<v_n|MS_n=1)\} * P\{MS_{n-1}=1 \wedge MS_n=1\})$.

The predicted number of children for household i can be calculated by multiplying these probabilities with the corresponding number of children. These predicted completed fertilities for all households in our sample are listed (classified into intervals) in the first column of table 4.2. For this table we have assumed that an expected number of children between 1.5 and 2.5 results in bearing 2 children, between 2.5 and 3.5 results in 3 children, etc.

Table 4.2: predicted number of children for households in our sample

Predicted fertility (number of children)	Number of households with predicted fertility, in case of no sex preselection techniques.	Number of households with predicted fertility, with sex preselection techniques available.
0 $(0 \leq E(k) < 0.5)$	338	304
1 $(0.5 \leq E(k) < 1.5)$	254	281
2 $(1.5 \leq E(k) < 2.5)$	370	394
3 $(2.5 \leq E(k) < 3.5)$	219	206
4 $(3.5 \leq E(k) < 4.5)$	19	15
5 $(4.5 \leq E(k) < 5.5)$	0	0
6 $(5.5 \leq E(k) < 6.5)$	0	0
Total number of children	1727	1747

In a similar way we can calculate the expected fertility in the new situation. In this case, parents no longer have to weigh the costs of a less desired extra child against a more preferred sex composition, as they can satisfy their sex preference with the last wanted child by selecting its sex (for all parities exceeding 2, that is). Consequently, we no longer need to use expected values of utility, as the uncertain argument of utility, the sex of children, can now be selected. The increase in utility resulting from an additional child at various parities is:

For n=0: $v(1,0) - v(0,0) = -0.382 + b_i$

For n=1: $v(2,1) - v(1,0) = -1.146 + d.\exp(2c) + b_i$

For n>1: $v(n+1,1) - v(n,1) = -0.382(2n+1) + d.\{\exp(c.(n+1)) - \exp(c.n)\} + b_i$.

Therefore, the probability that bearing 1 child is optimal for household i is:

$P\{v_0 < v_1 < v_2\} = P(0.38 < b_i < 0.65)$.

Bearing 2 children is optimal with probability:

$P\{v_1 < v_2 < v_3\} = P(0.65 < b_i < 2.25)$.

Note that this probability has increased in comparison with the old situation. In general, the probability that k children is optimal is:

$P\{v_{k-1} < v_k < v_{k+1}\}$.

In column 2 of table 4.2 we report the predicted completed fertilities of all couples in our sample in this case.

Comparing the two columns of table 4.2, we see that introducing sex preselection techniques raises the number of households having two children, and lowers the number of parents bearing more than two children, just as we expected beforehand. The increase in the

number of households having one child and the decrease in the number of households having no children at all are also caused by a larger probability of obtaining two children. After all, introducing sex preselection techniques only raises the probability of bearing two children at the expense of having one or more than two children. The *expected* number of children of all couples therefore shifts to some extent in the direction of two children. If the shift is big enough, the couple will appear in another row of table 4.2 in column two than they were in column one.

The predicted total number of children in our sample *increases* with 20 children, i.e. 1.2 per cent. This result may be somewhat surprising as it is often argued that sex preselection techniques will reduce fertility. In this respect it should be noted that the increase in fertility results from the low number of children per couple in the Netherlands *and* from the specific preference for a mixture of sexes. In countries where parents choose third and higher order births more often, the same sex preference may very well lead to a *decline* in total fertility of a population. Moreover, a different sex preference, like 'only sons are wanted' or 'only daughters', may also cause a decrease in total fertility. For instance, Leung (1994) finds evidence for a son preference among the Chinese in Malaysia using a dynamic analysis. He shows that sex selection on the firstborn child could reduce fertility of this group by about 3 %.

4.5 Conclusions

In the previous chapter we investigated whether parental sex preferences play a role in fertility decisions of couples in the Netherlands. We applied various methods and used different types of data, in order to check the robustness of our results. Although we found repeated evidence of a parental preference, the methods applied did not allow us to investigate sex preferences simultaneously with preferences for the number of children. In this chapter we therefore specified a simple structural model to investigate how parents can weigh a sex preference against a preferred parity. This model (again) provides evidence in favour of a parental preference for a mixture of sexes, and also shows that this preference is less important at higher parities.

Another purpose of our paper was to predict the impact of introducing sex preselection techniques on fertility. Based on the estimated structural model two opposite effects are found: an increase in first and second order births and a decrease in third and higher order

births. The total effect is an increase in total (completed) fertility of about 1 per cent. This increase results from the low average fertility in the Netherlands and from the specific sex preference found. In countries with more third and higher order births, or with a different sex preference, the introduction of sex preselection techniques may very well lead to a decline in total fertility of a population.

5 Financial management of households

5.1 Introduction

In this chapter we will investigate how couples manage their household finances. The financial management of a household is a complex of necessary activities, required for the consistence of a household. It encompasses a variety of financial decisions the household has to deal with, such as payment of bills, budgeting, purchase of food, clothing and durables (e.g. car, housing), and saving decisions. We are especially interested in how responsibilities for various financial decisions are divided between both partners. Several studies on intrahousehold allocation of resources suggest that the way in which couples organize their finances reflects the distribution of power between spouses (e.g. Pahl (1983), Wilson (1987), Treas (1991), Blumberg (1991), Hertz (1992), Vogler and Pahl (1993, 1994), Woolley and Marshall (1994)). In case only one partner handles all household finances both partners' access to household income may be different than in case both partners consult each other on all financial decisions.

Research into the relation between financial management and the division of power between partners suffers from two difficulties. The first is that the financial management of a household is hard to characterize in one variable or feature; it includes a diversity of decisions varying in importance, frequency, and amounts of money involved. In order to get a balanced insight in the financial management of households, we will have to examine various types of financial decisions and possibly also their interdependence. A second difficulty concerns the definition of power. Notwithstanding the considerable body of (sociological) research on money and power, the concept of 'power' is still not clearly defined.

The latter difficulty will be discussed in the next chapter. We will show that a way to study *and* explicitly define the distribution of power within households is to analyse household decision making within a game theoretic framework. This approach allows that both partners differ in their preferences to spend available household income. The extent to which both partners' preferences are weighed in the final household decisions reflects the distribution of power between both partners.

In the present chapter we mainly concentrate on the first difficulty concerning the diversity of financial management. We will investigate how households manage their household finances by examining how various types of financial decisions are divided between partners. As a starting point we use a typology of *household financial allocative systems* introduced by Pahl (1983, 1989). The systems differ in how responsibilities for managing household money are divided between partners, varying from totally separate to joint spheres of decision making. Pahl identifies five basic systems of money management[1]: the female whole wage system, the male whole wage system, the housekeeping allowance system, the independent management system, and the pooling system. Note that while the first four all involve separate spheres of responsibilities, the last system involves joint responsibility for household finances. According to Vogler and Pahl (1994) systems of financial allocation in themselves tell us little about inequalities, either in financial decision making or in access to money as a resource. However, the systems '(...) may, through the way in which they are related to inequalities in power over financial decision making, facilitate inequalities in access to money as a resource, which may in turn culminate in differences in living standards between individuals in the same household.' To investigate these relations they distinguish between two types of decision-making authority: *strategic control* is described as making the important and infrequent decisions that determine the major characteristics and features of the family, while *executive management* stands for implementing unimportant and time-consuming decisions within the limitations set by crucial and pervasive decisions made by the powerful spouse.[2]

A first question we will address in this chapter is how the financial allocative systems of Pahl are related to the division of various tasks in the financial management of households. We do this in a similar way as Vogler and Pahl (1994), by comparing the systems reported by partners with their answers to other questions on household finances. These questions concern responsibility for everyday household spending, regular household bills, big financial decisions, and personal spending money. They cover various levels of decision-making power: for instance, while 'final say in big financial decisions' is likely to represent *strategic*

[1] According to Pahl (1983) '(...) In reality, the proposed typology represents points on a continuum of allocative systems, but previous research suggests that the typology has considerable validity both within Britain and in other parts of the world.'

[2] Safilios-Rothschild (1976) uses the terms *orchestration power* and *implementation power*, respectively.

control, 'handling everyday household spending' may be an example of *executive management*. Therefore, our comparison will inform us on which kind of decision making relates to the allocative system of the household. We then can decide if we want to use the allocative system as an indicator of the division of financial responsibilities between partners. Such an indicator would highly simplify our further research into the relation between money and power: we could then focus on this indicator in stead of studying several parts of financial management simultaneously.

A second issue addressed in this chapter concerns the considerable differences we find between the reports of two partners on their financial allocative system. Why do partners provide different answers? A number of studies in this and related literature have ignored the problem of non-corresponding answers by collecting only one family member's perception. However, when both partners are interviewed considerable discrepancies have been reported (see Safilios-Rothschild (1970) and this chapter).

A priori several explanations for the discrepancies can be hypothesized. A first hypothesis is that the question asked may be ambiguous to respondents. To determine the financial allocative system of the household, respondents are asked to report who usually manages the household finances (the exact formulation of the question and the answering categories can be found in section 5.2). However, 'managing household finances' may cover various domains of financial decision making and at each domain both partners can play a different role. So depending on how respondents weigh the various components of 'managing household finances' they will choose the best fitting category. In this case, partners may perfectly agree on who is responsible for various parts of household finances but still report different types of allocative systems. Another explanation of the observed discrepancies may be that respondents are simply not aware of their authority. Olson and Rabunsky (1972) find that respondents can rather identify what decisions are made than who makes them. Mizan (1994) reviews some studies on discrepancies between self-report and observation. Feminist research has argued that men's and women's experiences may lead them to understand the world differently (Harding (1986)). Furthermore, respondents may be reluctant to admit or deny any authority over their partner (e.g. Turk and Bell (1972), Antonides and Hagenaars (1992)). This last suggestion would especially explain the large number of respondents in our sample reporting equal sharing of household finances. We will test a number of these hypotheses on our data.

In the next section we present the data on allocative systems used in our study. The data are drawn from the first wave (1991-1992) of the British Household Panel Survey (BHPS). In section 5.3 we compare households' reports on financial allocative systems with their answers to questions about other aspects of household finances. For this we select a subsample of couples of which both partners agree on their allocative system. In section 5.4 we will compare these results with the answers to these questions of partners that do not agree on their type of financial allocation. This enables us to test a number of the above mentioned explanations for the observed discrepancies between partners' reports on allocative systems. Section 5.5 summarizes our main conclusions.

5.2 Data: the British Household Panel Survey [3]

In the British Household Panel Survey (1991-1992) couples were asked to point out which financial allocative system they use to organize their household finances. The question was formulated as follows (Taylor (1992)):

People organise their household finances in different ways. Which of the methods on this card comes closest to the way you organise yours? It doesn't have to fit exactly - just choose the nearest one. You can just tell me which letter applies.

A I look after all the household money except my partner's personal money

B My partner looks after all the household's money except my personal spending money

C I am given a housekeeping allowance. My partner looks after the rest of the money

D My partner is given a housekeeping allowance. I look after the rest of the money

E We share and manage our household finances jointly

F We keep our finances completely separate

G Some other arrangement

The question was answered by both partners separately. We selected a subsample of couples of which we had available answers of both partners and some information on education,

[3] The data used in this and the following chapter were made available through the ESRC Data Archive. The data were originally collected by the ESRC Research Centre on Micro-social Change at the University of Essex. Neither the original collectors of the data nor the Archive bear any responsibility for the analyses or interpretations presented here.

current income etcetera. The next table shows the answers of both partners, with HFAS denoting the financial allocative system reported by the husband and WFAS the allocative system reported by the wife. We excluded categories F and G from our table, as these were chosen by only few couples and also raised some interpretation difficulties. The codes of HFAS and WFAS are defined as follows:

1 Wife is given a household allowance
2 Husband looks after all household money, except wife's personal spending money
3 Both share and manage household finances jointly
4 Wife looks after all household money, except husband's personal spending money
5 Husband is given a household allowance

In our opinion this ordering of the codes reflects a higher influence of the wife in higher codes: while the third system is associated with joint management, the first two are 'male managed', and the last two 'female managed' systems. One could argue, however, that the order of 1 and 2 is unclear and perhaps should be reversed, as well as the order of 4 and 5. But since the second and the fourth system explicitly exclude the partner's personal spending money from the household money looked after, we associate these with a more equal distribution of influence over partners than the first and fifth system. We will come back to this in section 6.5, but meanwhile we will assume that the financial allocative systems can be arranged as above.

Table 5.1: Type of financial allocative system used according to husband and wife

WFAS → HFAS ↓	1	2	3	4	5	Tot.
1	170	28	33	13	3	247
2	64	154	79	15	1	313
3	80	81	1138	174	2	1475
4	24	10	202	524	3	763
5	4	1	2	4	2	13
Tot.	342	274	1454	730	11	2811

The table shows that in roughly two-third of the cases both partners agree on which financial allocative system they use (diagonal cells). If one of the first four categories is reported by an individual, his/her partner mostly chooses the same category. The fifth category is reported by only few individuals (and usually by only one of both partners) so we have to interprete it carefully. We see that more than half of all respondents (1475 males and 1454 females) report to manage household finances jointly, over a quarter reports that the wife looks after all household money, and the housekeeping allowance system and 'husband looks after all the money' are reported each by about 10 percent of all respondents. These figures correspond very well with a study of Vogler and Pahl (1994), which found percentages of respectively 50, 26, 12 and 10 using the various allocative systems. However, their findings were based on a dataset, the (British) Social Change and Economic Life Initiative from 1987, which did not include reports of both partners separately about the financial allocative system of the household.

If both partners give non-corresponding answers, mostly one of them reports equal sharing of finances (the highest off-diagonal numbers are found either in the third row or in the third column). Also note that on average respondents ascribe less responsibility to themselves than their partners do: husbands more often choose higher categories than their wives. Consider, for instance, the column and row corresponding with allocation type 3: given that their partners choose this type, 204 husbands versus 176 wives choose a category with less male responsibility, while 112 husbands versus 161 wives choose a category with less female responsibility. The same holds for the other management types.

In the following sections we will analyse various subsamples of the dataset presented above. In the next section we concentrate on partners that agree on using one of the first four types of financial allocative systems (all observations in the first four diagonal cells). Alternatively, in section 5.4 we include only couples of which one of the partners reported 'joint management of household finances' while the other partner reported a different type of allocation.

5.3 Financial allocative systems and household financial decision making

In this section we will examine how the concept 'household financial allocative system' relates to both partners' influence in financial decision making. We do so by investigating the relation between the type of financial allocation reported by couples and their answers to

some questions about household financial decision making. The following questions from the BHPS concerning household finances will be examined:

1 *In your household who has the final say in big financial decisions?*

2 *In your household who makes sure that regular household bills are paid, I mean things like the bills for the gas, electricity, telephone?*

3 *And who is mainly responsible for handling your everyday household spending? I mean things like food, household necessities and other items of general housekeeping?*

4 *If you buy something for yourself costing between £10 and £20 would you usually: ask your partner if you could buy it; mention it to your partner; not mention it at all?*

Note that the questions concern various types of decision-making authority, varying from strategic control to executive management. A priori we can hypothesize various connections between these components and the financial allocative system of the household, based on our interpretation of the latter. For instance, we expect that in households with an allocative system with more responsibility for the husband, he will also have the final say in big financial decisions, and he is probably the one who makes sure that regular household bills are paid. Restrictions on the personal spending of both partners may also reflect the type of allocation used by the household. On the other hand, an issue like 'handling everyday household spending' may be less dominated by the 'authority balance' between partners, and is perhaps determined by efficiency considerations like who usually does the shopping.

In order to investigate the various components of household finances in relation with the financial allocative system reported by the couple, we select a subsample of couples of which both partners agreed on the type of financial allocation. In this way we avoid problems related with non-corresponding partners' reports on allocative systems. We also excluded the two couples reporting a household allowance for the husband, so that 1986 observations remain. In the following we will present the answers of both partners to the questions mentioned above in various tables. In these tables the answers of wives are listed in the columns under 'w', and those of the husbands under 'h'. The types of financial allocation are

labelled FAS1 to FAS4, representing respectively 'wife gets household allowance', 'husband looks after', 'household finances managed jointly', and 'wife looks after'. Please note that in fas1 and fas2 we expect the husband to have most influence, while in fas4 the wife probably has most influence in household decision making. The figures in the tables denote the percentage of wives and husbands reporting a certain financial allocative system that choose a particular answering category. For instance, table 5.2 shows that from the 170 couples reporting 'wife is given a hh allowance', 4 percent of the wives respond that the wife has the final say in big financial decisions, 45 percent say the husband has, and 51 percent say both have an equal say. For the 170 husbands the corresponding figures are respectively 3, 43 and 54 percent. Due to missings, rounding off, or respondents choosing an answering category 'other', the listed percentages may not sum up to 100 percent.

Table 5.2: Who has final say in big financial decisions? (percentages)

	WIFE		HUSBAND		BOTH	
	w	h	w	h	w	h
FAS1: wife allowance (170 obs.)	4	3	45	43	51	54
FAS2: husb looks after (154 obs.)	8	4	37	49	55	47
FAS3: jointly (1138 obs.)	7	5	20	23	73	72
FAS4: wife looks after (524 obs.)	20	16	11	13	70	71
Total (1986 obs.)	10	8	21	24	69	68

Table 5.2 shows that most respondents, notwithstanding their financial allocative system, respond that both partners have an equal say in big financial decisions. However, to some extent the answers of both partners correspond with the financial management system of the household. Households with an allocative system with less responsibility for the wife (fas1 or fas2) more often report the husband to have the final say (e.g. consider fas1: according to 45% of females and 43% of males the husband has the final say, while 4% of females and 3% of males report that the wife has). Households with fas4 more often report the wife to have the final say (e.g. 20% of females and 16% of males say 'the wife' and 11% of females and 13% of males say 'the husband has final say').

Table 5.3: Who makes sure that regular household bills are paid? (percentages)

	WIFE		HUSBAND		BOTH	
	w	h	w	h	w	h
FAS1: wife allowance (170 obs.)	8	5	82	86	8	6
FAS2: husb looks after (154 obs.)	7	2	82	91	10	7
FAS3: jointly (1138 obs.)	38	34	33	37	28	28
FAS4: wife looks after (524 obs.)	92	88	3	3	5	8
Total (1986 obs.)	47	44	33	36	19	19

The answers in table 5.3 clearly reflect the type of financial allocation of the household. According to both partners, in case of fas1 and fas2 usually the husband handles the household bills, while in case of fas4 usually the wife takes care of them. In couples reporting to share household finances (fas3) wives are as likely as husbands to handle household bills, while a considerable number of couples report to share responsibility for the bills. Overall we may conclude that some respondents seem to 'over-value' their own responsibility, as both sexes are mentioned more often by themselves than by their partners as the responsible person for the bills (e.g. in the column 'WIFE' the percentages under 'w' exceed those under 'h', and in the column 'HUSBAND' the opposite case holds).

Table 5.4: Who is mainly responsible for handling your everyday household spending? (percentages)

	WIFE		HUSBAND		BOTH	
	w	h	w	h	w	h
FAS1: wife allowance (170 obs.)	96	92	2	2	2	5
FAS2: husb looks after (154 obs.)	44	38	41	45	15	17
FAS3: jointly (1138 obs.)	70	67	5	5	25	28
FAS4: wife looks after (524 obs.)	96	92	1	2	3	6
Total (1986 obs.)	77	73	7	7	16	19

It is likely, as a matter of efficiency, that the person who does the (daily) shopping, i.e. in most cases the wife, handles everyday household spending. This is probably most explicit in case of fas1, where she gets an allowance to cover everyday household expenditures while her husband takes care of other finances. We see that most respondents report that wives are

mainly responsible for everyday spending, except for category fas2 in which both partners are equally often reported to have responsibility. Only in category fas3 a considerable number of couples handle everyday household spending jointly. So the answers of couples on everyday household spending also reflect the type of financial allocation.

Table 5.5: If you buy something for yourself costing between £10 and £20 would you usually: ask your partner if you could buy it; mention it to your partner; not mention it at all? (percentages)

	ASK		TELL		TELL NOTH.	
	w	h	w	h	w	h
FAS1: wife allowance (170 obs.)	17	5	52	69	29	25
FAS2: husb looks after (154 obs.)	17	8	47	54	32	34
FAS3: jointly (1138 obs.)	15	16	55	62	27	19
FAS4: wife looks after (524 obs.)	12	22	52	54	35	22
Total (1986 obs.)	15	16	54	60	30	21

Table 5.5 shows that more than half of all respondents mention a personal spending to their partner but do not ask for permission, while another 25 percent does not mention it to their partner at all. Although only few individuals report to ask permission, we typically find that in case of fas1 or fas2 wives more often report to 'ask' than husbands, and in case of fas4 husbands more often report to 'ask' than wives. Thus the person with the least responsibility in the allocative system reported is more likely to ask for permission for an expenditure than his/her partner.

To sum up, it may be said that who handles regular household bills most clearly reflects the household's financial allocative system. To a lesser but still substantial degree it is also related to who has authority in big financial decisions, responsibility for everyday household spending, and personal spending of both partners. So the household's financial allocative system relates to the division of responsibilities between partners both in executive management and in strategic control.

Please note that the previous tables, although they inform us not explicitly on disagreements between partners, do reveal that overall there are no substantial differences in the answers of both sexes. They thus provide no evidence of husbands or wives consistently

under- or overreporting their responsibilities.

5.4 Non-corresponding partners' reports on financial allocative systems

In the previous section we have only examined couples of which both partners agree on their allocative system. In this way we got round a number of problems related with non-corresponding partners' answers like, for instance, determining the 'actual' allocation system. We will now investigate a number of possible explanations, interpretations and consequences of non-corresponding reports on allocative systems by partners. We do this by comparing both partners' answers to the four questions about household decision making with their report of the household's allocative system. We restrict our analysis to couples of which one of both partners has chosen fas3 and the other partner has chosen a different category, as these combinations of non-corresponding partners' reports are observed most frequently in our sample (see table 5.1). We distinguish four groups of disagreeing couples: wife reports fas3 ('jointly') while husband reports fas1 ('wife allow.') or fas2 ('husb lks a.'), wife reports fas3 while husband reports fas4 ('wife lks a.'), husband reports fas3 while wife reports fas1 or fas2, and husband reports fas3 while wife reports fas4. While couples in the first and the third group combine 'joint management' with a 'male managed' allocative system, couples in the second and the fourth group report a combination of 'joint management' and a 'female managed system'. The groups contain 112, 202, 161, and 174 couples, respectively. In the following, we will present the answers to the questions about household finances of these four groups in the same way as in the previous section.

A priori we can formulate several hypotheses about expected outcomes from this exercise. For instance, we can hypothesize that partners report different allocative systems because they have different views on the distribution of responsibilities in the household (due to different expectations, interests, experiences, awareness, etc.). We would then expect that if the wife reports fas1 while her husband reports fas3, that her answers concerning the four aspects of household finances are comparable with the answers of wives choosing fas1 in tables 5.2 to 5.5, while her husband's answers are more related to the answers of husbands choosing fas3 in tables 5.2 to 5.5. Another possible hypothesis is that both partners agree on their financial decision making but that their allocative system is a mixture of two types listed in the questionnaire. Then accidentally they may report different systems while in fact both would like to report a type in between. If this holds true, we would expect to find a high

correspondence between couples reporting a certain combination of two allocation types, irrespective of which sex chooses which system. Alternatively, we may hypothesize that women are better able to assess the financial allocative system of their household than men (or vice versa). We would then expect only wives' answers to be comparable with those in the previous section, while husbands' answers will be different. In the following tables we will look for evidence of these hypotheses.

Table 5.6: Who has final say in big financial decisions? (percentages)

	WIFE		HUSBAND		BOTH	
	w	h	w	h	w	h
w: FAS3 & h: FAS1/2 (112 obs.)	5	5	37	37	58	57
w: FAS3 & h: FAS4 (202 obs.)	10	10	17	21	73	68
w: FAS1/2 & h: FAS3 (161 obs.)	6	6	35	40	58	54
w: FAS4 & h: FAS3 (174 obs.)	16	13	17	21	67	67

FAS1/2 = wife allowance *or* husb looks after; FAS3 = jointly; FAS4 = wife looks after

This table clearly shows that the first and third row are very much alike and the second and fourth row too. So it appears that the answers to 'who has the final say' is more determined by the combination of both partners' choices of allocative systems than by which sex chooses a certain system. A second remark concerns a comparison between this table and table 5.2, i.e. the one if partners report corresponding types of financial allocative systems. The answering patterns of the first and the third row seem to be in between the answering patterns in table 5.2 of couples reporting fas3 and couples reporting fas1 or fas2. In the same way the answers of couples in the second and fourth row seem to be midway between couples in table 5.2 reporting fas3 and fas4. This agrees with our hypothesis that partners disagreeing about the type of financial allocation represent a mixture of both allocation types reported.

We also want to point at a small difference between the second and the fourth row. Wives of couples in the fourth row report somewhat more often to have the final say in stead of both than wives in the second row, which corresponds with the larger responsibility they ascribe to themselves in the household allocative system. Apparently, respondents' views on who has the final say in big financial decisions have some influence in their answers about allocative systems. Note, however, that if this influence was substantial we would expect

partners' answers to differ by a lot more here than they did in table 5.2 (as here they choose different allocative systems), which is surely not the case. Now let us continue to the next table.

Table 5.7: Who makes sure that regular household bills are paid? (percentages)

	WIFE		HUSBAND		BOTH	
	w	h	w	h	w	h
w: FAS3 & h: FAS1/2 (112 obs.)	12	6	69	81	19	13
w: FAS3 & h: FAS4 (202 obs.)	80	83	6	6	13	10
w: FAS1/2 & h: FAS3 (161 obs.)	12	12	73	70	14	17
w: FAS4 & h: FAS3 (174 obs.)	84	76	6	10	9	13

FAS1/2 = wife allowance *or* husb looks after; FAS3 = jointly; FAS4 = wife looks after

In table 5.7 we again find a large resemblance between the first and the third row and between the second and the fourth. And again the answering patterns of these rows seem to be midway between the corresponding rows in table 5.3, i.e. the case when partners agree on their allocative system. If we compare the first row with the third we find that in the former case the husband more often than his wife responds that he handles the bills in stead of her or both, while in the latter case she more often reports that her husband handles them in stead of both. A comparison of the second row with the fourth shows that in the former case the husband more often than his wife responds that she handles the bills in stead of both, while in the latter case she more often reports that she handles them in stead of him or both. These differences confirm the different combinations of allocative systems chosen in the various cases, i.e. the partner that ascribes more responsibility for household bills to a certain person, is also likely to report a household allocative system with more authority for this person. So to some extent the reports on allocative systems appear to be caused by a different awareness of family authority of partners. But again these effects seem to be very small.

A first point to note before we discuss table 5.8 is that the rows of fas1 and fas2 in table 5.4 did not show very homogeneous patterns. As in this section both types are aggregated, the figures in the first and third row of table 5.8 look quite different from the first two rows of table 5.4.

Table 5.8: Who is mainly responsible for handling your everyday household spending? (percentages)

	WIFE		HUSBAND		BOTH	
	w	h	w	h	w	h
w: FAS3 & h: FAS1/2 (112 obs.)	71	65	15	20	14	15
w: FAS3 & h: FAS4 (202 obs.)	90	92	2	3	8	4
w: FAS1/2 & h: FAS3 (161 obs.)	71	67	17	16	12	17
w: FAS4 & h: FAS3 (174 obs.)	97	87	1	2	2	11

FAS1/2 = wife allowance *or* husb looks after; FAS3 = jointly; FAS4 = wife looks after

Once more we find roughly similar patterns for the first and the third row, and also for the second and the fourth row. And again the percentages of husbands and wives in every row of table 5.8 lie in between the percentages of the corresponding rows of table 5.4. Minor differences between the first and the third row, and between the second and the fourth confirm the different categories chosen by both partners. However, as the similarities between the rows seem much larger than their differences, we conclude that the combination of allocative systems reported by partners better indicates the answers on 'everyday household spending' than information on which partner chooses which system.

Table 5.9: If you buy something for yourself costing between £10 and £20 would you usually: ask your partner if you could buy it; mention it to your partner; not mention it at all? (percentages)

	ASK		TELL		TELL NOTH.	
	w	h	w	h	w	h
w: FAS3 & h: FAS1/2 (112 obs.)	17	13	54	63	28	23
w: FAS3 & h: FAS4 (202 obs.)	15	19	59	57	26	20
w: FAS1/2 & h: FAS3 (161 obs.)	17	12	54	60	25	26
w: FAS4 & h: FAS3 (174 obs.)	14	18	43	59	42	20

FAS1/2 = wife allowance *or* husb looks after; FAS3 = jointly; FAS4 = wife looks after

In table 5.9 the first and third row are very similar, but the fourth row is a bit different from the second. Wives report much more often to 'tell nothing' in stead of 'tell' in the last row than in the second row. The table shows that in the first and third row the wife more often 'asks' than her husband, while in the second and fourth row the opposite case holds.

We have to be careful with comparing these rows with the ones in table 5.5, as these are very much alike amongst themselves and especially the last two columns show no clear pattern over the various allocative systems. However, if we limit ourselves to the first column of table 5.9, we observe that the percentages of wives and husbands reporting to 'ask' are in between the reported percentages in the corresponding rows of table 5.5.

Summing up, we draw two conclusions from the previous tables. Firstly, the disagreement between partners about financial allocative systems may not be as large as they seem. The tables showed that partners who 'disagree' on the type of financial allocation do not exhibit larger discrepancies on who is responsible for different parts of household finances, in comparison with partners who 'agree' on the type of financial allocation. This supports our hypothesis that the partners actually agree on their allocative system but that they choose different categories to express it, due to, for instance, their system being in between two systems listed in the questionnaire[4], or both partners weighing the various components of household finances differently. Secondly, we do not find any evidence of one of both partners being better able to assess the allocative system of the household. More than that, in case of disagreement the combination of both partners' reports appears to give us more consistent information on how household finances are organised than only wives' reports or only husbands'. We therefore conclude that we prefer using both partners' reports about household finances to collecting only one family member's perception of financial management.

5.5 Conclusions

In this chapter we investigated to what extent household financial allocative systems reflect the division of responsibilities in the financial management of households. We found that allocative systems most clearly relate to who handles regular household bills (executive management), but are also related to who has the final say in big financial decisions, and to personal spending of both partners (strategic control). So aspects of both executive management and strategic control seem to be incorporated. In our opinion this combination of different types of decision-making authority hampers a clear interpretation of allocative systems. It therefore seems not justified to use allocative systems as a single indicator of the

[4] see footnote 1 of this chapter.

financial management of households. We do believe, however, that they provide useful information on the division of decision making, in addition to the other questions on household finances discussed. As a consequence, in the following chapter we will use all five questions on household finances to further investigate the relation between money and power.

We also examined the problem of non-corresponding reports on allocative systems by two partners. Our results support a hypothesis that partners reporting different systems actually agree on the organisation of household finances, but that they simply choose different categories to express it. This could indicate that partners have some problems to choose one of the five categories; in real life, allocative systems may not correspond exactly with the proposed typology.

The study presented in this chapter was explorative in nature. Our main purpose was to understand our data on household financial allocative systems, and to investigate their relation with other information on the household's financial management. In the next chapter we will concentrate on theoretical models that can explain the financial management of households, and test them empirically.

6 Financial management, efficiency, and bargaining power

6.1 Introduction

In this chapter we will continue our research into the relation between financial management and the division of power between partners. While chapter 5 concentrated on the diversity of financial management, in this chapter the conceptualization of 'power' will be the central theme.

In most economic research money is only considered at the household or family level. Studies on measuring income inequality or poverty usually assume that all household members equally share the household's income and that there are no inequalities or different values or goals between husbands and wives. Only recently economists have investigated the effect of alternative assumptions about sharing within families on income distribution (e.g. Davies and Joshi, 1994). This indicates the extent to which ignoring intrahousehold distributional considerations may underestimate inequality within households[1]. Woolley and Marshall (1994) examine several measures of inequality and conclude that '(...) accounting for intrahousehold inequality provides a more accurate and more comprehensive measure of overall economic inequality'.

In sociology, however, the intrahousehold distribution of money has received ample attention. Various studies suggest a significant association between a household's financial organization and inequalities between partners in decision making. Most of them refer to the 'family power'-literature[2], which has studied spousal decision making since 1960. For instance, Treas (1993) concludes that apart from transaction cost considerations, marital power differentials influence a couple's choice between holding joint or separate bank accounts. Blumstein and Schwarz (1983) find that '(...) cohabiting women are watchful and independent in financial matters, the possible loss of power being the driving force behind their caution'. In general, 'power' is conceptualized as the relative decision-making status of

[1] Haddad and Kanbur (1990) were the first to quantify how much of a difference the existence of intrahousehold inequality could make. However, they investigated calorie intake of household members, and not the distribution of income.

[2] Also denoted 'marital power'.

husband and wife in a household as measured by a number of decision-making items. Most studies argue that the power balance in a family relates to the comparative resources (like income, education and occupational status) of husband and wife, elaborating on Blood and Wolfe's (1960) 'resource theory of family power'. Various studies have tested this resource theory, both in developed and in developing countries; for an overview of family power research, see Safilios-Rothschild (1970), McDonald (1980), and Mizan (1994). However, a clear analytical framework to investigate *how* resources may influence the power balance in a household is not provided in these studies.

In our opinion, an appropriate way to study *and* explicitly define the distribution of power within households is to analyze household decision making within a game theoretic framework. A bargaining model of household behaviour allows that both partners differ in their preferences to spend available household income. In that case, the distribution of power between partners is reflected in the extent to which both partners' preferences are weighed in the final household decisions: the most powerful spouse will be better able to realize his/her preferences. In section 6.3 we will further discuss the bargaining model of household behaviour.

Although most sociological studies on financial management focus on a possible relation with family power, some of them also point at the burden of managing household finances. Pahl (1980) finds that in low income households, when financial management is more of a 'chore' than a source of power, women typically manage the household's money. Alternatively, in high income households men appear to be more likely to control finances while their wives receive a housekeeping allowance. So control over expenditures not necessarily means more power, but may also stand for the arduous task of making ends meet. This suggests that (at least) two aspects play a role in the household's choice how to divide household finances between both partners. One is the power aspect, based on the assumption that the one who controls can influence the final outcome. The other is the efficiency aspect, as the division of financial management between partners may be part of an efficient division of tasks within the household.

While we suggested to analyze the power aspect by using a bargaining model of household decision making, the efficiency aspect fits a more classical type of models using a household production function. Although these models have been used extensively to analyze both partners' allocation of time between work in the market, work at home, and

leisure (e.g. Becker, 1965; Gronau, 1973 and 1977; Kerkhofs, 1994), as far as we know the topic of money management has not yet been examined in this framework. In section 6.2 we will specify a household production model to explain the type of financial management used by households. Due to data availability this approach considers both partners' time inputs as the only characteristic of the household's financial management.

The bargaining and the household production approach each suggest alternative effects of certain household characteristics on the division of finances between partners. As will be discussed in section 6.4, empirical estimation of these effects may inform us on what model provides the best interpretation of the financial management of households. A complicating factor in this respect is that the financial management of households involves a diversity of decisions varying in importance, frequency and amounts of money involved. We therefore choose to analyze separately five different types of information on financial management, based on the same questions as we used in chapter 5: A) the household's financial allocative system, or 'who looks after household finances'; B) who has the final say in big financial decisions; C) who pays regular household bills; D) who handles everyday household spending; and E) do partners ask permission for personal spendings between £10 and £20. We already discussed in chapter 5 that these various parts of financial management reflect different types of decision-making authority, using Pahl's distinction between strategic control and executive management. Vogler and Pahl (1994) suggest that strategic control concerns important and infrequent decisions with the labour input being small in relation to resulting power, so the power aspect may very well overrule the efficiency argument. Alternatively, for executive management, concerning time-consuming and routine-like decisions within certain limitations, the efficiency argument is probably more persuasive and the household production approach may be most appropriate.

In sections 6.4 and 6.5 we examine for each part of financial management (A to E) whether the power argument or the efficiency argument applies in the division of responsibilities between partners. This allows us not only to test to what extent power and efficiency considerations play a role in the financial organization within households, but also to test Pahl's suggested classification of the five parts into strategic control and executive management. Please note that in the following by 'the household's financial management' we mean the division between partners of specific elements (from A to E) of managing household finances. Although several studies interchangeably use terms like 'decision making power',

'authority', 'responsibility', and 'management', we choose to use the last term as we think it is the most neutral term. 'Decision making power' may be more associated with strategic control and 'financial responsibilities' with executive management.

In the following two sections we first concentrate on theoretical models that can explain the type of financial management used by households. In section 6.2 we analyze the choice of a financial management system by a household production model, focusing on the time inputs of both partners. In section 6.3 we concentrate on possible power aspects in the organization of household finances, and analyze financial management within a bargaining framework. Next, section 6.4 discusses how both theoretical models can be tested empirically, the results of which are presented in section 6.5. In this analysis the five specific elements of financial management are all considered one at a time. Finally, section 6.6 concludes.

6.2 A household production model of financial management

In this section we interprete the management of household finances as a specific form of household production. Starting point is that all parts of financial management, varying from daily shopping to taking out a mortgage, cost time. We consider both partners' time inputs as the only characteristic of the household's financial management, so possible power aspects are ignored in this section. We assume the amount of home production (i.e. managing household finances, other forms of household production are ignored) to be exogenous, but the time inputs of both partners used to realize it can be chosen by the household. Note that this assumption distinguishes our approach from traditional analyses of household production, in which the household can choose the desired amount of home production as well. This distinction results from the nature of home production considered: while most examples in literature define home production to include cooking, cleaning, child care, and other services for which market alternatives may be or may not be available, we limit our analysis to financial management, consisting of activities that can only be done by the household's partners themselves.

The amount of home production resulting from the time inputs of both partners is described by a household production function:

$$Z = z(H_m, H_f) \tag{6.1}$$

where H_m and H_f denote the time inputs of the male and the female partner respectively. The optimal allocation of both partners' time to home production and other activities results from the household maximizing its utility subject to certain time and budget constraints and the home production function. We assume that the two-adult household has the following (joint) utility function:

$$U = u(X, L_m, L_f) \tag{6.2}$$

where X is the amount of consumption goods, and L_m and L_f are hours of leisure enjoyed by the male and female partner respectively. Note that we assume that partners do not derive any utility from managing household finances, so home production does not enter the utility function. However, we assume that the existence of the household requires an 'amount' of financial management Ź, such that $z(H_m, H_f) = Ź$. The choice of a certain specification for this production function will influence the substitutability between both partners time inputs. For instance, if we specify Z as:

$$Z = \alpha.H_m + \beta.H_f \tag{6.3}$$

the time input of the husband can be substituted by the time input of the wife at a constant rate α/β. Further on, however, we will show that this specification in most cases will lead to corner solutions, i.e. only one partner will participate in home production, while in our data we observe both partners participating in financial management very frequently. We therefore choose a more general specification, in which corner solutions are less prevalent. We assume the production function z to be concave, so z is increasing in both its arguments and the matrix of second derivates is negative semi-definite, with H_m and H_f substitutable at diminishing marginal rates.

Let T be the total time endowment of each partner in a household. Each partner's time can be allocated to leisure (L_p), home production (H_p), or working in a paid job (N_p), so the following time constraint must hold:

$$L_p + N_p + H_p = T, \qquad p=m,f \tag{6.4}$$

Moreover, the household is restricted to the household's budget constraint:

$$X = \mu + w_m.N_m + w_f.N_f \qquad \textbf{(6.5)}$$

where μ is the household's non-labour income, and w_p is the net wage rate of partner p.

The household maximizes its joint utility function (6.2) subject to the restrictions given by (6.4) and (6.5), the household production function (6.1), and non-negativity constraints on X, L_p, H_p, and N_p, where p=m,f. We assume that the non-negativity constraints on L_p are not binding in an optimal allocation, so both partners have a positive amount of leisure. The solution to the household's decision problem can then be characterized by the following Kuhn-Tucker conditions (after rewriting):

$$-\frac{\partial U}{\partial L_m} + \lambda_m - \nu.\frac{\partial z}{\partial H_m} = 0 \qquad \textbf{(6.6)}$$

$$-\frac{\partial U}{\partial L_f} + \lambda_f - \nu.\frac{\partial z}{\partial H_f} = 0 \qquad \textbf{(6.7)}$$

$$\frac{\partial U}{\partial X}.w_m - \frac{\partial U}{\partial L_m} + \mu_m = 0 \qquad \textbf{(6.8)}$$

$$\frac{\partial U}{\partial X}.w_f - \frac{\partial U}{\partial L_f} + \mu_f = 0 \qquad \textbf{(6.9)}$$

$$\mu_m.N_m = \mu_f.N_f = 0 \qquad \textbf{(6.10)}$$

$$\lambda_m.H_m = \lambda_f.H_f = 0 \qquad \textbf{(6.11)}$$

$$\mu_p \geq 0, \quad N_p \geq 0, \quad \lambda_p \geq 0, \quad H_p \geq 0, \quad p=m,f.$$

where μ_p and λ_p are the shadow prices of the inequality constraints on labour time and home production time of partner p respectively, and ν of the home production restriction.

In an optimal allocation of time, denoted by (L_m^*,L_f^*,N_m^*,N_f^*,H_m^*,H_f^*), both partners spend a positive amount of time in a paid job (i.e. $N_m^*>0$ and $N_f^*>0$) if $\mu_m=\mu_f=0$, so if

$$\frac{\partial U / \partial L_m}{\partial U / \partial L_f} = \frac{w_m}{w_f} \qquad \textbf{(6.13)}$$

Alternatively, if the right-hand side exceeds (is lower than) the left-hand side of the equation, only the husband (wife) has a paid job.

In an optimal allocation both partners participate in financial management (i.e. $H_m^* > 0$ and $H_f^* > 0$) if $\lambda_m = \lambda_f = 0$. From (6.5) and (6.6) it then follows that:

$$\frac{\partial U / \partial L_m}{\partial U / \partial L_f} = \frac{\partial z / \partial H_m}{\partial z / \partial H_f} \qquad \textbf{(6.14)}$$

which, in case both partners participate in the labour market, results in:

$$\frac{\partial z / \partial H_m}{\partial z / \partial H_f} = \frac{w_m}{w_f} \qquad \textbf{(6.15)}$$

Alternatively, if inequality holds in formula (6.14) it is optimal that only one of both partners handles financial management.

Note that the right hand side of (6.14) reflects the substitutability of both partners' time inputs in the home production function. If we choose specification (6.2), the substitutability will be constant (namely α/β) for all values of H_m and H_f. The isoquants for this case are presented in figure 6.1.a.

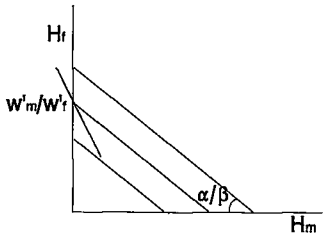

Figure 6.1.a: Isoquants for home production function $Z = \alpha.H_m + \beta. H_f$

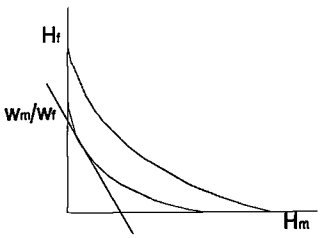

Figure 6.1.b: Isoquants for concave home production function $z(H_m,H_f)$

The figure shows that if w_m/w_f is either smaller or larger (for instance, w_m'/w_f' in figure 6.1.a) than α/β, it is optimal that the financial management is handled by one partner. Only when w_m/w_f exactly equals α/β it does not matter which partner handles financial management. However, we assumed the production function $z(H_m,H_f)$ to be concave, in which

case both partners' time inputs are substitutable at diminishing marginal rates. Figure 6.1.b shows that in this case corner solutions may occur less frequently.

We are particularly interested in how the optimal distribution of home production over both partners relates to both their wages, so if the functions h_m and h_f given by:

$$H_m^* = h_m(w_m, w_f) , \quad H_f^* = h_f(w_m, w_f) . \tag{6.16}$$

are increasing, decreasing or constant in both partners' wage rates.

Let us first consider the case that in the household's optimal time allocation ($L_m^*, L_f^*, N_m^*, N_f^*, H_m^*, H_f^*$) both partners participate in the labour force and in home production, so (6.15) holds. We know that the amount of home production depends only on H_m and H_f. Now what will happen if w_m increases? To restore equality in (6.15) $(\partial z/\partial H_m)/(\partial z/\partial H_f)$ must increase as well. Figure 6.1.b shows that the household can achieve this by decreasing H_m in favour of H_f. Similarly, if the wife's wage increases, the household will increase H_m at the expense of H_f.

Up to this point we have only considered interior solutions, namely when both partners participate in financial management and have a paid job. Now let us briefly examine what happens in case only one of both partners handles financial management (we still assume that both have a paid job). First suppose it is entirely handled by the husband, i.e. $H_m^* > 0$, $H_f^* = 0$, $\lambda_m = 0$ and $\lambda_f > 0$, so the Kuhn-Tucker conditions lead to:

$$\frac{\partial z / \partial H_m}{\partial z / \partial H_f} > \frac{w_m}{w_f} \tag{6.17}$$

Then an increase in w_m/w_f will affect (H_m^*, H_f^*) only if the increase is high enough to change the inequality sign in (6.17) into an equality. The household will then substitute units H_m by H_f until either the marginal rate of substitution equals the wage ratio, or the maximum amount of the female's time needed for home production is reached. So in correspondence with the case of an interior solution discussed above, a (large enough) rise in w_m/w_f will cause a fall in H_m^* and a rise in H_f^*. A decrease in w_m/w_f will have no effect on (H_m^*, H_f^*), as the inequality in (6.17) will still hold: the male will keep providing the maximal amount of his time needed for home production.

The case where only the wife participates in home production is analyzed analogously.

Finally, let us briefly mention the relationship between w_m/w_f and (H_m,H_f) in case at least one of both partners does not have a paid job. In these cases we have no information on w_p for the non-participating partner, but we do know that it is lower than the household's marginal utility of p's leisure time. Depending on the household's production function and the marginal utilities of both partners' leisure time, the household finances are managed by one or by both partners. It can be shown that an increase in the wage of one of both partners will either decrease this partner's share in home production, or will have no effect at all on the distribution of home production between partners. So overall we again expect to find a negative relationship between w_m/w_f and H_m.

So far we have not discussed any variables other than wages that can influence both partners' optimal time inputs in financial management. In addition to this we assume an individual's productivity in financial management to increase with his/her level of education, so the male's share in managing household finances will increase with his own education level, and decrease with the female's education level.

The main conclusion of this section is that the household production model suggests a negative relationship between a partner's wage rate and his participation in financial management. Figure 6.2 shows how H_m^* and H_f^* can relate to w_m/w_f when the wife is more productive in home production than the husband. In section 6.5 we will empirically investigate if the suggested relationships between w_m/w_f and H_m and H_f hold.

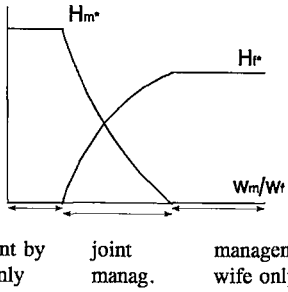

Figure 6.2: Possible relationship between H_m^* and w_m/w_f and between H_f^* and w_m/w_f.

6.3 A bargaining model of financial management

In the previous section we assumed that both partners' time inputs into financial management result from an efficient distribution of labour within the household. Alternatively, we will now focus exclusively on possible power aspects of the financial management of households. In sociological literature several authors have suggested that patterns of financial management within the household reflect the division of power in decision-making between partners (e.g. Blumberg, 1991; Blumstein and Schwartz, 1983; Hertz, 1992; Vogler and Pahl, 1994; Wilson, 1987). Unfortunately, most of these papers do not clearly define what is meant by marital power. To define explicitly the division of power between partners we analyze household decision making in a bargaining framework.

A bargaining model of household behaviour allows both partners to have different utility functions, so their preferences may differ. We denote the utility functions of both partners reflecting their preferences on X, L_m, and L_f by $U^m(X,L_m,L_f)$ and $U^f(X,L_m,L_f)$ respectively.[3] In case of egoistic agents, the leisure of one spouse does not directly affect the utility of the other spouse so the utility functions reduce to $U^i(X,L_i)$, i=m,f. If partners choose to behave noncooperatively, each will maximize his or her own utility function given the behaviour of his/her partner and a noncooperative equilibrium (e.g. a Nash or a Stackelberg equilibrium) will result. We assume that in this case there is no pooling of resources and no joint consumption, and partners attain utility levels $\Psi^m{}_N$ and $\Psi^f{}_N$ (where N stands for Nash). These noncooperative outcomes depend on both partners' wages and nonlabour income.

Alternatively, partners can behave cooperatively by making agreements. As the partner who would loose the most in case of disagreement is more likely to make concessions, the utility levels in the noncooperative outcome can be interpreted as 'threat points' in the bargaining process. The partners will therefore choose an allocation from the set of Pareto-optimal allocations of the household. These are solutions to the following maximization problem:

[3] X, L_m, and L_f have the same meaning as in the previous section; X is the amount of consumption goods, and L_m and L_f are hours of leisure enjoyed by the male and female partner respectively.

$$\begin{aligned} \max\ & U^{hh} = W(U^m(X,L_m,L_f),\ U^f(X,L_m,L_f)) \\ s.t.\ & U^m(X,L_m,L_f) \geq \Psi^m{}_N(w_m,w_f,\alpha) \\ & U^f(X,L_m,L_f) \geq \Psi^f{}_N(w_m,w_f,\alpha) \end{aligned} \qquad \textbf{(6.18)}$$

where U^{hh} is the household's utility function, and α denotes all variables (apart from wages) that determine the noncooperative outcomes for both partners, like nonwage incomes, human capital, or the opportunity cost of being married.[4] Note that the greater a spouse's threat point, the stronger the relative bargaining power of this spouse will be.

If patterns of financial management really reflect the division of power in decision-making between partners, we would expect to find a relationship between the participation in financial management of both partners and their relative bargaining power. A possible explanation for such a relation is that if a partner has a larger share in the management of household finances, this person can influence household decisions in favour of his/her own utility function[5]. If both partners know that this is the case, their participation in the household's financial management will exactly correspond with their bargaining power. The larger a partner's relative power, the larger will be his/her share in the management of household finances.

The maximization problem in (6.18) shows that the outcome of the cooperative bargaining game depends on both partners' threat points $\Psi^m{}_N$ and $\Psi^f{}_N$. Consequently, if we know how the threat points of both partners relate to their wage rates, we also know how the household's financial management relates to both partners' wage rates. Remember that we assume that in case of noncooperative behaviour there is no pooling and no joint consumption by partners. We will show that under this assumption a rise in a partner's wage rate implies

[4] McElroy (1990) mentions various so-called *extrahousehold environmental parameters* (EEPs), that may shift the threat points in Nash bargaining models of household demand but do not affect prices and nonwage incomes faced by married individuals. Examples are measures of competitiveness in the marriage market, parents' wealth, additional nonwage income received in the form of welfare when unmarried, and tax changes due to leaving marriage.

[5] For instance, Gray (1979) found that husbands who handed the whole of their wages over to their wives, were less likely to work overtime than husbands who gave their wives a fixed housekeeping allowance. In the latter case husbands often regard extra earnings as personal spending money and so had a greater incentive to do overtime.

an increase in his threat point Ψ^i_N, using the Stone-Geary specification of individual preferences.

In the non-cooperative situation with no pooling and no joint consumption, partner m maximizes:

$$U^m(X_m,L_m,L_f) = \alpha_m \log(L_m-\gamma_m) + \alpha_f \log(\bar{L}_f - \gamma_f) + \alpha_X \log(X_m-\gamma_X) \qquad \textbf{(6.19)}$$
$$s.t. \quad X_m = w_m(T - L_m) + \mu_m$$

where $\bar{L}_f$ is the (given) amount of leisure enjoyed by partner f, X_m is the amount of goods consumed by m, μ_m is m's non-labour income, and $\alpha_X = 1-\alpha_m-\alpha_f$. Similarly, partner f maximizes:

$$U^f(X_f,L_m,L_f) = \beta_m \log(\bar{L}_m-\delta_m) + \beta_f \log(L_f - \delta_f) + \beta_X \log(X_f-\delta_X) \qquad \textbf{(6.20)}$$
$$s.t. \quad X_f = w_f (T - L_f) + \mu_f$$

with $\beta_X = 1-\beta_m-\beta_f$. Solving the maximization problem (6.19) gives the optimal amount of leisure for partner m:

$$w_m L_m = w_m\gamma_m + \left(\frac{\alpha_m}{1-\alpha_f}\right).(w_m T + \mu_m - w_m\gamma_m - \gamma_X) \qquad \textbf{(6.21)}$$

The utility level associated with this optimal solution is:

$$\Psi^m{}_N = \alpha_m \log\left[\frac{\alpha}{w_m}.(w_m T+\mu_m-w_m\gamma_m-\gamma_X)\right] + \alpha_f \log\left[\bar{L}_f - \gamma_f\right] \qquad \textbf{(6.22)}$$
$$+ \alpha_X \log\left[(1-\alpha).(w_m T+\mu_m-w_m\gamma_m-\gamma_X)\right]$$

with $\alpha \equiv \alpha_m/(1-\alpha_f)$. The optimal noncooperative outcome for partner f can be derived analogously. Making use of the 'Envelope theorem' it follows that:

$$\frac{\partial\Psi^i{}_N}{\partial w_i} > 0 \quad \textit{and} \quad \frac{\partial\Psi^i{}_N}{\partial w_j} = 0 \;, \quad i\neq j \qquad \textbf{(6.23)}$$

So if a partner's wage rate increases, the noncooperative Nash-outcome of this partner increases as well, while the other partner's outcome remains the same. Note that this result depends on our assumption of no pooling and no joint consumption in the noncooperative

outcome. In Appendix 6A we show that the effect of a wage increase remains unclear if we allow pooling and joint consumption in the noncooperative outcome, in accordance with Kooreman and Kapteyn's (1990) model.

Assuming that our bargaining interpretation of financial management is correct, a rise in the male's wage rate implies an increase in his relative bargaining power, which will raise his share in household financial management. Alternatively, an increase in the wife's wage rate will cause a positive (bargaining) effect on her share of household finances. So in contrast with our results in the previous section, in the bargaining framework the wage rate of a partner has a positive effect on his/her participation in financial management.

6.4 Testing the household production model versus the bargaining model

Both the household production model and the bargaining model can be used to explain the financial management of households theoretically. The previous sections show that a crucial difference between both approaches is the expected influence of both partners' wage rates. While the household production model predicts a negative relationship between an individual's wage and his/her share in financial management, the bargaining model implies a positive relationship. This difference between both models forms the basis of the method we will apply to test both models empirically.

To investigate how the financial management of households relates to various household characteristics, we consider the division between partners of five different parts of household finances (in the following also referred to as categories 'A' to 'E'): A) looking after household finances, denoted by the household's financial allocative system (as discussed in chapter 5); B) having the final say in big financial decisions; C) paying regular household bills; D) handling everyday household spending; and E) asking permission for personal expenditures between £10 and £20. Each part is likely to reflect a different level of decision-making authority. A priori, in accordance with Vogler and Pahl (1994), we expect that 'handling everyday household spending' and 'taking care of regular household bills' are examples of executive management, i.e. unimportant and time-consuming decisions within limitations. For these parts the efficiency argument seems to be more persuasive than the power argument, so they probably best fit the household production model. Alternatively, we expect that 'having a final say in big financial decisions' and 'asking permission for small personal expenditures' involve strategic control. Consequently, they may better fit the

bargaining model. We do not postulate any expectations with respect to 'the household's financial allocative system' because of our findings in chapter 5. This variable seemed to be related to all the other parts of household finances, and is therefore likely to reflect both efficiency and power considerations. The empirical results may give us some hints on if we should interprete the various parts of financial management in terms of marital power or as the result of an efficient division of duties within the household.

In the following subsections we further elaborate on how the household production and the bargaining model apply to the parts A to E of financial management. In accordance with our notation in sections 6.2 and 6.3 we will denote the time spent by partner i on part x of financial management by H_i^x. As we have information provided by both partners separately on parts A to D, we check if both answers correspond with each other. In our analysis of these four parts we only use observations for which both partners have chosen the same answering categories. For category E, however, we only have answers of one partner available.

The most crucial explanatory variables in our estimations are both partners' wage rates and their education levels. Other possibly influential variables we will consider are the number of children present, importance of religion, and the amount of non-labour income of the household. These variables were not mentioned in the previous sections as they play no particular role in the distinction between the household production and the bargaining interpretation of financial management. However, they may very well help to discriminate between the various types of financial management used by households.

6.5 Empirical results

To be able to investigate empirically the relationship between wages and the various parts of financial management we need information on both partners' wage rates, also of individuals who do not report to have a job in the survey. We therefore first estimate a wage equation for males and females separately, based on the individuals for which we do observe the wage rate. We use age, age squared and four dummy variables for level of education as explanatory variables. The resulting wage equations are (t-values in parentheses):

$$w_m = \underset{(0.21)}{0.21} + \underset{(3.84)}{0.18age} - \underset{(-3.22)}{0.002age^2} + \underset{(4.30)}{0.87e1} + \underset{(7.34)}{1.64e2} + \underset{(10.55)}{3.42e3} + \underset{(12.07)}{3.38e4}$$

$$w_f = \underset{(1.90)}{1.30} + \underset{(2.82)}{0.09age} - \underset{(-2.34)}{0.001age^2} + \underset{(4.53)}{0.60e1} + \underset{(4.63)}{0.84e2} + \underset{(12.01)}{2.89e3} + \underset{(12.78)}{2.65e4}$$

with R^2s of 0.11 and 0.16 respectively[6]. Using these equations we calculate predicted values of wage rates for individuals in our sample that do not participate in the labour force. For all other individuals we use observed wage rates in our estimations.[7]

6.5.1 The household's financial allocative system

The question asked to respondents was[8]:

'Which of the following methods comes closest to the way your household finances are organised?'

1) Female partner is given a housekeeping allowance

2) Male partner looks after all household money, except wife's personal money

3) Both share and manage household finances jointly

4) Female partner looks after all household money, except husband's personal money

Other answering categories are excluded in this analysis. The interpretation of the four answering categories and their ranking may be different in the bargaining framework than in the household production approach. In terms of marital power we would order the four systems as indicated above, reflecting an increasing influence of the wife going from

[6] These equations are estimated by OLS. In theory, one should correct for the selection bias caused by using only participating individuals in the estimation of the wage equation. However, for the males Heckman's two-step procedure gives poor results and the implied estimate of ρ lies outside the (-1,1) range. For the females the procedure offers no problems, but the selection bias has no significant effect in the wage equation.

[7] It is not an uncommon procedure to use observed wage rates for workers and predicted wage rates for non-workers. See e.g. Kooreman (1986, p.23) and van Soest (1990, p.102). Note that by using this method random variation in wages across individuals is ignored for non-workers.

[8] Slightly reformulated. For the exact formulation see section 5.2.

answering category 1 to 4.[9] In order to test if the bargaining approach can explain the allocative system used by the household we will estimate an ordered probit model based on these four answering categories. In this model a latent variable, say z, is defined, which represents the wife's share in managing household finances. When we denote the financial allocative system reported by the couple by y, the ordered probit model defines the following relationship between z and y:

$$
\begin{aligned}
z &= \beta' x + \epsilon \qquad\qquad \epsilon \sim N(0,1) \\
y &= 1 \quad if \quad z \leq \mu_0 \\
&= 2 \quad if \quad \mu_0 < z \leq \mu_1 \\
&= 3 \quad if \quad \mu_1 < z \leq \mu_2 \\
&= 4 \quad if \quad z > \mu_2
\end{aligned}
\qquad \textbf{(6.26)}
$$

We normalize μ_0 to zero. Assuming that the bargaining interpretation is correct, this method offers us an opportunity to test if the ordering of the allocative systems as we proposed indeed reflects an increasing influence of the wife for higher codes. If this is not the case, the estimated μ's will not be of increasing order (i.e. $\mu_0 < \mu_1 < \mu_2$). Furthermore, we will discuss if the estimated β, reflecting the relationship between the distribution of financial management between partners (z) and a number of socio-economic characteristics of the household, supports the bargaining model of section 6.3 or not.

In the household production model only the time inputs of both partners matter. In that case the 'household allowance' system (answering category 1) is somewhat difficult to interprete, as both partners spend some time on managing household finances but each operates at his/her own level of authority. As we do not want to aggregate this category with answering category 3 (shared management), we leave it out of our analysis so that three categories remain: 2, 3 and 4. We analyse the household's choice between these three categories by estimating two probit equations: one concentrating on the choice between category 4 ($H_m^A=0$) versus 2 and 3 ($H_m^A>0$), and one on the choice between category 2 ($H_f^A=0$) versus 3 and 4 ($H_f^a>0$). In words: the first probit equation examines if the husband participates or not, and the second examines participation or not for the wife. We prefer to

[9] One could argue that the mutual ordering of 1 and 2 is unclear and perhaps should be reversed. But since the second category explicitly excludes the wife's personal spending money from the household money looked after, we associate it with a more equal distribution of power between partners than the first category. In the following we will test the ordering of allocative systems empirically.

estimate two probit equations in stead of one ordered probit on the three answering categories. This enables us to investigate if the participation of the wife relates to the same extent to certain variables as the participation of the husband. If this is the case both probits will give exactly the same results, also similar to the results from one ordered probit.

We thus estimate three probit equations, in which the following dummies are used as dependent variables:

(A1) 0 = Wife is given a household allowance (160 obs)
1 = Husb. looks after all household finances (147 obs)
2 = Both share household finances (1055 obs)
3 = Wife looks after all household finances (491 obs)

(A2) 0 = Husb. looks after all household finances or both share household finances ($H_m^A>0$)
1 = Wife looks after all household finances ($H_m^A=0$)

(A3) 0 = Wife looks after all household finances or both share household finances ($H_f^A>0$)
1 = Husband looks after all household finances ($H_f^A=0$)

The first is based on possible power aspects of various household financial allocative systems and the last two concentrate on both partners time inputs. Note that a majority of households (57 per cent) reports to share household finances.

As explanatory variables we include the variables mentioned in the previous section with the wage rates of both partners being the crucial ones to distinguish between the two suggested theoretical models. Remember that in the model discussed in section 6.2 the *ratio* w_m/w_f plays a role. We therefore include the logarithms of both wage rates; if it really is their ratio that is of importance, we will then find that both coefficients are of equal magnitude and have opposite signs. The signs of the estimated coefficients may inform us on what approach is the most appropriate: the one discussed in section 6.2 or the one in section 6.3.

The empirical results are presented in table 6.1. The ordered probit presented in the first column is based on a ranking of the financial allocative systems according to increasing power for the female partner. The results show that a lower male wage rate results in a higher share of the female in the management of household finances, which strongly supports the bargaining model. The female's share is also increased by a lower education level of the male and a lower household non-labour income. Note that the mu's are estimated without any difficulties. An alternative model in which the order of 'wife is given an allowance and

'husband looks after' were reversed could not be estimated.[10] This finding confirms our assumption that the household allocative systems should be ordered as suggested above.

Table 6.1: Probit analyses of financial allocative systems (t-values in parentheses)

variables	A1	A2	A3
constant	1.741 (12.49)**	-0.157 (-1.03)	-1.434 (-7.26)**
$\ln(w_m)$	-0.215 (-3.75)**	-0.159 (-2.13)**	0.169 (1.67)*
$\ln(w_f)$	0.140 (1.60)	0.085 (0.84)	-0.263 (-1.97)**
education male	-0.123 (-4.64)**	-0.172 (-5.04)**	0.054 (1.26)
education female	0.039 (1.27)	-0.045 (-1.22)	-0.040 (-0.82)
# children	-0.006 (-0.25)	0.072 (2.25)**	0.017 (0.40)
non-labour income	-0.030 (-4.28)**	-0.033 (-3.50)**	0.034 (3.49)**
religion important	0.063 (0.99)	0.019 (0.23)	-0.070 (-0.66)
mu(1)	0.401 (12.80)**		
mu(2)	2.043 (42.07)**		

The last two columns of table 6.1 show that the signs of the coefficients for $\ln(w_m)$ and $\ln(w_f)$ do not correspond with the household production model: both partners' time inputs in financial management increase with their own wage rate. For instance, the probability that the wife's time input is zero decreases with her wage (see third column). Apart from these 'own wage'-effects, the probability of 'husband looks after' is negatively related with his partner's wage, which contradicts the household production model.

We also find that a higher non-labour income increases the male's share and decreases the female's share in the management of household finances. This appears to be similar to Pahl's (1980) finding that in high income households men are more likely to control finances (while their wives receive a housekeeping allowance) than in low incomes. However, in contrast with Pahl the result does not concern total income but only non-labour income, so wage incomes of both partners do not account for the effect. Furthermore, the probability of 'wife looks after' increases with the number of children, and decreases with the education level of her partner. The latter effect can be explained, within the household production context, by our assumption that the male's productivity in financial management increases with his education level.

[10] The estimation algorithm stops as the calculated μs turn out not to be of increasing order.

6.5.2 The final say in big financial decisions

The second part of financial management investigated by us is based on the following question:

'In your household who has the final say in big financial decisions?'

1) husband

2) equal say

3) wife

An interpretation of these answering categories in the bargaining framework is straightforward: the power of the female partner increases with higher answering codes. An interpretation in terms of time inputs involved is less trivial; the time spent on the final say may be small in comparison with the search for information preceding the final say, and possibly these two stages concern different partners. However, we assume that if a partner has the final say, he or she is the only person spending time on making the final decision. Actually, as in our probit equations only differences in time inputs between the various answering categories matter, the exact assumption of time spent on an activity is not important. Instead, the assumption that a partner's time input is higher or lower than the other partner's time input in one answering category compared to another category is crucial.

To analyze the information provided by this question we estimate two probit equations, taking the following two dummy variables as a starting point:

(B1)	0 = Husband or both have final say in big financial decisions ($H_m^B > 0$)	(1826 obs)
	1 = Wife has final say in big financial decisions ($H_m^B = 0$).	(106 obs)
(B2)	0 = Wife or both have final say in big financial decisions ($H_f^B > 0$)	(1538 obs)
	1 = Husband has final say in big financial decisions ($H_f^B = 0$).	(394 obs)

In a majority of households both partners have a final say in big financial decisions. In 5 per cent of the households the wife has a final say, and in 20 per cent the husband has. Table 6.2 presents the results of both probit estimations. The first column shows insignificant coefficients for $\ln(w_m)$ and $\ln(w_f)$, and for most other variables. Alternatively, in the second column a rise in the husband's wage increases the probability that he has the final say in big financial decisions. A possible explanation is that the wage differences between households reporting 'both have final say' and 'wife has final say' (analyzed in B1) are smaller than wage

differences between households reporting 'both have final say' and 'husband has final say' (analyzed in B2). Another explanation for the poor results in column one may be the small number of observations (about 5 per cent) where the dependent variable takes the value one. Note, however, that the signs of the wage coefficients in the second column point to the bargaining model.

A higher education level of the female appears to decrease the probability that the husband has the final say in big financial decisions. Alternatively, a larger number of children increases the probability that the husband has the final say. The latter result may also point at the bargaining model; Ott (1992) shows, considering fertility as a prisoner's dilemma, that childbearing decreases the bargaining position of the wife. We also find that importance of religion significantly reduces the probability of the wife having the final say. Probably, religion leads to a more traditional division in final say, in which either the husband or both partners have a final say in big financial decisions.

Table 6.2: Probit analyses of final say in big financial decisions (t-values in parentheses)

variables	B1	B2
constant	-1.179 (-5.71)**	-1.089 (-6.84)**
$\ln(w_m)$	-0.134 (-1.25)	0.194 (2.61)**
$\ln(w_f)$	-0.109 (-0.77)	-0.060 (-0.57)
education male	-0.078 (-1.56)	0.042 (1.30)
education female	-0.006 (-0.11)	-0.168 (-4.42)**
# children	-0.025 (-0.50)	0.119 (3.73)**
non-labour income	0.017 (1.41)	0.008 (0.92)
religion important	-0.247 (-2.05)**	0.081 (1.05)

6.5.3 Everyday household spending

A third question asked concerns everyday household spending.

'Who is mainly responsible for handling your everyday household spending? I mean things like food, household necessities and other items of general housekeeping?'

1) mainly husband

2) both

3) mainly wife

This question is expected to concern executive management. Deriving the time inputs of partners is again not straightforward because of the use of the word 'mainly'. We assume,

however, that if the responsibility lays mainly with one partner, the time spent by the other partner can be neglected. Our interpretation of the answering categories in terms of power is that power rises with a higher involvement of a partner. So in category 3 both the time input and the share in family power of the female partner is higher than in category 1.

Again two probit equations are estimated, the results of which are presented in table 6.3. The dummy variables analyzed are defined as follows:

(C1)	0 = Husband or both handle everyday household spending ($H_m^C>0$)	(352 obs)
	1 = Wife handles everyday household spending ($H_m^C=0$)	(1865 obs)
(C2)	0 = Wife or both handle everyday household spending ($H_f^C>0$)	(2106 obs)
	1 = Husband handles everyday household spending ($H_f^C=0$)	(111 obs)

Table 6.3: Probit analyses of handling everyday household spending (t-values in parentheses)

variables	C1	C2
constant	1.007 (6.80)**	-1.871 (-8.84)**
$\ln(w_m)$	0.110 (1.51)	-0.064 (-0.61)
$\ln(w_f)$	-0.012 (-0.12)	0.133 (0.90)
education male	-0.074 (-2.39)**	0.032 (0.74)
education female	-0.119 (-3.42)**	0.017 (0.33)
# children	0.145 (4.25)**	-0.107 (-2.06)**
non-labour income	-0.019 (-2.52)**	0.041 (4.55)**
religion important	0.042 (0.55)	-0.035 (-0.33)

In 84 per cent of households the wife handles everyday household spending, while in only 5 per cent it is exclusively the husband's responsibility. Although the estimated coefficients of both partners' wage rates are not significant, their signs correspond with the household production approach; for both partners an increasing wage rate increases the probability that his/her partner handles everyday household spending. A larger number of children and a lower non-labour income increase the probability that the wife handles everyday household spending and decrease the probability that the husband handles everyday household spending. Moreover, a lower education level for both partners increases the probability of the wife handling everyday household spending on her own. Overall, the results appear to provide no evidence in favour of either one of the theoretical models.

6.5.4 Regular household bills

A fourth part of managing household finances is handling regular bills. The exact formulation of the question asked to respondents is:

'In your household who makes sure that regular household bills are paid, I mean things like the bills for the gas, electricity, telephone?'

1) mainly husband

2) both

3) mainly wife

This question is also expected to concern executive management. The interpretation of the answers in terms of time inputs and power is similar to that of the previous question: in category 3 both the time input and the share in family power of the female partner is higher than in category 1.

The probit equations concerning regular household bills are based on the following dummy variables:

(D1)	0 = Husband or both take care of regular household bills ($H_m^D>0$)	(1073 obs)
	1 = Wife takes care of regular household bills ($H_m^D=0$)	(1051 obs)
(D2)	0 = Wife or both take care of regular household bills ($H_f^D>0$)	(1311 obs)
	1 = Husband takes care of regular household bills ($H_f^D=0$)	(813 obs)

Regular household bills are mostly taken care of by only one partner: in 49 per cent of households the wife takes care of them, and in 38 per cent of households the husband does. Table 6.4 shows that the signs of the coefficients for both partners' wage rates correspond with the bargaining interpretation: a rise in a partner's wage rate increases the probability that this person will take care of regular household bills. This contradicts our suggestion (and Vogler and Pahl's) that this part of financial management reflects executive management and should have little to do with power. Apparently, the labour intensity of paying regular household bills is small in relation to power gains associated with it.

The share of the husband in taking care of regular household bills also increases with his level of education, the amount of non-labour income and the importance of religion. The number of children seems to slightly increase the probability that the wife takes care of regular household bills.

Table 6.4: Probit analyses of taking care of regular household bills (t-values in parentheses)

variables	D1	D2
constant	0.456 (3.47)**	-0.943 (-6.96)**
$\ln(w_m)$	-0.177 (-2.81)**	0.349 (5.34)**
$\ln(w_f)$	0.100 (1.19)	-0.193 (-2.23)**
education male	-0.154 (-5.64)**	0.147 (5.37)**
education female	0.038 (1.25)	-0.042 (-1.38)
# children	0.051 (1.87)*	-0.008 (-0.29)
non-labour income	-0.057 (-7.38)**	0.057 (7.63)**
religion important	-0.139 (-2.12)**	0.122 (1.84)*

Before we go on to discuss part E of financial management we want to make some general comments on the empirical results of parts A to D. As the reader may recall, we preferred to estimate two probit equations on every part in stead of one ordered probit, so that we could investigate if the participation of the wife relates to the same extent to certain variables as the participation of the husband. If the coefficients of both probits have opposite signs, this would mean that the corresponding variables shift the participation from one partner to the other. Both the household production and the bargaining model suggest such a relationship. If, however, coefficients in both probits have the same sign, the corresponding variables cause a shift between the two 'solo' cases (i.e. only one of both partners participates) and the case of joint participation. In tables 6.3 and 6.4 all estimated coefficients have opposite signs in the two columns, although the opposite coefficients are not always both significant. In tables 6.1 and 6.2 we find equal signs in both columns in only four cases[11], but in all of these cases at least one of both coefficients is not significantly different from zero. Overall we conclude that the influence of variables appears to be symmetric. Note that the significance of the estimated coefficients is influenced by the number of observations in the answering categories of the probit equation.

A second remark concerns the coefficients for the wages of both partners. Remember that in the theoretical model discussed in section 6.2 the *ratio* w_m/w_f plays a role. We therefore included the logarithms of both wage rates; if it really is their ratio that is of importance, we will then find that both coefficients are of equal magnitude and have opposite signs. The estimation results show that both partners' wage rates mostly have opposite signs: only in probit B1 both coefficients are negative albeit insignificant. For all four parts of

[11] The constant term is not considered.

financial management Likelihood Ratio tests do not reject the hypothesis that both coefficients are of equal magnitude with opposite signs.

6.5.5 Asking permission for personal expenditures

A final question from the BHPS investigated by us is:

'If you buy something for yourself costing between £10 and £20 would you usually:

1) ask your partner if you could buy it

2) tell your partner

3) not mention it at all.'

Our analysis of this part of financial management is somewhat different from the rest. In the first place, a household production interpretation does not seem plausible as no time inputs are involved in this question. We therefore concentrate exclusively on possible power aspects of the extent to which partners feel inclined to ask permission for personal spending. Secondly, in categories A to D we have answers of both partners to the same question available, and we select only observations for which both partners provide the same answer. However, in category E respondents are only asked if they themselves ask permission for personal expenditures between £10 and £20, and not if their partners ask them for permission. So in this section we cannot check if the answers of both partners correspond with each other.

We will start our analysis by examining both partners' answers separately. We estimate ordered probit equations on the following dummy variables, reflecting the answers provided by wives (E1) and husbands (E2) respectively.

(E1)	0 = Wife reports that she asks permission	(382 obs)
	1 = Wife reports that she only tells partner	(1357 obs)
	2 = Wife reports that she does not mention it	(767 obs)
(E2)	0 = Husband reports that he asks permission	(400 obs)
	1 = Husband reports that he only tells partner	(1539 obs)
	2 = Husband reports that he does not mention it	(567 obs)

A majority of respondents only *tells* his or her partner about personal expenditures between £10 and £20: 54 per cent of wives and 61 per cent of husbands. Moreover, 15 per cent of wives and 16 per cent of husbands say they ask their partner for permission. However, it is not clear if this information can be interpreted in terms of power. The extent to which

partners ask permission may be mainly determined by the total amount of household income available: a very low household income may require more control of both partners, than an abundant household income. If this is the case, each partner's answer on asking permission may be more related to poverty than to power. Alternatively, it may be informative to examine *differences* in the responses of partners. Irrespective of the amount of household income, one partner may feel more inclined to ask permission than the other. To investigate this we create a new variable E3, which is defined as follows:[12]

(E3)	0 = Wife gives more account to husband than vice versa	(442 obs)
	1 = Wife and husband choose the same answering category	(1429 obs)
	2 = Wife gives less account to husband than vice versa	(635 obs)

This variable may reflect any differences between partners in the extent to which they feel free to use household income for personal expenditures. In 18 per cent of households the husband gives less account to his wife than she to him, while in 25 per cent of households the opposite holds. Estimating an ordered probit on E3 may inform us on what variables influence these differences between partners.

The results of all three ordered probits are presented in table 6.5. The first column shows that the wife becomes less likely to ask permission for personal expenditures if both her own and her partner's wage rate increases, and if the number of children is smaller. This may confirm our suggestion that the asking of permission has more to do with poverty and 'making ends meet' than with power. We also find that wives with higher education levels feel less inclined to ask permission. The second column shows that the husband is less likely to ask permission if his own wage rate increases and if he has a lower number of children; his partner's wage rate has no significant influence. A rise in his partner's education level, however, makes him less likely to ask permission. Again, these results are a bit difficult to interprete in terms of power.

The variable analyzed in the third column may be more related to power. We find that a higher value of the wife's wage rate results in a higher value of E3. So wives with a higher

[12] The value of E3 follows from the difference between the values of E1 and E2:
If: E1 < E2, then E3 equals 0;
E1 = E2, then E3 equals 1;
E1 > E2, then E3 equals 2.

wage rate are more likely to give less account to their husbands than their husbands to them, than wives with lower wage rates. This suggests that the extent to which partners feel free to spend household income on personal expenditures increases with the amount of money brought in monthly by themselves. This confirms the bargaining model, in which the access of both partners to common household income depends on their wage rates. Further note that only the wife's wage rate is significant. Perhaps, her contribution to the household's income is more important in this respect than the traditionally 'taken for granted' contribution of the male.

Table 6.5: Probit analyses of asking permission for personal spending (t-values in parentheses)

variables	E1	E2	E3
constant	0.427 (4.04)**	0.536 (5.30)**	0.751 (7.03)**
$\ln(w_m)$	0.197 (3.86)**	0.283 (5.86)**	-0.068 (-1.28)
$\ln(w_f)$	0.290 (4.04)**	0.051 (0.78)	0.222 (3.33)**
education male	0.010 (0.42)	-0.001 (-0.06)	0.019 (0.85)
education female	0.066 (2.48)**	0.054 (2.09)**	0.017 (0.68)
# children	-0.090 (-4.16)**	-0.042 (-2.01)**	-0.037 (-1.77)*
non-labour income	-0.009 (-1.46)	-0.004 (-0.72)	-0.003 (-0.55)
religion important	-0.082 (-1.47)	-0.091 (-1.63)	0.011 (0.19)
mu(1)	1.572 (44.32)**	1.775 (48.51)**	1.602 (46.41)**

6.6 Conclusions

In this chapter we investigated what determines a household's choice of financial management. We specified two models to explain the division of financial management between partners. We first ignored any power aspects and concentrated on an efficient division of management activities between partners. The most crucial characteristics of financial management in that case are both partners' time inputs, and these are analysed in a household production model. Next, we specified a bargaining model to derive an interpretation of financial management in terms of power.

The empirical results show that the household production model does not very well in explaining various management systems: only for part C (everyday household spending) we find coefficients with signs corresponding with this model, but the coefficients are not significantly different from zero. This part of financial management is considered as executive management, with the possible power gains being small in relation to the labour input involved. For all other parts the estimated effects of wage rates point at the bargaining

interpretation. Even for 'who makes sure regular hh bills are paid' the results correspond to this model. Probably, the power gains of managing this part are larger than we (and Vogler and Pahl) expected. We also find, in accordance with earlier results of Pahl, that the participation of wives in financial management is higher in low income households than in high income households. For future research, it would be interesting to investigate if efficiency aspects play a larger role in low income households than in high income households; the estimates of the previous section can provide no answer to this question.

In the analysis of this chapter we have considered both alternative models separately. Probably, however, both efficiency and power aspects play a role simultaneously. The opposite wage effects will then cancel out to some extent. For instance, the insignificant wage coefficients in part C of financial management may be caused by opposite bargaining and efficiency effects of equal magnitude. Alternatively, the bargaining effects found in parts A, B, D, and E do not exclude that efficiency considerations apply as well, albeit to a (significantly) smaller extent.

Our overall conclusion is that power aspects do play a role in the organization of household finances. Consequently, information on financial management may contribute to current research on modelling household decisions in a bargaining framework. For instance, measures of financial management of households can be used to parametrize the distribution of bargaining power in game theoretic models of household labour supply. In our opinion, this is an interesting suggestion for future research.

Appendix 6A: An alternative noncooperative outcome in the bargaining model

In section 6.3 we assumed that in the noncooperative outcome there is no pooling of resources and no joint consumption by partners. Under this assumption we derived that the noncooperative Nash-outcome of a partner increases with his/her wage rate. We will now show that if we allow for pooling of resources and joint consumption in the noncooperative outcome, which is, for instance, assumed by Kooreman and Kapteyn (1990), the effect of a wage increase remains unclear.

In the non-cooperative Nash equilibrium analyzed in Kooreman and Kapteyn, partner m maximizes:

$$U^m(X,L_m,L_f) = \alpha_m \log(L_m - \gamma_m) + \alpha_f \log(L_f - \gamma_f) + \alpha_X \log(X - \gamma_X)$$
$$s.t. \quad X = w_m (T - L_m) + w_f (T - L_f) + \mu \qquad \textbf{(A.1)}$$

where $\alpha_X = 1-\alpha_m-\alpha_f$, L_i is the amount of leisure enjoyed by partner i, X is the amount of goods consumed by the household, and μ is the household's non-labour income. Similarly, partner f maximizes:

$$U^f(X,L_m,L_f) = \beta_m \log(L_m - \delta_m) + \beta_f \log(L_f - \delta_f) + \beta_X \log(X - \delta_X)$$
$$s.t. \quad X = w_m (T - L_m) + w_f (T - L_f) + \mu \qquad \textbf{(A.2)}$$

with $\beta_X = 1-\beta_m-\beta_f$. For convenience's sake we take $\gamma_i=\delta_i=0$, i=m,f,X. Solving the maximization problem of partner i *given* the leisure of partner j gives the following conditional demand equations for both partners' leisure:

$$w_m L_m = \left(\frac{\alpha_m}{1-\alpha_f}\right) . Y \qquad \textbf{(A.3)}$$

$$w_f L_f = \left(\frac{\beta_f}{1-\beta_m}\right) . Y \qquad \textbf{(A.4)}$$

with $Y = w_m.T + w_f.T + \mu$

From (A.3) and (A.4) the leisure demand equations for both partners corresponding to the

Nash equilibrium can be derived, and the amount of goods consumed by the household:

$$w_m L_m = \left(\frac{\alpha(1-\beta)}{1-\alpha\beta}\right) . Y \qquad \textbf{(A.6)}$$

$$w_f L_f = \left(\frac{\beta(1-\alpha)}{1-\alpha\beta}\right) . Y \qquad \textbf{(A.7)}$$

$$X = \left(\frac{1-\alpha-\beta+\alpha\beta}{1-\alpha\beta}\right) . Y \qquad \textbf{(A.8)}$$

$$\textit{with} \quad \alpha \equiv \frac{\alpha_m}{1-\alpha_f} \quad \textit{and} \quad \beta \equiv \frac{\beta_f}{1-\beta_m}$$

The indirect utility level of partner m associated with this Nash solution is:

$$\Psi^m{}_{KK} = \alpha_m \log\left(\frac{\alpha(1-\beta)}{1-\alpha\beta}.\frac{Y}{w_m}\right) + \alpha_f \log\left(\frac{\beta(1-\alpha)}{1-\alpha\beta}.\frac{Y}{w_f}\right) + \alpha_X \log\left(\frac{1-\alpha-\beta+\alpha\beta}{1-\alpha\beta}.Y\right) \qquad \textbf{(A.10)}$$

It can be shown that:

$$\frac{\partial \Psi^m{}_{KK}}{\partial w_m} = \frac{T}{Y} - \frac{\alpha_m}{w_m} \quad \textit{and} \quad \frac{\partial \Psi^m{}_{KK}}{\partial w_f} = \frac{T}{Y} - \frac{\alpha_f}{w_f}$$

Expressions for the noncooperative outcome for partner f can be derived analogously. These expressions show, as $\Psi^i{}_{KK}$ depends not only on w_i but also on w_j, that it is not clear if partner j gets relatively more power if w_j increases. It is also possible that partner i benefits more from an increase in j's wage than partner j himself/herself.

7 Conclusions and discussion

In this thesis we investigated consumption and decision making of households, with a special interest in the individual members involved. In the first chapter we sketched an overview of literature on intrahousehold allocation of resources, and more generally on household economics. Studies that have shown the social and academic importance of this research topic are briefly summarized, and various approaches to modelling household decisions are discussed. In the other chapters we presented our own empirical work. We specified and estimated microeconomic models of household behaviour, addressing three different themes related to intrahousehold allocation of resources: boy-girl discrimination in the intrahousehold allocation of food (chapter 2), parental preferences for the sex of their children (chapters 3 and 4), and the intrahousehold organisation of money (chapters 5 and 6).

Chapter 2 addressed a major problem of investigating intrahousehold allocation, namely that most available data sets only report information at the household level, and not 'who gets what' in the household. Nevertheless, to some extent household-level data can be used to examine the impact of children of different sex and age groups on household expenditures. We applied a method to investigate boy-girl discrimination in Peru using household-level expenditures on food consumed exclusively by adults. We estimated rank three Engel curves for the expenditure shares of 30 food categories, and included various dummies for the presence of children of certain age and sex categories.

Although boys and girls showed to have different effects on expenditures on some food categories, we found no significant differences between the impact of boys and girls on expenditures on the only adult good 'alcoholic beverages'. We thus concluded that this particular data set showed no evidence of boy-girl discrimination. Another result of our analysis was that the inclusion of a quadratic logarithmic expenditure term in the traditional Working/Leser curves significantly improved the specification for most food categories. Most foods appeared to change from a luxury at low levels of total expenditure to necessities or inferior goods as the total expenditure level increased.

The analysis was based on an assumption of exogeneity of total food expenditures. An improvement of the study could be to investigate possible endogeneity of total expenditures,

and to deal with this by using appropriate instruments. However, although this may improve the specification of the model, we feel that it is unlikely that it will seriously alter the results on boy-girl discrimination.

The fact that we find no significant boy-girl discrimination may result from considering only one adult good: alcoholic beverages. Investigation of other adult goods might show different results. The only way to find out is to extend the research to other goods, but this requires detailed information on the household's expenditures on various other consumption goods than food.

A different part of the Peruvian LSMS dataset that may shed light on possible boy-girl discrimination within the family are data on individual education levels. In a preliminary study (Niemansverdriet, 1993) we used these data to investigate factors that influence participation in education of both sexes in Peru. In accordance with Tansel's (1992) results for Côte d'Ivoire and Ghana, we found that in general men participate more in education than women, and that maternal education specifically influences girls' education. An interesting question for future research would be if the different education levels of boys and girls are caused by discrimination or by efficiency considerations (e.g. Rosenzweig and Schultz, 1982). Moreover, we would like to investigate if the specific effect of maternal education, and perhaps also of other characteristics of the mother, can be interpreted as evidence in favour of the bargaining model of household behaviour. This would suggest a study similar in spirit to Thomas (1990), who concluded that mothers tend to allocate more to daughters, and fathers to sons.

A second theme of this thesis concerned a question related to boy-girl discrimination and intrahousehold allocation of resources, namely if parents have an overall preference for the gender of their children. Literature suggests that the existence of parental sex preferences could provide an explanation for boy-girl differences in the intrahousehold allocation of goods.

The main interest in both chapters 3 and 4 is in the methodology used to investigate sex preferences, as well as in possible policy implications. In chapter 3 we applied and discussed three reduced form methods to investigate sex preferences. Alternatively, in chapter 4 we specified and estimated a simple structural model of parental preferences for both number and sex of children. For the empirical analyses we used a Dutch dataset, both to stress that sex

preferences are not restricted to developing countries and to link up with a recent discussion on sex preferences raised by the opening of a 'gender clinic' in the Netherlands.

The first method used in chapter 3 was based on Parity Progression Ratios (PPRs), using number and sex of children from past births to investigate additional births. Due to the problem of right censoring and the resulting inaccurate calculation of the 'true PPR', we concluded that this method was less useful for our purposes. Next, we applied a Cox proportional hazard analysis on birth intervals, a method that explicitly controls for right censoring. It assumes that couples who are less satisfied at a certain parity will tend to have shorter subsequent birth intervals than couples who are more satisfied. We found that couples with exactly two sons or two daughters were more likely to have a third child than couples who had a son and a daughter. So parents appeared to have a preference for at least one child of each sex. Thirdly, we investigated information about sterilization decisions of respondents, which is not very common in literature. The assumption underlying this method is that people only choose for a sterilization if they are satisfied with their actual household composition. While an initial probit analysis of this information gave somewhat unconvincing results, a 2SLS estimation, that dealt with the possible endogeneity of the explanatory variable 'number of children', showed that couples with children of both sexes are more likely to have a sterilization than other couples.

Although the reduced form methods provided evidence for a preference for a mixture of sexes in the Netherlands, they do not clarify how parents weigh a sex preference against a preferred number of children. Consequently, they do not enable us to investigate how fertility will change if parents obtain the possibility of choosing the sex of their children. This requires estimation of preference parameters in a structural fertility model, which is carried out in chapter 4. With this model the interrelationship between preferences for both number and sex of children can be examined more explicitly. Using a Maximum Likelihood procedure we estimated the effect of various household characteristics and the sex of the household's children on the probability that a couple obtains a certain number of children. To achieve identification in our empirical model we used information on both the number of past births and on sterilization decisions and the age of respondents. We found that parental preferences for number of children and for a 'mixture of sexes' are substitutes.

Using the estimates of the structural model we analyzed possible effects of introducing sex preselection techniques on fertility. We found two opposite effects, namely an increase

in first and second order births and a decrease in third and higher order births. The total resulting effect was a rise in fertility of about 1 per cent. In other countries, however, the introduction of sex preselection techniques may very well lead to a decline in total fertility, due to more third and higher order births, or due to a different sex preference.

Our analysis of sex preferences can be improved in various ways. Firstly, if we had richer data available, we could use time varying covariates in our estimations. For instance, we now only use income and type of job of the respondent at the moment of interview, while it would be more interesting to use information on these variables at different moments in time. This would enable us to estimate a dynamic model of fertility, investigating the effects of life-cycle variations in parents' income and other variables on the timing of births. Another possible improvement is to allow for unobserved heterogeneity of couples. For instance, Heckman et al. (1985) conclude that controlling for unobservables affects the sign and the statistical significance of the impact of several variables on fertility. All these possible improvements are not easily incorporated in our structural model. They require a much more complicated dynamic model, analyzing all available birth intervals of couples simultaneously; such a model is used in Heckman et al. (1985) and in Leung (1988). Unfortunately, such a comprehensive analysis is beyond the scope of this thesis.

It will be interesting to follow future practices of the 'gender clinic' recently opened in the Netherlands. It may reveal useful information on which parents choose to select a certain sex and why. Anyway, in a recent interview in a daily journal (*Trouw*, October 17th 1995) the chief executive of the 'gender clinic' stated that most of the parents at their waiting list already had two boys and now wanted a girl. His remark supports our findings in chapters 3 and 4.

In the third and last part of this thesis we empirically investigated the organization of money within the household. We explicitly concentrated on how various financial tasks are divided between both partners, and if this influences the access of both partners to household income. Although our main interest was to investigate a possible relation between the financial management of households and power, we first concentrated (in chapter 5) on the diversity of financial management itself. We examined information on the 'financial allocative system' of households, a concept introduced by Pahl to provide an overall indicator of how partners manage household finances. We investigated how specific parts of financial management are

divided between partners, and how these relate to the 'financial allocative system' of the household. Furthermore, we examined differences in both partners' reports on questions concerning financial management. Our findings convince us that for a good insight in the household's financial management, we should consider information on all various parts of financial management and not just on allocative systems, and that we should use information based on both partners' answers in stead of relying on one partner's perception.

Next, in chapter 6, we specified two alternative models that may explain the intrahousehold organization of finances. The first model considered was a home production model, in which the financial management results from an efficient distribution of both partners' time inputs. The other model was a bargaining model, assuming that the one who manages household finances can influence the final decision of the household. These two alternative models impy different effects for certain variables on the financial management of the household, which enable us to investigate empirically which model best fits the available data. We estimated various probit equations, representing the division between partners of five different parts of household finances. The results showed that the household production model does not perform very well in explaining various types of financial management. Several estimates, however, correspond with the bargaining interpretation of financial management. We therefore conclude that power aspects play a more dominant role in the organization of household finances than considerations related to an efficient division of tasks.

One could discuss that it would be more practical to create one single measure of financial management in stead of considering all five parts separately as we did in chapter 6. For instance, Woolley and Marshall (1994) construct a measure of female influence by simply averaging the female influence score across all household decisions included in a questionnaire. However, some important disadvantages of such a procedure should be noted. Firstly, it will be very difficult to decide on a sensible weighing of the various decisions into one measure; it is far from obvious why one would equally weigh all decisions, as done by Woolley and Marshall. Secondly, such a measure will always reflect the type of financial decisions it includes. For instance, an additional question on food expenses would affect the measure in a different way than an extra question on mortgages. And finally, one will always loose information when taking an average of various items.

Another point for future research is the possible use of information on financial

management in bargaining models of household decisions. For instance, in Kooreman and Kapteyn's (1990) model of household labour supply a parameter λ incorporates the relative bargaining power of both partners. If the household's financial management is related to the distribution of bargaining power within households, the financial management could inform us on what bargaining solution applies to certain households. In a similar way as Barmby (1994) makes λ a function of household specific wage rates of both partners, we suggest to parametrize λ using information on the household's financial management.

References

Ahn, N. (1994). 'Effects of the one-child family policy on second and third births in Hebei, Shaanxi and Shanghai.' *Journal of Population Economics*. 7(1): 63-78.

Amat y León, C. and D. Curonisy (1987). *La Alimentación en el Perú.* (Alimentation in Peru.) Lima: Centro de Investigación de la Universidad del Pacífico.

Antonides, G. and A.J.M. Hagenaars (1992). *The distribution of welfare in the household.* Mimeo, Erasmus University, Rotterdam.

Apps, P. and E. Savage (1989). 'Labour supply, household production and intra-family welfare distribution.' *Journal of Public Economics*. 39: 335-364.

Arnold, F. and E.C.Y. Kuo (1984). 'The value of daughters and sons: a comparative study of the gender preferences of parents.' *Journal of Comparative Family Studies*. 15(2): 299-318.

Bairagi, R. (1993). *Is gender preference an obstacle to the success of family planning programmes in rural Bangladesh?*. Proceedings of International Population Conference Montréal 1993, Vol.I.

Banks, J., R. Blundell, and A. Lewbel (1992). *Quadratic Engel curves, welfare measurement and consumer demand.* Working paper, Institute for Fiscal Studies, London.

Becker, G.S. (1965). 'A theory of the allocation of time.' *Economic Journal*. 75: 493-517.

Becker, G.S. (1973). 'A theory of marriage: Part I.' *Journal of Political Economy*. 81: 813-846.

Becker, G.S. (1974). 'A theory of marriage: Part II.' *Journal of Political Economy*. 82: S11-S26.

Becker, G.S. (1974). 'A theory of social interactions.' *Journal of Political Economy*. 82: 1063-1093.

Becker, G.S. (1975). *Human capital: a theoretical and empirical analysis with special reference to education.* New York: National Bureau of Economic Research.

Becker, G.S. (1981). *A treatise on the family*. Cambridge, MA: Harvard University Press.

Behrman, J.R. (1990). 'Intrahousehold allocation of nutrients and gender effects.' In: Osmani, S.R. *Nutrition and poverty*. Oxford: Oxford University Press. pp.287-320.

Behrman, J.R. and A.B. Deolalikar (1990). 'The intrahousehold demand for nutrients in rural South India. Individual estimates, fixed effects, and permanent income.' *Journal of Human Resources*. 25(4): 665-696.

Blood, R.O., and D.M. Wolfe (1960). *Husbands and wives: the dynamics of married living*. New York: The Free Press.

Blumberg, R.L. (1991). 'Income under female versus male control.' In: Blumberg, R.L. (ed.). *Gender, Family and Economy: the Triple Overlap*. Newbury Park: Sage.

Blumstein, P., and P. Schwartz (1983). *American couples*. New York: Morrow.

British Household Panel Survey principal investigator, ESRC Research Centre on Micro-social Change. (1993). Data files and associated documentation. Colchester: ESRC Data Archive.

Charles, N. and M. Kerr (1987). 'Just the way it is: gender and age differences in food consumption.' In: Brannen, J. and G. Wilson (eds.). *Give and take in families: studies in resource distribution*. Londen: Allen and Unwin.

Chen, L.C., E. Huq and S. D'Souza (1981). 'Sex bias in the family. Allocation of food and health care in rural Bangladesh.' *Population and Development Review*. 7(1): 55-70.

Chiappori, P.A. (1988). 'Nash-bargained households decisions: a comment.' *International Economic Review*. 29(4): 791-796.

Chiappori, P.A. (1992). 'Collective labor supply and welfare.' *Journal of Political Economy*. 100(3): 437-467.

Chowdhury, M.K. and R. Bairagi (1990). 'Son preference and fertility in Bangladesh.' *Population and Development Review*. 16: 749-757.

Cleland, J., J. Verrall and M. Vaessen (1983). 'Preference for the sex of children and their influence on reproductive behaviour.' *World Fertility Survey Comparative Studies* No. 27 (Voorburg, Netherlands, International Statistical Institute).

Coombs, C.H., L.C. Coombs and G.H. McClelland (1975). 'Preference scales for number and sex of children.' *Population Studies*. 29: 273-298.

Coombs, L.C. and T.H. Sun (1978). 'Family composition preferences in a developing culture: the case of Taiwan, 1973.' *Population Studies*. 32: 43-64.

Coombs, L.C. (1979). 'Prospective fertility and underlying preferences: a longitudinal study in Taiwan.' *Population Studies*. 33: 447-455.

Das, N. (1987). 'Sex preference and fertility behavior: a study of recent Indian data.' *Demography*. 24(4): 517-530.

Davies, H., and H. Joshi (1994). 'Sex, sharing and the distribution of income.' *Journal of Social Policy*. 23(3): 301-340.

Deaton, A. (1989). 'Looking for boy-girl discrimination in household expenditure data.' *World Bank Economic Review*. 3(1): 1-15.

Deaton, A. and J. Muellbauer (1980). *Economics and Consumer Behavior*. Cambridge (USA): Cambridge University Press.

Engel, Blackwell and Miniard (1987). 'Family Decision Making.' In: Assael, H. *Consumer behavior and marketing action*. Boston: PWS-Kent Publishing Company.

Ferree, M.M. (1990). 'Beyond separate spheres: feminism and family research.' *Journal of Marriage and the Family*. 52: 866-884.

Gianotten, V.R.M., J.W. le Grand, R.A. Timmer, and A.H.H. de Wit (1988). *Peru* (in Dutch). Amsterdam: Royal Institute for the Tropics.

Glewwe, P. (1988). 'The distribution of welfare in Peru in 1985-86.' *LSMS Working Paper*, No. 42.

Gray, A. (1979). 'The working class family as an economic unit.' In: Harris, C. (ed.) *The sociology of the family*. Sociological Review Monograph: University of Keele.

Gronau, R. (1973). 'The intrafamily allocation of time: the value of the housewives' time.' *American Economic Review*. 68: 634-651.

Gronau, R. (1977). 'Leisure, home production, and work. The theory of the allocation of time revisited.' *Journal of Political Economy*. 85(6): 1099-1123.

Gronau, R. (1991). 'The intrafamily allocation of goods - How to separate the adult from the child.' *Journal of Labor Economics*. 9(3): 207-235.

Haddad, L. and R. Kanbur (1990). 'How serious is the neglect of intra-household inequality?' *Economic Journal*. 100: 866-881.

Haddad, L. and R. Kanbur (1992). 'Intrahousehold inequality and the theory of targeting.' *European Economic Review*. 36: 372-378.

Hagenaars, A.J.M., and S.R. Wunderink-van Veen (1989). *Soo gewonne, soo verteert: economie van de huishoudelijke sector*. Leiden: Stenfert Kroese.

Harding, S. (1986). *The science question in feminism*. Ithica, N.Y.: Cornell University Press.

Heckman, J.J., V.J. Hotz and J.R. Walker (1985). 'New evidence on the timing and spacing of births.' *American Economic Review*. 75: 179-184.

Heckman, J.J., and J.R. Walker (1990). 'The third birth in Sweden.' *Journal of Population*

Economics. 3: 235-275.

Hertz, R. (1992). 'Financial affairs: money and authority in dual-earner marriage.' In: Lewis, Izraeli, Hootsmans (eds.). *Dual-Earner Families: International Perspectives*. London: Sage.

Hoem, B. (1993). 'The compatibility of employment and childbearing in contemporary Sweden.' *Acta Sociologica*. 36: 101-120.

Horney, M.J., and M.B. McElroy (1988). 'The household allocation problem: empirical results from a bargaining model.' *Research in Population Economics*. 6: 15-38.

Hotz, V.J., and R.A. Miller (1988). 'An empirical analysis of life cycle fertility and female labor supply.' *Econometrica*. 56: 91-118.

Ilmonen, K. and M. Pantzar (1986). 'Determinants in the modern choice of food.' *Journal of Consumer Studies and Home Economics*. 10: 97-110.

Kapteyn, A. and P. Kooreman (1992). 'Household labor supply: what kind of data can tell us how many decision makers there are?' *European Economic Review*. 36: 365-371.

Kerkhofs, M. (1994). *A quadratic model of home production decisions*. Research Memorandum 94.01: University of Leiden.

Kishor, S. (1993). 'Gender and child mortality in India.' *American Sociological Review*. 58: 247-265.

Kooreman, P. (1986). *Essays on microeconometric analysis of household behavior*. Ph.D. dissertation, University of Tilburg.

Kooreman, P. and A. Kapteyn (1990). 'On the empirical implementation of some game theoretic models of household labor supply.' *Journal of Human Resources*. 25(4): 584-598.

Lancaster, T. (1990). *The econometric analysis of transition data*. Cambridge University Press, Cambridge.

Leung, S.F. (1988). 'On tests for sex preferences.' *Journal of Population Economics*. 1: 95-114.

Leung, S.F. (1991). 'A stochastic dynamic analysis of parental sex preferences and fertility.' *Quarterly Journal of Economics*. 106: 1063-1088.

Leung, S.F. (1994). 'Will sex selection reduce fertility?' *Journal of Population Economics*. 7(4): 379-392.

Leuthold, J.H. (1968). 'An empirical study of formula income transfers and the work decision of the poor.' *Journal of Human Resources*. 3: 312-323.

Lundberg, S. and R.A. Pollak (1993). 'Separate spheres bargaining and the marriage market.' *Journal of Political Economy*. 101(6): 988-1010.

Manser, M. and M. Brown (1980). 'Marriage and household decision-making: a bargaining analysis.' *International Economic Review*. 21(1): 31-44.

McClelland, G.H. (1979). 'Determining the impact of sex preferences on fertility: a consideration of parity progression ratio, and stopping rule measures.' *Demography*. 16(3): 377-388.

McDonald, G.W. (1980). 'Family power: the assessment of a decade of theory and research, 1970-1979.' *Journal of Marriage and the Family*. 42: 841-854.

McElroy, M.B. and M.J. Horney (1981). 'Nash-bargained household decisions: toward a generalization of the theory of demand.' *International Economic Review*. 22(2): 333-349.

McElroy, M.B. (1990). 'The empirical content of Nash-bargained household behavior.' *Journal of Human Resources*. 25(4): 559-583.

Mincer, J. and S. Polachek (1974). 'Family investments in human capital: earnings of women.' *Journal of Political Economy*. 82(2), S76-S108.

Mizan, A.N. (1994). 'Family power studies: some major methodological issues.' *International Journal of Sociology of the Family*. 24(2): 85-91.

Moors, H.G. (1980). 'Seksevoorkeur en gezinsvorming in Nederland.' *Bevolking en Gezin*. 9(1): 29-48.

Niemansverdriet, M. (1993). 'Deelname aan onderwijs in Peru.' Master thesis, Wageningen Agricultural University.

Olson, D.H. and C. Rabunsky (1972). 'Validity of four measures of family power.' *Journal of Marriage and the Family*. 34: 224-234.

Ott, N. (1991). *Fertility and division of work in the family: a game theoretic model of household decisions*. Mimeo, University of Frankfurt, Frankfurt.

Ott, N. (1992). *Intrafamily bargaining and household decisions*. New York: Springer Verlag.

Pahl, J. (1980). 'Patterns of money management within marriage.' *Journal of Social Policy*. 9(3): 313-335.

Pahl, J. (1983). 'The allocation of money and the structuring of inequality within marriage.' *Sociological Review*. 31(2): 237-262.

Pahl, J. (1989). *Money and marriage*. London: Macmillan Education Ltd.

Pitt, M.M., M.R. Rosenzweig, and Md.N. Hassan (1990). 'Productivity, health, and inequality in the intrahousehold distribution of food in low-income countries.' *American Economic Review*. 80: 1139-1156.

Piwoz, E.G. and F.E. Viteri (1985). 'Studying health and nutrition behaviour by examining household decision-making, intra-household resource distribution, and the role of women in these processes.' *Food and Nutrition Bulletin*. 7(4): 1-31.

Rosenzweig, M. and T.P. Schultz (1982). 'Market opportunities, genetic endowments, and intrafamily resource distribution: child survival in rural India.' *American Economic Review*. 72: 803-815.

Safilios-Rothschild, C. (1970). 'The study of family power structure: a review of 1960-1969.' *Journal of Marriage and the Family*. 32: 94-104.

Safilios-Rothschild, C. (1976). 'A macro and micro-examination of family power and love.' *Journal of Marriage and the Family*. 37: 355-362.

Samuelson, P.A. (1956). 'Social indifference curves.' *Quarterly Journal of Economics*. 10(1): 1-22.

Schultz, T.P. (1990). 'Testing the neoclassical model of family labor supply and fertility.' *Journal of Human Resources*. 25(4): 599-634.

Senauer, B., M. Garcia and E. Jacinto (1988). 'Determinants of the intrahousehold allocation of food in the rural Philippines.' *American Agricultural Economics Association*. 70: 170-180.

Smith, S. (1991). 'Economic analysis and the division of income within the family.' In: Smith, S. *Economic policy and the division of income within the family*. London: The Institute for Fiscal Studies. pp.10-31.

Soest, A.H.O. van (1990). *Essays on micro-econometric models of consumer demand and the labour market*. Ph.D. dissertation, University of Tilburg.

Taylor, M.F. (ed.) (1992). *British Household Panel Survey user manual volume A & B*. Colchester: University of Essex.

Thomas, D. (1990). 'Intra-household resource allocation. An inferential approach.' *Journal of Human Resources*. 25(4): 635-664.

Treas, J. (1991). 'The common pot or separate purses? A transaction costs interpretation.' In: Blumberg, R.L. (ed.). *Gender, Family and Economy: the Triple Overlap*. Newbury Park: Sage.

Treas, J. (1993). 'Money in the bank: transaction cost and the economic organization of marriage.' *American Sociological Review*. 58: 723-734.

Turk, J.L. and N.W. Bell (1972). 'Measuring power in families.' *Journal of Marriage and the Family*. 34: 215-223.

Vogler, C. and J. Pahl (1993). 'Social and economic change and the organisation of money within marriage.' *Work, Employment and Society*. 7(1): 71-95.

Vogler, C. and J. Pahl (1994). 'Money, power and inequality within marriage.' *Sociological Review*. 42: 263-288.

Widmer, K.R., G.H. McClelland and C.A. Nickerson (1981). 'Determining the impact of sex preferences on fertility: a demonstration study.' *Demography*. 18(1): 27-37.

Williamson, N. (1976). *Sons or Daughters*. Sage Publications, London.

Willis, R.J. (1974). 'Economic theory of fertility behavior.' In: Schultz, T.W. (ed.). *Economics of the family. Marriage, children, and human capital*. Chicago: University of Chicago Press.

Wilson, G. (1987). 'Money: patterns of responsibility and irresponsibility in marriage.' In: Brannen, J. and G. Wilson (eds.). *Give and take in families. Studies in resource distribution*. Londen: Allen & Unwin.

Woolley, F.R. and J. Marshall. (1994). 'Measuring inequality within the household.' *Review of Income and Wealth*. 40(4): 415-431.

Wolpin, K.I. (1984). 'An estimable dynamic stochastic model of fertility and child mortality.' *Journal of Political Economy*. 92(5): 852-874.

Samenvatting (Summary in Dutch)

Lange tijd is het huishouden door economen als een homogene eenheid beschouwd. In economische modellen die het gedrag van huishoudens beschreven werd geen aandacht besteed aan de verdeling van beschikbare middelen tussen de diverse leden van het huishouden. Echter, gedurende de laatste decennia hebben diverse onderzoeken aangetoond dat er verschillen tussen leden kunnen bestaan voor wat betreft voedselconsumptie, toegang tot onderwijs en gezondheidszorg, sterfte-risico's, tijdsbestedingspatronen en het kunnen beschikken over geld.

Dit proefschrift richt zich op de besluitvorming en consumptie van huishoudens, met speciale aandacht voor de individuele leden van een huishouden. De nadruk ligt op het formuleren en empirisch toetsen van micro-economische modellen die de allocatie van goederen binnen huishoudens kunnen beschrijven en verklaren. In hoofdstuk 1 wordt eerst een kort overzicht gegeven van onderzoek op dit terrein. We bespreken een aantal studies die verschillen in consumptie tussen huishoudleden op basis van geslacht of op basis van leeftijd hebben onderzocht. Daarnaast schetsen we de ontwikkeling in modellen waarmee het gedrag van huishoudens is beschreven en geanalyseerd, en de problemen rond de beschikbaarheid van gegevens om allocatie binnen huishoudens empirisch te kunnen onderzoeken. In de overige hoofdstukken worden achtereenvolgens de volgende thema's behandeld: het onderzoeken, op basis van bestedingen van huishoudens, van een mogelijk verschillende behandeling van zonen en dochters, voorkeuren van ouders voor kinderen van een bepaald geslacht, en de organisatie van financiën binnen huishoudens.

In hoofdstuk 2 analyseren we bestedingen van huishoudens in Peru aan diverse voedselcategorieën. Deze analyse biedt ons de mogelijkheid te onderzoeken of er sprake is van een verschillende behandeling van jongens en meisjes binnen het huishouden. Met name de invloed van de aanwezigheid van kinderen op voedselcategorieën die uitsluitend door ouders geconsumeerd worden, zogenaamde 'adult goods', kan ons informatie geven over mogelijk verschillende bestedingen aan zonen en dochters. We schatten Engelcurves voor dertig verschillende voedselcategorieën, waarbij we dummies opnemen voor de aanwezigheid van kinderen van een bepaalde leeftijd en geslacht. Hoewel uit onze resultaten blijkt dat

jongens en meisjes de uitgaven aan een aantal voedselcategorieën verschillend beïnvloeden, vinden we geen significante verschillen tussen hun effect op uitgaven aan 'adult goods'. We beredeneren dat hieruit geconcludeerd kan worden dat de betreffende dataset geen verschillende behandeling tussen zonen en dochters toont. Een andere conclusie van onze analyse is dat het opnemen van een kwadratische term van de totale voedselbestedingen in de Engelcurves de specificatie voor de verschillende voedselcategorieën significant verbetert. De meeste categorieën blijken als 'luxe' goed te kunnen worden aangeduid bij een laag voedselbudget, en als noodzakelijke of inferieure goederen bij hogere voedselbudgetten.

In de hoofdstukken 3 en 4 onderzoeken we een onderwerp dat sterk verbonden is met een verschillende behandeling van jongens en meisjes binnen huishoudens, namelijk de vraag of ouders een voorkeur hebben voor kinderen van een bepaald geslacht. In de literatuur wordt gesuggereerd dat dergelijke voorkeuren een verklaring zouden kunnen bieden voor een ongelijke verdeling van goederen binnen huishoudens tussen zonen en dochters. In hoofdstuk 3 bespreken we verschillende methoden om geslachtsvoorkeuren van ouders te onderzoeken, die gebruik maken van verschillende typen gegevens over de vruchtbaarheid van huishoudens. Voor de empirische analyses maken we gebruik van een Nederlandse dataset, om te benadrukken dat geslachtsvoorkeuren niet uitsluitend in ontwikkelingslanden voorkomen. De analyse heeft implicaties voor de recente discussie in Nederland rond de mogelijkheid om het geslacht van kinderen te beïnvloeden.

Als eerste passen we een aangepaste versie van de Parity Progression Ratio (PPR)-methode toe, welke gebaseerd is op het aantal kinderen dat ouders reeds hebben gekregen. Echter, vanwege zogenaamde *censoring*-problemen en de hieruit voortvloeiende onnauwkeurigheid van de berekende PPR concluderen we dat deze methode minder geschikt is voor onze doeleinden. Vervolgens analyseren we tijdsintervallen tussen opeenvolgende (mogelijke) geboortes door middel van een Cox proportional hazard model, welke expliciet rekening houdt met het censoring-probleem. Uit deze analyse blijkt dat ouders met twee zonen of twee dochters een grotere waarschijnlijkheid hebben om een derde kind te krijgen dan ouders die een zoon en een dochter hebben, hetgeen duidt op een voorkeur voor minstens een kind van elk geslacht. Tevens schatten we een probit- en een 2SLS-vergelijking van de beslissing van ouders zich te laten steriliseren. De probit analyse geeft onbevredigende resultaten, mogelijk als gevolg van de endogeniteit van een van de verklarende variabelen. De 2SLS-schatting die hiervoor corrigeert, toont dat paren met zowel een zoon als een

Curriculum Vitae

Simone Dobbelsteen was born in 's-Hertogenbosch on 21 July 1968. She attended secondary school at the Jeroen Bosch College in 's-Hertogenbosch.

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