Expectations and U.K. Firms' Employment and Production Plans: Microeconometric Analysis of the CBI's Business Survey

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ABSTRACT

This thesis uses the opinions of U.K. business managers about past and future trends in key economic variables to test a number of basic economic theories of firm behaviour: the decision to hire labour, to expand production, and to change prices. Individual qualitative responses from the Confederation of British Industry's quarterly Industrial Trends Survey from September 1982 to January 1984 are used to determine if firms act on expectations in the manner predicted by economic theory, that is, firms should adjust their behaviour in accordance to expected changes in external business conditions.

Access to individual firms' responses over consecutive surveys results in data on both plans and expectations formulated in one period, and the realizations of those plans and expectations in the next period. The qualitative responses are used in ordered probit and conditional log-linear models to determine how expectations of external factors shape a firm's plan, as well as to determine why a firm did not follow through on its plan.

Overall, the role of expectations in economic decision-making are confirmed.

- Firms plan to hire and to raise production if demand conditions are expected to improve, and vice versa.
- Firms plan to raise prices if cost conditions are expected to worsen, and vice versa.
- The fulfillment of plans is contingent on "errors" in forecasting external conditions. Firms adjust their plans in the manner that economic theory predicts if conditions differ from what was originally predicted.

These conclusions applied whether the data was all firms in the sample (roughly 9000) or a special sub-sample of firms (roughly 550) which responded to all six quarterly surveys.

TABLE OF CONTENTS

	pages
Abstract	2
Table of Content	3-4
List of Tables and Figures	5-6
Acknowledgments	7
Chapter 1: Overview and Summary	8-22
1.1 Introduction	
1.2 Surveys and the Role of Expectations in Economics	
1.3 Surveys of Economic Conditions	
1.4 Survey Data and the Techniques for Estimation	
1.5 Rational Expectations: A Short Digression	
1.6 Extending the Uses of Survey Data in Economic Models	
1.7 Outline of the Thesis	
Footnotes	
Chapter 2: Description of Business Surveys	23-51
2.1 Introduction	
2.2 Economic Surveys	
2.3 The Confederation of British Industry's Survey	
2.4 Leading Indicators of the Economy	
2.5 The Available Subset	
2.6 The Ups and Downs of Business Surveys	
2.7 Forecasting Accuracy	
2.8 Conditional Forecasting Accuracy	
Footnotes	
Tables 2.1 - 2.5	
Figures 2.1 - 2.2	
Chart 2.1	
Chapter 3: Modelling Demand for Labour and Employment Using Survey Data	52-82
3.1 Introduction	
3.2 The CBI Industrial Trends Survey	
3.3 A Dynamic Model of Labour Demand	
3.4 Empirical Implementation	
3.5 Employment Plans	
3.6 Employment Outturns	
3.7 Unfilled Plans and Unanticipated Shocks	
3.8 Conclusions	
Footnotes	
Tables 3.1 - 3.8.	

pages

Chapter 4: Price and Output Decisions in a Production Smoothing Model 83-121
4.1 Introduction
4.2 The Data
4.3 A Simple Model of Pricing and Production Decisions
4.4 Bivariate Ordered Probit Models
4.5 Log-linear Probability Models and a Comparison with Previous Studies using Business Survey Data on Inventories
4.6 Plans, Revisions and Expectation Formation
4.7 Conclusions
Footnotes
Tables 4.1 - 4.12

Chapter 5: Modelling Output and Employment Decisions 122-154
5.1 Introduction
5.2 Models of Output and Employment
5.3 Description of the Data
5.4 A Simple Model of the Firm
5.5 Discussion and Concluding Remarks
Footnotes
Tables 5.1 - 5.7

Chapter 6: Conclusions 155-159
6.1 General Conclusions
6.2 Specific Conclusions
6.3 Possible Extensions

Appendix 160-162

References 162-168

LIST OF TABLES AND FIGURES

pages

Chapter 2: 45-51

Table 2.1 The CBI Dataset: Oct. 1982 - Jan 1984
Table 2.2 Percentage of Firms by Employment and SIC
Table 2.3 Percentage of Firms Answering 'Up', 'No Change' and 'Down'
Table 2.4 Forecast Errors: Percentage of Firms
Table 2.5 Conditional Forecast Errors for Employment: Percentage of Firms
Figure 2.1 Labour Turnover (Engaged - Dismissed)
Figure 2.2 Forecast Errors
Chart 2.1 A Taxonomy of Business Surveys

Chapter 3: 75-82

Table 3.1 Univariate Ordered Probit Models for Employment Plans (Panel of Firms)
Table 3.2 Univariate Ordered Probit Models for Employment Plans (Pooled Surveys)
Table 3.3 Univariate Ordered Probit Models for Employment Plans: Size by Numbers Emplyed (Pooled Surveys)
Table 3.4 Univariate Ordered Probit Models for Employment Plans: Food, Drink and Tobacco Firms (Pooled Surveys)
Table 3.5 Univariate Ordered Probit: Neoclassical Model (Pooled Surveys)
Table 3.6 Univariate Ordered Probit: Keynesian Model (Pooled Surveys)
Table 3.7 Univariate Ordered Probit Models for Employment Outturns (Pooled Surveys)
Table 3.8 Univariate Ordered Probit Models of Unfilled Employment Plans (Pooled Surveys)

Chapter 4: 110-121

Table 4.1 Bivariate Ordered Probit Models for Price and Output Plans (Jan 1984)
Table 4.2 Bivariate Ordered Probit Models for Price and Output Plans (Panel)
Table 4.3 Univariate Ordered Probit Models for Price and Output Plans (Pooled)
Table 4.4 UnBivariate Ordered Probit Models for Price and Output Plans: Food, Drink and Tobacco Industry (Jan 1983)
Table 4.5 Univariate Ordered Probit Models for Price and Output Plans: Firms Employing 500 or more (Jan 1983)

pages

Table 4.6 Conditional Log-linear Probability Model for Output and Prices (Jan 1984)
Table 4.7 Conditional Log-linear Probability Model for Output and Prices (Pooled)
Table 4.8 Conditional Log-linear Probability Model for Output and Prices with Inventory and Order Backlog Appraisal Variables (Jan 1984)
Table 4.9 Conditional Log-linear Probability Model for Output and Prices with Inventory and Order Backlog Appraisal Variables (Pooled)
Table 4.10 Frequencies of Correct Forecasts and Forecast Errors (Percentages)
Table 4.11 Conditional Log-linear Probability Model for Output and Price Surprises (Oct. 83/Jan 84)
Table 4.12 Conditional Log-linear Probability Model for Output and Price Surprises (Pooled)

Chapter 5: 148-154
Table 5.1 Bivariate Ordered Probit Model of Expected Output and Employment (Pooled)
Table 5.2 Univariate Ordered Probit Model of Expected Output and Employment (Pooled)
Table 5.3 Univariate Ordered Probit Model of Expected Output : and Employment: Long-Run Demand Case (Pooled)
Table 5.4 Bivariate Ordered Probit Model of Realised Output and Employment (Pooled)
Table 5.5 Univariate Ordered Probit Model of Realised Output and Employment (Pooled)
Table 5.6 Univariate Ordered Probit Models: Surprise Model and Test of Rationality of Expectations using Information (Pooled)
Table 5.7 Conditional Log-linear Probability Model for Output and Employment (Pooled)

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Chapter 1

'I know what you're thinking about,' said Tweedledum; 'but it isn't so, nohow.'
'Contrariwise,' continued Tweedledee, 'if it was so, it might be; and if it were so, it would be; but as it isn't, it ain't. That's logic.'

Lewis Carroll: Alice's Adventures in Wonderland)

1.1 Introduction

For reasons of logic or otherwise, modern academic economists have made only limited use of the information available from surveys of the economy. Surveys which yield quantitative data easily incorporated into standard econometric models have found some favour, while those which generate qualitative responses, and/or attitudes and opinions about the state of the economy are viewed with great suspicion. Moreover, academic economists rarely conduct their own surveys and instead test their theories with data from surveys conducted for other purposes.[1]

By contrast, the other social sciences routinely examine the interplay between perception, opinion and subsequent action. Economists share an interest in these issues and yet have largely been willing to eschew attitudinal surveys nonetheless. The reason for this would appear to be at least two-fold. First, economists consider survey responses to be subjective, fraught with measurement and other errors, and therefore unreliable sources of information. McCloskey (1986, p.7), in his critique of modern economic methodology, states the third of his "economist's Ten Commandments":

> "Observability entails objective, reproducible experiments;
> mere questionnaires interrogating human subjects are useless,
> because humans might lie."

The modernist approach in economics, as McCloskey calls it, places surveys of attitudes and opinions outside the realm of scientific method and economics has striven hard to don the scientific mantle. Second, and more fundamentally, the attitudes and opinions of investors and consumers regarding what they do and why they do it, are simply irrelevant when the foundation of modern economic methodology is a rational optimising individual. In his influential book, Friedman (1953, p.31) claimed:

> "The evidence cited to support this assertion [that businessmen do not maximise returns] is generally taken from the answers to questions about the factors affecting their decisions - a procedure for testing economic theories that is about on a par with testing theories of longevity by asking octogenarians how they account for their long life...."

Friedman goes on to qualify his statement somewhat, allowing surveys some role in "suggesting leads to follow" in forming hypotheses but he still concludes that surveys are "almost entirely useless as a means of testing the validity of economic hypotheses." Instead, a positivist approach leads the economist to specify an objective function and the constraints the individual faces, solve the optimisation problem, and derive predicted behaviour. This positivist methodology is justified as long as the people's actions can be characterized as if they followed theoretical constructs, regardless of what they themselves might say were the reasons or motivations for their actions. Strict adherence to this methodology, coupled with the probability that respondents might lie anyway, would appear to leave little scope for attitudinal surveys in economics.

For example, in consumer theory, economists take tastes as "given". This has two impacts on economic analysis of consumer behaviour. First, economist ignore the development of, and change in, tastes. Preferences for goods are reduced to a set of axioms that define well-behaved and mathematically tractable functions, embodying a metaphysical notion called utility (see Robinson, 1962). Second, since tastes are "given", they are exogenous to the positivist economic model and there is no role for investigating attitudes and opinions underlying a number of complex and interesting issues within consumer behaviour, such a why goods become fashionable and how people perceive the act of consumption itself (e.g. social, ethical and cultural aspects of consuming goods).

Little regard, conversely, has been paid to the accuracy of official statistics, or time series data in general, the foundations on which so much of the impressive edifice of modern applied econometrics is built. Morgenstern's singular study (1960) on the accuracy of economic data raises many relevant points. Perhaps foremost, related to McCloskey's "Third Commandment" (though a generally recognised point which separates econometrics from statistics), is the lack of an experimental framework.[2] More generally, Morgenstern highlights the possibility that in responding to the collectors of government statistics, people will have the incentive to lie (e.g. about taxable income) and the fact that many statistics can only be estimated by samples and surveys.[3] Yet these "official statistics" are generally accepted as more reliable and more accurate than those derived from specific economic surveys which may include questions on opinions about the state of the economy.[4]

In this thesis, we will make more direct use of attitudinal surveys to test fundamental assumptions about the economic behaviour of firms. Economists have increasingly focused on expectations of the future in order to create a dynamic theory of economic behaviour. The central role of expectations requires that economics take attitudinal surveys seriously in testing economic models.

1.2 Surveys and the Role of Expectations in Economics

The bias against qualitative research in economics did not always exist. As Wiles (1984, pp. 213-214) states:

> "In 1938-9 empirical research by means of visits and questionnaires was not yet taboo; one was even encouraged to test economic theories in this way. No one had yet conned us into the belief that 'Revealed preference' and the regression analysis of official macro-statistics were alpha and omega."

Nor have all economists and econometricians ignored the information available in attitudinal survey data. Indeed quite early on in the development of quantitative economics, surveys were used to examine the role of expectations. Anderson (1952) and Thiel (1952) used survey data, from the IFO Institut of Munich, to examine pricing behaviour of German firms. Klein (1954), Haavelmo (1958) and Katona (1958) all emphasised the importance of direct measurement of expectations to test how expectations affect economic decisions more generally.

Haavelmo (p. 357) argued in his 1958 Presidential address to the Econometrics Society that:

> "...most of us feel that if we could use explicitly such variables as, e.g. what people think prices or income are going to be, or variables expressing what they think the effect of their actions are going to be, we would be able to establish relations that could be accurate and have more explanatory value....It is my belief that if we can develop more explicit and a priori convincing economic models in terms of these variables which are realities in the minds of people even if they are not in the current statistical yearbooks, then ways and means will eventually have to be found to obtain actual measurement of such data."

Despite this interest in the late 1950s, the use of information from economic surveys was limited for a prolonged period. A major resurgence resulted from papers by Knobl (1974) and Carlson and Parkin (1975), modelling inflationary expectations and integrating anticipations into theories of economic behaviour.

Expectations play a central role in economic theory because current decisions are influenced by views of what will happen in the future. Perhaps the clearest examples arise in financial markets where one attempts to anticipate trends in order to "beat the market"; buy before prices rise and sell before prices fall. Expectations also affect the real economy since the time lag in production implies that producers want to anticipate changes in demand for their product. Cost of adjustment theory adds a further complication because if costs of changing existing work patterns are higher the faster they are altered, then it pays to anticipate trends and act in light of these expectations in order to minimise adjustment costs.[5]

Accordingly, a great deal of effort has gone into studying expectations in economic models. This can take two forms: conducting surveys about opinions on key economic variables or developing economic theories about how expectations are formed. Given the ambiguity economists have expressed regarding attitudinal surveys, it is not surprising that the latter path was well trodden and the former largely ignored. An accurate theory about expectations formation would allow economists to construct an economic model which incorporates the expectational process and so, to an extent, eliminate the need for surveys of attitudes and opinions about the state of the economy. Many theories have been proposed, from the earlier mechanistic Adaptive Expectations hypothesis to the theoretically more rigorous Rational Expectations Hypothesis; the latter especially has generated a great deal of economic research and is widely used so that models account for expectations of the future.

We hope to show however that these two approaches to understanding the role of expectations in economic decision-making are highly complementary. Regardless of how sophisticated a theory of expectations one develops, that theory must still be tested using actual data on expectations (otherwise one is faced with the Duhem-Quine problem, see Hargreaves Heaps, 1981). Therefore, the interest in expectations in economic theory implies that applied econometric work on expectations formation must take seriously the information found in attitudinal economic surveys. Surveys remain the only source of direct observations of expectations for testing the adequacy of the proposed theories of expectations formation.

1.3 Surveys of Economic Conditions

Surveys about various aspects of the economy are carried out in almost all advanced economies, recording the views of consumers, producers and 'experts'. In fact, there has been a policy of harmonising surveys within the European Community so that similar data are gathered across all member states. Approximately 50 million European Currency Units (ECUs) were spent annually to collect data from consumers and producers in the 1980s (see European Economy Supplements C and D respectively). This is in addition to national or regional surveys carried out within each country by business groups, academic institutions and market research companies. However this seemingly straightforward approach to gathering information about the future course of the economy still poses the problem of who to canvass, what questions to ask, and in what form to record the responses.

There is also the problem of how to integrate this information into a methodology geared to analyzing "official" (i.e. quantitative) statistics. Most attitudinal surveys of the manufacturing sector often only record the expected direction of change in economic variables. Thus the data usually are qualitative rather than quantitative, that is, they capture the information in a limited number of discrete categories rather than via a continuous range of values. These data are also often referred to as ordinal or categorical, capturing the underlying continuous scale in the ordering of the categories.

Research into human cognition (Newell and Simon, 1972) deems people capable of forming rankings without being able to assign exact measures of the "distance" between those

rankings.[6] Ordinality is therefore not foreign to economics and is undoubtedly widespread as a means of assessing and ranking social phenomena.
Indeed a principle advance in economic theory was the over-throwing of cardinal utility by ordinal utility.

General social surveys also exist which capture information about individuals that has proven fruitful for economic research. In the U.K., many social surveys such as the General Household Survey (GHS) and the Family Expenditure Survey (FES) have been used in work on public policy.[7] A wide variety of surveys about the labour market, such as the Labour force Survey (LFS) and the Workplace Industrial Relations Survey (WIRS), have been used by labour economists. Just as surveys are unique sources of data on expectations, they are also the only way to gather information necessary to estimate economic models where one wishes to explain the influence of individual characteristics such as age, gender, race or income. Economists have probably been more comfortable with these surveys because the information is quantitative rather than qualitative despite the potential for lying. The preference for quantitative data can be overcome while the concern over accuracy of survey responses has proven more intractable.

1.4 Survey Data and the Techniques for Estimation

Major advances in handling discrete or qualitative data have been made recently with econometricians instrumental in extending the techniques of logit and probit models originally developed by biometricians (see Amemiya, 1981, 1984 and Maddala, 1983). Qualitative response models have been applied to a wide variety of economic decisions, including labour force participation, migration, transportation choice and the purchase of consumer durables, to name a few (see Amemiya, 1981 for more extensive references).

The unifying theme of these studies is the modelling of individual choice which requires discrete or limited dependent variable techniques for estimation and (usually) data from surveys. Variables that explain consumer choice are a mixture of individual attributes and characteristics of the goods (or states) being chosen which can usually only be collected from a survey. In theoretical terms, these models can be seen as examples of implementing the characteristics approach to demand proposed by Gorman (1980) and Lancaster (1971).

Having the means to deal with qualitative data does not imply a will to do so. Uses of survey data such as the weight of a vehicle, the time spent in a vehicle, or even the race, sex or income of the individual still rely on "objective" measures. Attitudes and opinions, however, have no role to play. Indeed the development of qualitative response models, as applied by economists, aims at explaining an underlying unobserved or latent attitude or opinion that led to the observable choice.

Even where economists have used survey data on expectations to test theories of expectations formation, the approach has usually relied on "quantifying" the qualitative responses; generating an aggregate average rate of expected inflation has been most common (see Carlson and Parkin, 1975). These data can then be analyzed by standard regression techniques for time-series data.[8]

1.5 Rational Expectations: A Short Digression

The work presented in this thesis will not focus on any particular theory of expectations formation and will not presuppose a specific theory underlies the expectations recorded by the surveys. The aim of this thesis is to reinforce the role of expectations in economic thinking, not specifically to refute or support any particular theory of expectations.

However, it is appropriate to make some comments about the "Rational Expectations Hypothesis" (REH) before proceeding, given its prevalence in economics generally and its implications to the use of survey data in economics in particular. Rationality in economics has assumed something of a mantra; economic decisions are based on an ultra-consistent analysis of potential costs and benefits. Individuals choose a course of action which is most beneficial to them based on the information available; all available information is used because to do otherwise leaves potential gains unrealized (for more on this, see Hargrave Heaps, 1981). The REH stands as the pinnacle to date in economic studies of expectations formation (though there is on-going work on learning process for expectations), so much so that it seems to be "received wisdom" in economic thinking.

This acceptance is disquieting for a number of reasons. Firstly, all the tests of expectations formation using survey data have at least questioned, if not rejected the REH in one form or another. As happens though in economics, refutation of a theory that is attractive a priori is difficult if not impossible. Therefore, consider some prior reasoning for both the appeal of the REH to economists and the unconvincing nature of the theory in broader terms.

In his widely-used book on the REH, Begg (1982, p. 29) argues the "point of departure of Rational Expectations is that individuals should not make systematic errors." Hence, "guesses must be correct on average" and divergences attributable only to "random movements". However, in so many aspects of their lives, people seem to make systematic errors; they regularly go outside without umbrellas despite easily and cheaply acquired information from weather forecasts, or they are consistently late for buses, trains or meetings.[9] Similarly they often make the same mistakes repeatedly in their personal relationships (notwithstanding the work by Becker, 1980 and others to subsume even interpersonal relations within the economist's methodology of utility maximization). Psychologists (Rachlin, 1989) have suggested that people use "representative heurestics" to draw general conclusions from limited information. Thus, in their personal relationships, people act after only brief interaction, possibly leading to marriage and subsequent divorce, and may do so many times over. Yet somehow within their economic activity, Begg claims (p. 61), "It is not attractive to assume that individuals make systematic errors".

The unappealing nature of such an assumption arises, of course, if one accepts the prior assumption that people are rational, in a fashion specific to economics, requiring strong consistency of tastes and actions, and optimization at all times. Accept rational optimising behaviour and one is almost bound to accept the REH.

Thurow (1984, chapter 6) encapsulates this argument. The adoption of the REH by the "New Classicists" is natural when one assumes market clearing in the economy. The world is defined in a tautological way so that since markets clear, expectations must be rational and if expectations are rational, then markets clear. Only random shocks and unsystematic misinformation drives the economy off its natural path. Hence (p.167), expectations "are rational and not adaptive, not because it has been proven so, but because they must be so if the individual decision maker is supposed to act as Homo Economicus is supposed to act. And he must be acting as Homo Economicus, or else opportunities would exist to earn extra profits - something that cannot, by definition, occur in a price auction model."

Begg draws the link between the REH and economic methodology nicely when he says (p. 62), "it is easy to see why many economists find Rational Expectations an appealing assumption, replacing earlier ad hoc treatments with an approach squarely based on incentives, information and optimisation - the traditional themes of ***new classical*** macroeconomic foundations [my emphasis]." Begg is not wholly uncritical of the REH in his book. Indeed the criticisms leveled over the differences in information available to individuals when they form their expectations and the differing incentives to acquire this information (pp. 67-69) seem particularly wounding. On this, see also McCloskey (1983). Neither author, however, questions the role of rational optimising behaviour or market clearing assumptions in the REH. And curiously, despite a sub-title of "Theories and Evidence", Begg's book does not cite a single study which uses survey data to test theories of expectations, all of which cast doubts about the rationality of expectations.

The final buttress employed by proponents of REH against these arguments is that even where errors do occur, the result is that people learn from their mistakes (hence employing information efficiently). However, there is experimental evidence from psychologists (Wason, 1969) which suggests that people have difficulty "making use of disconfirming information" and so are unwilling to examine information that contradicts their prior beliefs. Nonetheless, REH will undoubtedly continue to undergo mutations that will keep it embedded in economic theory, despite continued reservations.

The last word on this subject will fall to Steven Nock[10], a university of Virginia sociologist who uses the term "marital losers" to describe people with a 'tendency to repeat 'risky' marriage patterns helps to explain the high divorce rate in remarriages.' People pursuing nuptial bliss persist in 'marrying a person without a job, someone from a different religion or someone with a substantially different amount of education.'

1.6 Extending the Uses of Survey Data in Economic Models

In addition to using survey data to test theories of expectations formation, some attempts have been made to integrate these data into large macroeconometric forecasting models (Wylleman, 1985). A logical extension, notwithstanding Friedman's injunction, is to use these data directly in economic models that incorporate expectations to test theory directly, without also appending an expectations formation mechanism. This strand of research has proved much slower to develop. Only recently have individual survey responses have been used in qualitative response models, for example Nerlove (1983) uses German and French surveys to test theories of the inventory and production behaviour of firms.

The data used in this thesis are disaggregated (firm level) responses from the Confederation of British Industry's (CBI) Industrial Trends Surveys. These data cover only six consecutive quarters between the last quarter of 1982 and the first quarter of 1984, but the sample covers a broad cross-section of about 1600 manufacturing firms. The survey asks for both the expected and realised changes in economic variables such as numbers employed and output prices, recording the answers as a categorical variable: "up", "no change" and "down".

As a precondition to using these data to directly test economic theory, we will examine the reliability and accuracy of survey data as direct observations of expectations, that is, do firms generally carry out their plans or stated intentions. Thereafter, the main thrust is, whether models using direct observations of expectations lend support to economist's interpretations of how people's own expectations affect their behaviour.

The work presented in this thesis will, therefore, differ from the much of the work outlined above. First, while the role of expectations is taken seriously in testing the effect of expectations on economic behaviour, no specific theory of expectations is tested. Second, rather than using aggregate measures derived from the survey responses, the data is used to test theories at the level at which the theories are formulated, the individual firm. Third, wider use will be made of techniques specific to analysing cross-tabulated data, to complement econometric analysis. Finally, the standard approach to modelling behaviour using qualitative data assumes that there is an underlying unobserved variable, the attitude or opinion of the individual, which gives rise to the observable behaviour (e.g. buying a car or joining a union). One modelling strategy proposed here will examine the planning or decision-making process directly to try and understand how attitudes and opinions about some exogenous variables effect those plans and intentions. That is, we distinguish between ex ante plans and ex post realisations.

1.7 Outline of the Thesis

We are broadly interested in three questions:

1. Are the responses recorded by the CBI surveys truly representative of firms' expectations?

2. What is the role of expectations when firms plan their actions (do firms behave as economic theory suggests)?

3. To what extent do past expectations explain current actions (are plans realised and, if not, is it due to expectations not being fulfilled)?

Chapter 2 of the thesis gives a detailed description of the available CBI data, comparing it with other surveys and explaining the uses to which survey data have been put. We attempt to justify the use of survey responses as direct observations of expectations using a variety of measures of predictive success and failure of these expectations.

The main analysis is presented in Chapters 3, 4 and 5. In Chapter 3, we examine the influence of expectations of external conditions on firms' hiring decisions, testing single equation models of labour demand using the CBI data. The distinction between ex ante labour demand (plans) and ex post employment (realisations) is clearly illustrated. We also try to explain, from the survey data, why plans are not always realised.

In Chapter 4 we consider a production smoothing model to examine the role of expectations in output, pricing and inventory behaviour. Building up and running down stocks of finished goods allows a firm to accommodate errors in its expectations about demand conditions or to minimize costs of production over time. Nonetheless, expectations of demand and cost conditions influence production and pricing decisions. This role is illustrated in a situation where data on actual expectations are available.

Chapter 5 presents a model of output and employment decisions to further test the role of demand and cost expectations in firms' planning. Traditionally, output is used as a proxy for demand in explaining firms' labour market decisions. As in Chapter 3, separate demand expectations drawn from the CBI surveys are used to explain labour market behaviour, with output now being a separate dependent variable also explained by expectations of demand and factor costs.

Finally, chapter 6 summarises the findings and draws overall conclusions about the results.

Footnotes:

1. The point is not that economic surveys are non-existent, indeed the purpose of the thesis is to use data from existing surveys. Rather it is that in academic circles and within the confines of economic methodology, surveys are undervalued. Pudney (1989) also points out that economists tend to analyse surveys conducted for other purposes, rather than commissioning and conducting specific surveys.

2. Economic research based on experiments is a growing field. See, for example, Tietz, Albers, and Selten (1986) or Smith (1989).

3. He does point out the errors from questionnaires more generally; issues relevant to the suspicion about using survey data, which must be taken seriously in trying to bring surveys into wider use.

4. The former are considered objective while the latter are subjective so that the former aid in rigorous research and the latter result in heuristic speculation.

5. But as Brechling (1975) points out, costs of adjustment affect behaviour because the future is uncertain, leading to anticipatory behaviour and/or lags in adjustment. If the future were certain, these costs could still be minimised by acting entirely at the appropriate moment.

6. The conventions of ordinal data assign numbers to identify each category, the "highest" rank being assigned the lowest numerical label. This occurs in many common instances: degree classifications in higher education rank a "First class" degree as best; or the top of a sporting league is number one.

7. The original aim of the FES was to provide information about expenditure patterns for calculating the weights for the Retail Price Index.

8. A large literature has developed, most of it quite recently, using different surveys and techniques to test models of expectations (for surveys see Holden, Peel and Thomson (1985), Lovell (1986) and Pesaran (1988).

9. Thurow (1984, p. 156) says, "Psychologists who have worked on learning theory give us evidence that human beings do not instantly arrive at correctly specified rational decisions. Psychologists have found instead that people often make systematic mistakes, that they take time to move from one mode of behaviour to another."

10. Globe and Mail, Feb 23, 1995, p. A24.

11. The references all spring from the 1980s, see Koenig, Nerlove and Oudiz (1981), Nerlove (1983), Kawasaki, Macmillan and Zimmermann (1984).

CHAPTER 2

'Then you should say what you mean,' the March Hare went on.
'I do,' Alice hastily replied, 'at least - at least I mean what I say - that's the same thing, you know.'

(Lewis Carroll: Alice's Adventures in Wonderland)

Description of Business Surveys

2.1 Introduction

Economic theory has increasingly emphasised the role of expectations about the future but the only way in practice to know what someone expects will happen is to ask them directly. The Confederation of British Industry's (C.B.I.) Industrial Trends Survey is one of many surveys gathering information on a variety of aspects of the economy; equivalent surveys are conducted in other countries. Originally, economists were interested in the responses to expectational surveys as a means of creating leading indicators of the business cycle. For instance, evidence from a question about changes in 'business optimism' from the CBI survey has become widely reported by the financial pages as a leading indicator of changes in demand for the U.K. economy. Recently, economists have used these data as inputs into empirical research on expectations. This later work has evolved naturally from models of the expectations formation process which generate data on expectations (Cagan, 1956, Muth, 1961). With the growth in the number of competing theories of expectations and the burgeoning literature on empirical applications, came the need to test those theories independently. And for that, one needs appropriate data on expectations available only from surveys.

Our task in this chapter is threefold. First, we will give some general background on the many surveys which have been used in economic studies. Most studies have used these data to test theories of expectations formation and almost exclusively use the data in an aggregative form (Carlson and Parkin, 1975 sparked a number of subsequent studies)[1]; see

Gourireux, Monfort and Pradel (1986) for an example using firm by firm data. We will not review in detail the evidence about economic theories of expectations that has emerged from this body of research, except to say that in general the Rational Expectations Hypothesis is rejected, and (when compared) more mechanistic theories such as Adaptive Expectations have been found to be superior. We refer the interested reader to the literature (survey articles include Holden, Peel and Thompson, 1985, Lovell, 1986, and Pesaran, 1987).

Second, we concentrate on the CBI survey, the source of data for the econometric work in Chapters 3, 4 and 5 of this thesis. We begin by examining the role of survey data in generating leading indicators of the economy. Work has shown that these indicators do, in fact, anticipate actual events (Klein and Moore, 1981, Keating, 1983, and Yuan, 1984). Besides being the only independent source of data on expectations, they can also be shown to be *useful* representations of expectations in that they are quite accurate at predicting the turning points in the business cycle.

Third, we explicitly address the issue of the consistency and accuracy of the expectations expressed in the survey responses to establish further that the data are useful representations of firms' intentions or plans. This issue has been largely ignored in the literature, with little or no evidence to justify that survey data are appropriate for testing expectations formation mechanisms (but see Kawasaki and Zimmermann, 1986, or Nerlove, 1983). We will present evidence on the consistency between forecasts of the future and the actual outcomes, which is possible when one has individual firms' responses from one survey to the next.

This leads to a related point. Surveys such as the CBI's are not merely evidence about expectations of purely exogenous events. Throughout, we will emphasise a distinction between information about intentions or plans (variables over which firms exercise some direct influence), and expectations, which refer to exogenous changes. A similar distinction is made by Hanssens and Vanden Abeele, 1987, who distinguish intentional (i.e. planned) expectations and contingent (i.e. exogenous) expectations. Hence, the usefulness of survey data in economic analysis is not limited to testing theories of expectations but also in testing theories of economic behaviour directly. Economic theory is predictive, not merely an explanation of events that have already occurred. Therefore, using survey data to model the firms' decision-making process leads to an alternative to testing ***ex ante*** economic theory with ***ex post*** data. This is the task undertaken econometrically in later chapters of the thesis. We now turn to describing the available data.

2.2 Economic Surveys

Surveys of economic conditions exist for all OECD countries (see OECD Main Economic Indicators: Sources and Methods, No. 37, 1983). The questions asked clearly vary widely across countries, depending upon the aspect of the economy being investigated but within the EC at least there has been an attempt to standardise the surveys of member countries so that comparable information is gathered. Given the number and scope of the surveys, we can only hope to highlight some general features and provide references for the interested reader to pursue regarding specifics of individual surveys. We identify two characteristics which are useful for classifying the various surveys.

First, to whom is the survey addressed: who is the respondent? Clearly there are appropriate respondents for expectations of different aspects of the economy. Three possible candidates have been addressed in surveys: businessmen/firms (if one wishes to know about the production side of the economy); consumers (for information about the consumption side of the economy); and 'experts', i.e. professional or academic economists, or practitioners in specialised areas (for expectations about money supply changes or interest rates, for example).

Second, in what form are the responses recorded? Questions are framed so that responses take either a qualitative or a quantitative form. Qualitative responses generally capture only the direction of change of the variable in question. Responses are usually restricted to a small number of categories; whether the trend is up, unchanged, or down is the most common taxonomy. Some questions ask opinions about the current state of affairs, such as whether stocks are above average, average or below average for instance but similarly yield qualitative categorical responses.

Quantitative responses, by contrast, ask for specific numerical values of the change in, or state of, the variable of interest. For instance, the trend in inflation could be expected to rise by 5%, or within a band from 1% to 5%. Stocks could be at 90% of their normal value. Some surveys record a mix of qualitative and quantitative responses. In Chart 2.1 (see the end of this chapter), we have grouped a number of surveys that have been used in economic research according to the two dimensions of respondent and nature of response.

The chart illustrates the large number of countries which conduct surveys and is in no way comprehensive. The criterion for selection to the chart is that the data have been used in a study published in an (English-language) academic economics journal.[2] Many other surveys, especially those relating to inventory and investment behaviour, are referenced in the proceedings of the CIRET conferences (e.g. Oppenheimer and Poser, 1984 and 1986). Interestingly, the majority of the U.S. surveys are quantitative whilst the European countries tend to collect qualitative data (which was true even before harmonisation). Similarly it is the Americans who concentrate on "expert opinion" whereas these surveys are less likely in other countries.

One can argue that qualitative survey responses are actually more accurate than quantitative responses about expectations. This follows because the respondent need only be correct concerning the direction of change in the variable, not the magnitude of that change. While the former may be relatively easy to guess, errors in predicting exact values or even ranges would not be deemed surprising. Clearly some would counter that vital information is lost from collecting only qualitative responses because knowing the actual magnitude is so important (Pesaran, 1987). However, whether we start with either quantitative or qualitative responses, some method is generally required to convert numerous and diverse micro-level responses into the aggregate macro-level responses that policy makers desire, and find useful.

Whether this additional level of sophistication in moving from micro-level data to a single aggregate measure of expectations is desirable, especially with the added potential for error or induced distortion, can be debated. In addition there have been many advances in econometric techniques for estimating qualitative response models (see Amemiya, 1981 and Maddala, 1983). Testing theories of expectations formation and the role expectations play in business decisions may also be better undertaken at the micro rather than macro-economic level and this has led to a growing body of literature which employs discrete data. We will be using the CBI Industrial Trends Survey data to pursue our own microeconometric work. Therefore, let us describe the evolution of that survey in a bit more detail and then concentrate on the subset of data we will be using.

2.3 The Confederation of British Industry's Survey[3]

The CBI has conducted its survey continuously since June 1958, sending questionnaires to over 2000 firms each quarter (3 times a year prior to 1972).[4] In general, about 1600 firms, covering all major Standard Industrial Classifications in manufacturing, respond in each quarter. Firms are also classified according to their size (numbers employed) and by whether or not they do any export business.

The CBI survey is marked by great continuity in the structure of its questionnaire; rarely has the wording of questions changed, although new questions have been added.[5] Since 1975, with the EC harmonisation of member states' surveys, the CBI has also conducted a monthly survey focused on a more limited subset of questions. The majority of questions in the CBI survey take the form:

> 'Excluding seasonal variations, what has been the trend over the past four months and what is the expected trend over the next four months, with regards to:
>
> (i) numbers employed;
> (ii) volume of output;
> (iii) volume of total new orders;
> (iv) volume of stocks of finished goods;
> (v) average costs per unit of output, and;
> (vi) average prices at which domestic orders are booked.'

Answers are recorded as 'up', 'no change', 'down' or 'not applicable', the latter being a small residual category. We have focused on only the limited set of questions above because they are illustrative (the full questionnaire is reproduced as Appendix 1) and because responses to these questions will be used in our later empirical models. These questions capture both the realised and the expected trends in these variables and will therefore be referred to as outturn/expectation questions. The Ifo and INSEE surveys (see Chart 2.1), in Germany and France respectively, employ a similar format.

Other questions elicit opinions or attitudes about the state of economic affairs. For example, a frequently referred to question is:

> 'Are you more or less optimistic, then four months ago, about the general business conditions in your industry?'

As mentioned previously, this question is widely interpreted as an indicator of expected demand.[6] This, and other questions about the state of capacity utilisation, stocks and order books will be referred to as attitudinal questions. The responses are more diverse (the categories are not simply 'up', 'down' and 'unchanged') and, quite importantly, no outturn is recorded. This latter distinction makes responses to these questions less useful in our study, though they have been used elsewhere (Konig and Nerlove, 1983). Some of them are used in our model of production smoothing (Chapter 5).

Very little guidance is given to respondents about answering the C.B.I. survey's questions. For example, there is no definition of what "no change" should imply. By contrast, the INSEE and Finnish CBI surveys explicitly suggest that a change of less than 2% (up or down) be recorded as no change. Undoubtedly this characteristic adds to the subjective nature of the CBI responses, as does the uncertainty over which four month period is used by firms when answering the questions. Nonetheless, evidence from the CBI (McWilliams, 1983) shows that common answering practices are discernible.

The CBI itself remains the major interpreter of the survey responses, using various questions as leading indicators of trends in the economy. The principle method for dissemination of the results is publication of the "balance statistic" (also known as the net balance), the percentage of firms who respond in the increase category minus the percentage in the decrease category. The percentages are weighted sums of individual responses, the weights accounting for each firm's relative importance in its industry according to numbers employed and value of output. The balance statistics for the trend in output, employment and new orders are widely quoted as leading indicators of the business cycle. Other prominent questions about the state of the economy, such as the level of business optimism and of capacity utilisation also receive attention, to the extent of being published in the U.K. Central Statistical Office's (CSO) Economic Trends (May 1988, p. 80).

2.4 Leading Indicators of the Economy

The question immediately arises, how good are the leading indicators derived from the CBI data at predicting actual changes in the U.K. economy? The answer is, with qualifications, quite good. Bear in mind our earlier comment that qualitative data convey less information than quantitative data. Therefore, even if we are confident that the balance statistic indicates that the trend in production will be upwards, this is scant guide as to how much output will rise. In contrast, a quantitative indicator predicting a 5% rise in output can be easily compared to official statistics to see whether a 5% change (with allowance for a margin of error) did indeed occur.

The principle use of qualitative leading indicators is to predict the turning points in the business cycle, rather than to give a point estimate about a specific variable such as output. Having sounded that cautionary note, balances derived from CBI data have been shown to explain trends in observed time series of output, prices and employment (the variables we focus on in our empirical work). Using regression techniques, Yuan (1984) estimates equations relating the qualitative outturn responses from the CBI surveys (in the form of the balance statistic) to actual quantitative changes recorded in CSO statistics.[7] The assumption is also made that the same functional form describes the relationship between responses to expectational questions and actual changes.

The problems with using survey data regarding the time period captured by the outturn responses and the corresponding official statistics which should be used as a comparison can be illustrated here. Since different firms have in mind different time periods when asked about the past four months, the choice of months from which to draw the quantitative data corresponding to the qualitative balances has an important bearing on the conclusion of whether the survey data are accurate or not.

In a special survey on answering practices (Ballance and Burton, 1983), the CBI found that when considering the change over the last four months or the change expected over the next four months, the vast majority of firms (67%) answer on the basis of the change over the entire four months in question compared to the change over the entire four months previous. A substantial minority (23%) calculate the change by comparing two changes: the level at the end of the next four months minus the level at the beginning of that period, and the same calculation for change over the four previous months. The remainder use a variety of criteria to judge whether a change has occurred or not.

In our statistical work, we will simplify and use calendar year quarters. Thus, answers to expectation questions in the January survey are assumed to compare the change over the entire next quarter (January to March) to the change over the entire quarter immediately preceding (October to December). This is in keeping with the majority of respondents to the special CBI survey.

In Figure 2.1 below, we have plotted the change in employment as computed by the U.K. Department of Employment against the CBI balance for the outturn of employment between 1974 (quarter 2) and 1985 (quarter 4). Employment Gazette (DE, 1985, Table 1.6) publishes a four month moving average of engagements and dismissals (as a percentage of employment in the previous quarter). Taking engagements minus dismissals as the 'official outturns', we compare them with the CBI balance for survey outturns. The former measures the percentage change in ***employees*** and the latter measures the difference between the percentage of firms responding they will increase or decrease employment. Thus these two measures of labour turnover will undoubtedly differ in absolute values. Nonetheless, the series track each other quite closely. As stated above, we have simplified and assumed that the CBI survey responses refer to the four months immediately before (after) the date of questioning for the outturns (expectations). This supports the work by Yuan mentioned above (see his graph, p. 62) who found the values of employment changes from his regression equation using survey balances matched the actual changes quite well.

Another problem with using qualitative data in the manner of Yuan (1984) and Pesaran (1984) is that even if the balances for realisations (outturns) match official statistics reasonably well, this is not evidence that the expectations recorded by the survey are therefore accurate indicators of future trends in the economy. It is simply assumed that the relationship estimated between survey outturns and actual outturns applies for expectational data.

All is not lost, however. Even the outturn responses can be deemed a leading indicator in the sense that these data are collected and disseminated faster than official statistics. Therefore one is able to get a picture from the survey results of what has happened, and is likely to happen to the economy, in advance of the official statistics. This latter point has been emphasised by Klein and Moore (1981). Using the balance statistic, they have shown that the CBI series for new orders is relatively successful at tracking and anticipating the turning points in the U.K. economy over the business cycle.[8]

2.5 The Available Subset

While the CBI survey has a long history, it is only recently that the firm level responses have been released. Traditionally, only the aggregate percentages in each response category have been available to the public. The data available for our study cover a relatively short period: consecutive surveys from October 1982 to January 1984, or 6 quarters in all. While this is a short time horizon, the data represent the responses of 1600 or more firms each quarter. Further, having a firm's responses from consecutive surveys allows us to match its expectation from one survey to its outturn in the next. This property of the data set will prove very useful in our discussion of the accuracy of survey responses.

Table 2.1 below summarises the number of firms responding to each survey in the available subset. Note that when we use the data in our econometric work, we will drop the 'not applicable' category; this is rarely more than 2% of the sample for any question, and never more than 4% of the respondents. Also, in some situations, we will want to use answers paired over consecutive surveys to give us appropriate lags of variables and this will further reduce the sample size as some firms answer in one quarter but not the next. Even so, we always have data from more than 1500 firms per survey in each of the models estimated. Further, a total of 551 firms answered all six surveys, thus forming a substantial panel through which we can assess the stability of our results over time.

Firms are classified according to their size (numbers employed) and their industrial classification (SIC code). We do not show the proportions for each survey separately; obviously these change little over such a short span of time. We do however present the percentage of firms in each grouping in Table 2.2 below. The percentages fluctuate slightly over time but this is not surprising since the number of firms answering each survey also fluctuates. The percentage of firms in each SIC in our panel is stable as we would expect; firms rarely change industry type. The number of firms in each size classification will, however, be more likely to change (in the whole sample or the panel) as some firms take on or shed labour, and cross the threshold between categories. Thus the variation observed is not of any importance in itself.

What the results do indicate, is that the smallest firms are somewhat under-represented in the panel, with larger firms thus being more likely to answer all six surveys. This may reflect a systematic bias; three possibilities exist:

- either large firms are less likely to go bankrupt and so fall out of the survey for reasons of extinction, or;
- large firms have the resources necessary to always respond to the CBI questionnaires, or;
- large firms are more favourably inclined towards the CBI and its surveys.

How this bias affects our later results is unclear and also, the differences are small. There does not, however, appear to be any systematic under-representation or over-representation by industrial sector.

In the next sections of this chapter, we will deal with issues of the forecast accuracy of our subset of CBI surveys. Our aim is to establish that the data are useful representations of firms' expectations since they, in general, act on their plans. We will also highlight a potential source of bias which has been observed in other surveys (see Theil, 1967): the majority of firms' responses fall in the no change category for many questions.

2.6 The Ups and Downs of Business Surveys

In Section 2.4 above, we showed how the aggregate balances closely matched official statistics and therefore may be useful leading indicators of fluctuations in the economy. The balance statistic is intuitively appealing, being positive if more firms (appropriately weighted) feel that employment outturns (for instance) have risen rather than fallen (and similarly for expectational responses). The balance treats the responses at face value - and it may be a slippery slope to do otherwise - therefore ignoring the no change responses. Yet, the CBI (McWilliams, 1983, pp. 17-18) notes that expected employment changes are 'upward biased', so that a balance of between 5 and 10 percent is compatible with no change in actual employment being recorded in CSO statistics on employment. Expected price changes and expected new orders also seem to be upward biased (balances of 10-15% are recorded even when no change occurs). Cost and output expectations do not appear to suffer from this form of bias.

Table 2.3 reports the proportion of firms is each response category for questions which generate the data used in our later empirical work. The CBI surveys share a characteristic observed in the Ifo and INSEE surveys (see Thiel, 1967 and Nerlove, 1983, p. 1264): the majority of responses cluster in the no change category for both expectations and outturns.

For firms answering at least two consecutive surveys, about sixty per cent of the firms in any survey report that no change is expected to occur over the next four months in numbers employed. In October 1982, 58% of firms reported they did not expect to change employment over the coming quarter. In the subsequent survey, only roughly half the firms report that employment remained unchanged during the last four months. Thus, in the January 1983 survey, only 51% of firms actually kept employment unchanged over the period in question. Therefore, there is a tendency for expectational responses to overstate the stability of employment compared with the changes that actually occur, as recorded in the next survey's outturn responses.

For the output question, just over 60% of firms expect output to be constant in each survey, with about 55% subsequently reporting no actual change. With respect to (domestic) new orders, about 60% of firms expected "no change", but even fewer (42-46%) subsequently reporting no change outturns, compared with the output questions. The questions on unit costs and average prices show a reversal of this pattern; fewer firms expecting no change to occur than reported no change as their outturn. Nonetheless, well over half of firms' respond in the no change category to both questions, approaching seventy per cent on average for price outturns. These patterns and proportions are replicated in the panel of 551 firms.

The large number of "no change" responses for expectational questions may simply reflect genuine uncertainty about the future. Alternatively, it may reflect changes which are not considered significant and so are recorded as no change in either expectations or outturns. The INSEE survey, as noted above, accounts for this with guidelines that changes of 2% (plus or minus) should be regarded as no change, as does the Finnish Confederation of Industry's survey (see Rahialia, Terasverta and Kanniainen, 1986). Despite this, "no change" responses dominate these surveys as well.

This latter characteristic of answering practices underpins the work on quantification of survey data. Theil (1966) assumed that when firms respond, they implicitly set a narrow band within which actual changes are reported to be zero. This is necessary when assuming that there is a continuous subjective probability distribution underlying the discrete responses since the probability of a zero response is itself zero. The just noticeable difference or difference limen, as it is called, must either be assumed, (as in early studies by Knobl, 1974 or Carlson and Parkin, 1975), or estimated (as suggested by Foster and Gregory, 1977, Batchelor, 1982 or Keating, 1983).

We will return to this issue again in our empirical work since it is important to try to account for any potential bias that results from answers clustering in the no change category. The accuracy of the forecasts is essential to justifying the use of such data in testing expectations. We would not be greatly comforted if the forecast accuracy results from there being a wide band of expected and realised changes over which firms simply respond that no change will (has) occurred.

More clear-cut trends are present in the 'ups' and 'downs'. Not surprisingly as the British economy recovered from the 1980 recession, the proportion of firms expecting to increase employment rose over our sample period, as did the proportion of firms recording "increase" outturns in employment. Conversely, fewer firms expected employment to fall in each successive survey between the end of 1982 and the start of 1984. This pattern emerges for the output, new orders, unit cost and average price questions as well.

Thus, one might conclude that firms are quite conservative or cautious about their predictions about future changes, as further reflected by the tendency for such a high proportion of answers to fall in the no change category.

2.7 Forecasting Accuracy

Above, we have considered aggregate patterns of expectation and subsequent realisation responses in the C.B.I. survey. Some of the discrepancy between expectations and realisations, of course, arises because not all firms answer all surveys. However we noted that similar patterns pertained to our panel of 551 firms answering all six surveys. Now we try to analyse the predictive accuracy of the CBI surveys by generating the "forecast error" for each firm answering consecutive surveys. Forecast errors, in a qualitative sense, can be calculated by matching a firm's expected change, recorded in survey t-1 for period t, with its outturn response recorded in survey t (see Theil, 1967, Kawasaki, Macmillan and Zimmermann, 1982 or Nerlove, 1983).

The usual approach to analysing qualitative survey data is via cross-tabulation or contingency tables (Upton, 1978 or Agresti, 1984). In Figure 2.2 we present a variant of this (following Thiel, 1967) where we match pairs of surveys so that expectational responses are tabulated across rows of the table and realisations are tabulated down the columns.

Each cell (f_{ij}) of Figure 2.2a represents the frequency of firms' responses.[9] The values in the fourth column (f_{i+}) and the fourth row (f_{+j}) are simply the sums along the respective columns and rows; in other words the marginal tables. Finally, the entry in the extreme lower right-hand corner (f_{ij}) is the total number of firms in the sample.

Next, we will define a forecast error, in an ordinal sense, as those cases where expectations and outturns do not fall in the same category. Consider the cell in the upper-most left corner. If the firm expects that it will increase employment over the next four months, then its response falls in the (+) column for ΔN^* in Figure 2.2b. Suppose this firm also records a positive outturn represented by the (+) row for ΔN_t. Then we define the firm as having accurately forecast its employment intentions (denoted by the (=) sign), at least in this limited ordinal sense.

If instead the firm expects an increase but the outturn is recorded as no change, the firm is judged to have over-estimated future employment. This results in a case being added to cell f_{12}. The other cells in the diagram follow quite obviously.

One might wish to argue that the magnitude of the error is greater, and therefore worse, if the firm records an actual fall in employment when it expected employment to rise, compared to the case of an actual fall when no change was expected. Thiel (1967) did not feel this distinction was warranted, given the approximation already necessary to define qualitative forecast errors. This step would impose "distance" measures on qualitative data. Nerlove (1983) similarly concluded that this alternative classification scheme made no difference in econometric applications. Our own testing led to the same conclusion, therefore, to keep matters simple we have chosen to avoid this complexity.

We have calculated the proportion of forecast errors for the CBI surveys and compared these with the results obtained by Kawasaki and Zimmermann (1986) for the Ifo surveys. The number of accurate forecasts, in an ordinal sense, is the sum of the diagonal cells

($f_{++} + f_{==} + f_{--}$) of Figure 2.2a. Firms which over-predict the direction of change lie in cells $f_{+=}$, f_{+-}, and $f_{=-}$. Finally, the sum ($f_{=+} + f_{-+} + f_{-=}$) gives the under-predictions. Table 2.4 shows the proportion of over-predictions (+), accurate predictions (=), and under-predictions (-) respectively. British firms are on the whole quite accurate in their assessment of both planned and exogenous variables.

The forecast errors are computed for the whole sample for all firms answering at least two consecutive surveys and for the panel of 551 firms answering all six surveys (yielding 5 pairs of adjacent surveys in each instance). Over 60 per cent of firms in both the "full" sample and the panel forecast accurately, expecting and realising employment, unit cost and average price changes in the same categories. Forecasts of both stocks and output are correct in just under 60% of cases. Only the new orders forecasts fall below 50% accuracy. British firms have a tendency to under-predict rather than over-predict, as indicated by a higher percentage of firms falling in the (-) column. This implies that firms are likely to expect a lower change than is realised in practice.

The tendency to under-predict is particularly marked when U.K. firms record price expectations. By contrast, the Ifo results which show a slight tendency to over-predict price changes. Kawasaki and Zimmermann (1986) pooled responses from monthly surveys conducted in 1977/8 and 1980/1. In both periods, well over 70% of German firms forecast price changes accurately. The explanation for this difference may simply lie in the time periods under consideration. The late 1970s and early 1980s were somewhat more inflationary than a few years later, allowing U.K. firms to more accurately predict the change in prices. Alternatively, it may reflect differences in pricing behaviour between countries; German firms may be "price setters" and U.K. firms might be "price-takers", relatively speaking.

Kawasaki and Zimmermann (1986) take the analysis of forecast accuracy in business surveys further, constructing a "bias index" based upon the proportion of forecast errors. This bias index is attractive since it has a straightforward interpretation: the value is 1 if all bias results from over-predictions (the expectation falls in a qualitatively higher category, e.g. "increase", than the subsequently recorded realisation, e.g. "no change") while the value is -1 if all bias results from under-predictions.

The bias index might also have been improved by accounting for the "distance" between the ordinal responses discussed earlier. That is, the index might reflect the severity of the forecasting error. We have not pursued this procedure, feeling that there is already a great deal of inexactness in constructing our forecast errors, using differences in qualitative response categories to do "arithmetic".

Note that the panel of firms is not significantly better at forecasting when compared to our overall sample; the proportions for the full sample are very similar to those for the panel. We interpret this as weak evidence that there is limited 'learning by doing' in answering the surveys. Firms which stay in the sample over time are probably no better at predicting the future. This may also offer evidence to counter arguments that firms strive for internal consistency in answering the surveys by explicitly recalling their reported expectation and matching their outturn response accordingly. If this were true one might expect firms in the panel to exhibit a different (more accurate) pattern of responses than the whole sample which includes all firms who answered two consecutive surveys.

It is also unclear why the firm would find it an advantage to be perceived to be internally consistent about expectations and realisations. Pesaran (1987) suggests that firms use their responses to influence government policy, however, the manner in which this occurs is not discussed. If so, it would imply:

1. the CBI survey results are considered in policy making decisions;
2. the variables being surveyed reflect areas where governments have policy discretion, and;
3. the government pays attention to firms and/or the CBI in its deliberations.

While interesting in principle, we do not pursue this issue further.

2.8 Conditional Forecasting Accuracy

Table 2.4 still masks a great deal of detail by aggregating all the correct forecasts, and so could potentially be misleading. Recall that almost two-thirds of all firms respond "no change" when asked their plan to change employment levels. Thus, even if in total plans appear accurate, this might result because of the preponderance of "no change" forecasts which are "fulfilled" because the (expected and realized) changes that do occur are small enough for firms to ignore. Firms which expect increases or decreases could therefore be wildly inaccurate about forecasting increases or decreases in employment but the results are swamped by the very large numbers of "accurate" forecasts of stability. Thus, we wish to examine the accuracy of plans to increase and to decrease employment separately to see how accurate they are, and if perhaps changes in one direction are more likely to be fulfilled than the other. Table 2.5 presents the contingency tables for expected employment at period t+1 recorded in period t, and the subsequent realised employment in period t (recorded at time t+1), for each pair of surveys.[10] The subscript 1 refers to our first survey, 1982:Q4, and the subscript 2 to 1983:Q1, and so on.

Each column tells us the likelihood of realising a plan for employment, conditional on the stated plan. The results show us that firms are quite accurate at forecasting. First, note there is basically a rising proportion of firms expecting to increase employment over the sample period, as noted earlier. These firms are also more likely to realise those plans over the sample period, rising from just over 40% to 55%. In 1982:Q4, only 88 firms pan to hire workers whereas by 1983:q4, 207 firms planned to increase their work force. Second, firms not expecting to change their employment constitute well over 60% of the sample at each survey date. There is also a marked stability in the accuracy of those plans, at about two-thirds. Finally, 70% of those who planned to decrease their employment met their plan, but these plans were less often fulfilled at the end of our sample period. As well, the numbers of firms expecting to decrease employment also falls, as we would expect from the macro picture discussed earlier.

Therefore, we conclude that it is not the prevalence of plans for stable employment, nor the fact that these plans are generally fulfilled (the middle cell of the table), that leads to the picture of forecasting accuracy discussed in Section 2.6 above.

We have also calculated the corresponding contingency tables for cost, price, and output, but do not present them in full. Briefly, forecasts of cost and price increases are more prevalent than decreases. Both show a wider degree of inaccuracy than employment, especially costs where the forecast accuracy is only just over 50%. Note also the prevalence of accurate forecasts of stable prices. One explanation for this could be that firms respond to any shocks with quantity rather than price changes, to the extent that they are non-price takers. Neither plans to increase or to decrease output are met with greater than 55% accuracy over our sample period. Stability of output is again the most accurately forecast case.

Thus, we must re-interpret the results in Table 2.4. In those results, price forecasts were the most accurate, but this can be shown to rely on the disproportionate number of "no change" predictions and outturns. The accuracy of employment plans is, however quite evenly spread across all categories. Forecasts of cost changes were also quite accurate according to the aggregate picture and this too stems from the prevalence of "no change" expectations that are realised. Forecasts for output are less accurate than others in Table 2.4.

We now turn to the task of using these data to estimate models of employment, output and pricing plans for U.K. firms.

Footnotes:

1. Carlson and Parkin (1975) proposed a method for converting qualitative data into aggregate quantitative time-series by assuming that the responses are subjective probabilities which are distributed normally. The task is then to calculate the mean and variance of the distribution of responses to yield the average value of the expectation. Most studies deal with inflation, using the questions on the expected changes in prices. Many variants and extensions to Carlson and Parkins' methodology have been proposed (see for instance Foster and Gregory,1977 or Batchelor, 1982). Pesaran (1984) suggests an alternative methodology based on regression techniques applied to the proportion of firms responding increase and decrease.

2. Data such as from the Livingstone surveys have been used by several authors to test expectations formation mechanisms. The interested reader should consult Holden, Peel and Thompson (1985, Chapter 3) or Pesaran (1987, Chapter 8) for references to published work using the various surveys.

3. The contents of the CBI surveys are also described by Klein and Moore (1981) and McWilliams (1983).

4. In 1971, one set of results was 'lost' in a postal dispute and not tabulated within the six weeks after the submission deadline as is normal practice.

5. In 1975, there was a change in questions regarding the trend in output and new orders from the value of output (orders) to the volume of each. It was hoped this would account for high rates of inflation and give more accurate information about real changes.

6. The CBI (McWilliams, 1983) gives the interpretation of this question as: 'Generally a leading indicator of the production cycle in manufacturing leading by about 6-9 months: often picks up strongly impact of political or economic events...'

7 Econometric analysis comparing the CBI survey data with official statistics is also undertaken by Keating (1983).

8. To compare the balances, which refer to changes in new orders, with a quantitative variable for the volume of new order, Klein and Moore cumulate the balances. Their results show that the mean lead was 12 months for peaks and 10 months for troughs.

9. Alternatively, these values can be interpreted as the proportion of firms by dividing each cell frequency by the total number of firms. Denote this by $P_{++} = f_{++} / f_{ij}$ for the upper left-most cell. Hence the nine inner cells, the fourth column and the fourth row all sum to one.

10. Instead of the row sums being equal to one, the marginal table gives the actual frequency of firms planning to increase, keep constant or decrease employment respectively, with the total number of respondents appearing as the extreme lower left entry.

TABLE 2.1

THE CBI DATASET: OCT 1982 - JAN 1984

Survey Date	Number of Firms
October 1982	1635
January 1983	1680
April 1983	1644
July 1983	1608
October 1983	1598
January 1984	1644

	9809

TABLE 2.2

Percentage of Firms by Employment and SIC[1]

Number Employed:	Full Sample %	Panel %
1 - 199	50	45-47
200 - 499	22-24	24-26
500+	26-28	28-31

Industrial Classification:	Full Sample %	Panel %
Food, Drink and Tobacco	5	6
Chemicals, Coal and Petroleum	9-10	9
Metal Manufacture	5-6	4
Mechanical Engineering	20-21	19
Electrical Engineering	10	10
Shipbuilding, Marine and Vehicles	3-4	4
Metal Goods	8-10	10
Textiles, Clothing, Footwear, Leather	17-19	19
Other Manufacturing	17-20	18

1 Each survey analysed separately, thus there were between 22-26% of firms employing 200-499 employees across our 6 quarters of data.

TABLE 2.3

Percentage of Firms Answering 'Up', 'No Change' and 'Down'

Numbers Employed:

Survey	Expectations (+)	(=)	(-)	Realisations (+)	(=)	(-)
October 1982	8.4	57.6	33.8	12.0	50.9	36.5
January 1983	9.6	61.6	28.8	10.0	50.9	39.1
April 1983	16.4	62.9	20.6	14.0	51.2	34.7
July 1983	19.1	61.3	19.6	20.1	49.5	30.4
October 1983	14.6	64.3	21.0	23.0	53.4	23.6
January 1984	18.6	64.7	16.7	22.2	56.6	21.2

Volume of Output:

Survey	Expectations (+)	(=)	(-)	Realisations (+)	(=)	(-)
October 1982	16.0	62.5	21.3	15.1	53.9	30.9
January 1983	19.0	64.0	16.4	18.6	54.6	26.5
April 1983	30.2	62.3	7.1	26.3	56.3	17.0
July 1983	29.8	61.1	8.6	30.2	55.3	14.1
October 1983	26.5	62.9	10.3	29.7	55.3	14.7
January 1984	28.2	63.7	7.8	34.7	53.6	11.4

Volume of Domestic New Orders:

Survey	Expectations (+)	(=)	(-)	Realisations (+)	(=)	(-)
October 1982	14.8	62.1	22.4	16.1	41.8	41.6
January 1983	18.8	64.5	15.9	19.7	46.8	32.9
April 1983	30.6	60.6	8.0	32.5	46.1	20.8
July 1983	29.1	60.8	9.1	34.9	43.4	21.0
October 1983	24.0	64.3	10.9	33.9	45.4	19.9
January 1984	29.4	62.5	7.4	39.8	43.6	16.2

Unit Costs:

Survey	Expectations (+)	(=)	(-)	Realisations (+)	(=)	(-)
October 1982	35.9	57.4	6.0	32.8	59.7	6.8
January 1983	41.4	52.5	5.5	30.1	62.2	7.1
April 1983	41.6	51.1	6.7	35.1	56.3	8.1
July 1983	30.8	62.7	6.7	32.0	59.4	8.1
October 1983	40.3	52.9	6.2	30.5	61.6	7.4
January 1984	47.9	46.1	5.4	33.9	58.6	7.0

Domestic Prices:

Survey	Expectations (+)	(=)	(-)	Realisations (+)	(=)	(-)
October 1982	23.8	66.8	9.0	17.5	68.7	13.6
January 1983	32.3	60.7	6.7	14.8	71.8	13.0
April 1983	34.0	61.8	3.8	25.9	64.3	9.5
July 1983	27.1	67.8	4.7	23.6	67.2	8.6
October 1983	33.9	60.6	5.1	24.0	67.6	7.9
January 1984	44.6	51.3	3.7	24.8	67.5	7.2

TABLE 2.4

Forecast Errors: Percentage of Firms

Variable	Full Sample (+)	(=)	(-)	Base	Panel (551 Firms) (+)	(=)	(-)
Employment	17	65	18	5957	17	67	16
Cost	16	61	23	5912	16	61	23
Price	12	66	22	5928	12	66	22
Stocks	22	57	21	5180	21	58	21
Orders	25	49	26	5890	25	49	26
Output	22	57	21	5928	22	58	20

TABLE 2.5

Conditional Forecast Errors for Employment: Percentage of Firms[1]

(a)

		ΔN_2 (+)	ΔN_2 (=)	ΔN_2 (-)	No.
ΔN^*_1	(+)	.42	.48	.10	88
	(=)	.11	.65	.24	696
	(-)	.02	.29	.68	415
					1199

(b)

		ΔN_3 (+)	ΔN_3 (=)	ΔN_3 (-)	No.
ΔN^*_2	(+)	.50	.39	.11	112
	(=)	.13	.65	.22	703
	(-)	.03	.24	.73	347
					1122

(c)

		ΔN_4 (+)	ΔN_4 (=)	ΔN_4 (-)	No.
ΔN^*_3	(+)	.59	.32	.08	188
	(=)	.16	.64	.20	737
	(-)	.02	.24	.74	264
					1189

(d)

		ΔN_5 (+)	ΔN_5 (=)	ΔN_5 (-)	No.
ΔN^*_4	(+)	.53	.39	.08	207
	(=)	.19	.65	.15	744
	(-)	.06	.26	.67	231
					1182

(e)

		ΔN_6 (+)	ΔN_6 (=)	ΔN_6 (-)	No.
ΔN^*_5	(+)	.55	.39	.06	170
	(=)	.18	.69	.13	750
	(-)	.06	.35	.59	245
					1165

1. Time subscripts refer to survey dates: 1 = Oct 1982, 2 = Jan 1983, 3 = Apr 1983, 4 = July 1983, 5 = Oct 1983, 6 = Jan 1984. The asterisk refers to expectations formed at time t for period t+1.

CHART 2.1

SURVEYS OF ECONOMIC OPINION AND CONDITIONS

	QUALITATIVE	QUANTITATIVE	MIXED
FIRMS	Confederation of British Industry Industrial Trends Survey (U.K.) Australian Chamber of Commerce/ Bank of NSW, Survey of Industrial Trends (Australia) Institute of Economic Research's Quarterly Survey of Business Opinion (NZ) National Institute for Economic Research, Business Tendency Survey (Sweden) Supplement B (EEC)	Dept.of Industry and Commerce Survey of Manufacturing Activity (SOMA) (Australia) Bureau of Economic Analysis (USA) Mondo Economico (Italy) F. Endicott/Northwestern University (USA) Financial Times Survey of Business Opinion (UK)	Ifo (Germany) INSEE (France)
CONSUMERS	Gallup (UK) Supplement C (EEC)		Survey of Consumer Finances (U.S.) Survey of Consumer Finances (Canada) Institute of Applied Economic and Social Research (Australia)
EXPERTS		Money Market Services (USA) Goldsmith-Nagan Inc. (USA) Livingstone/Philidelphia Bulletin (USA) ASA-NBER Survey of Forecasts of Economic Statisticians (USA)	

<u>FIGURE 2.2</u>

(a)

Proportions of firms in Response Categories Matching Expectations for t with Realisations for t

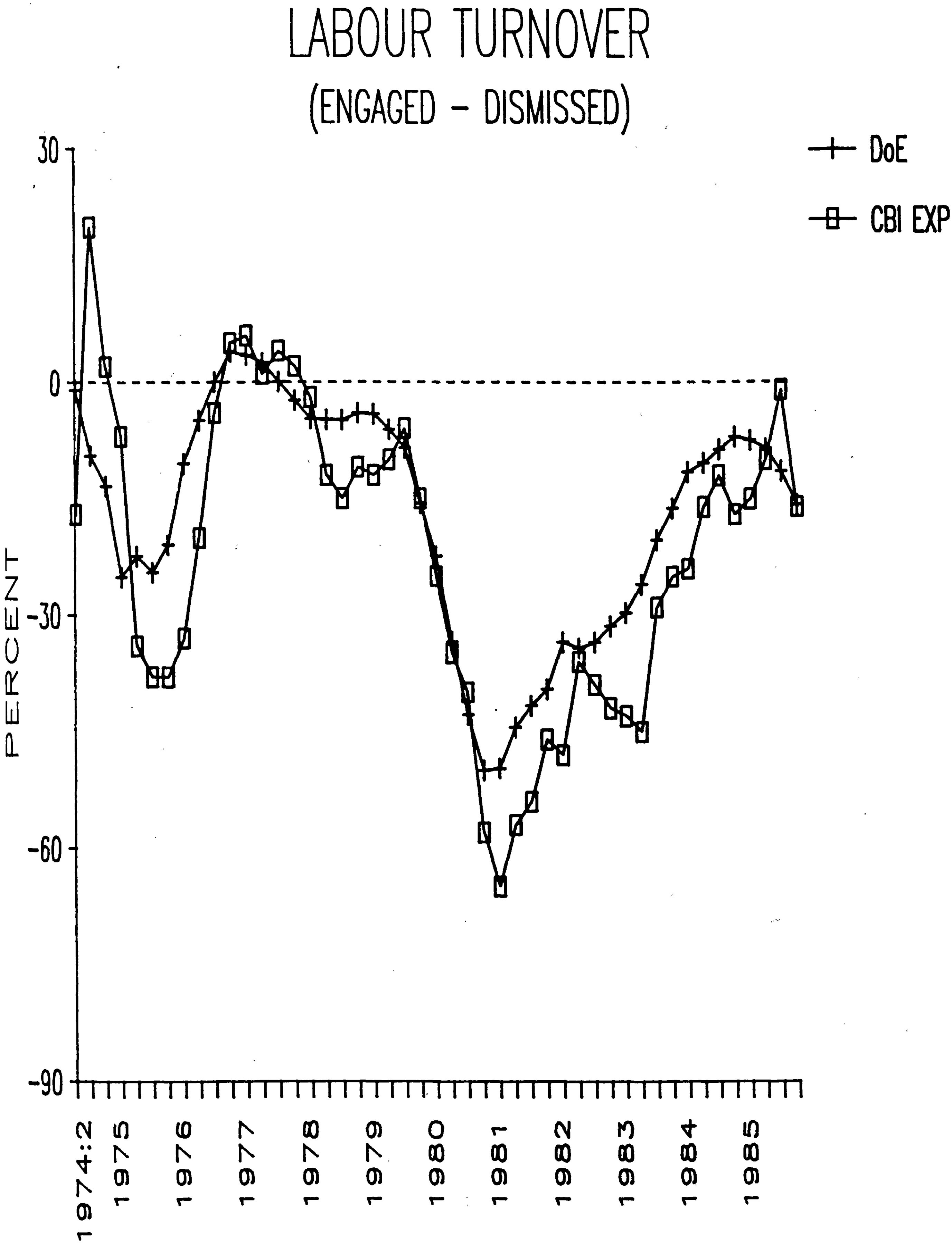
		Realised Changes			
		(+)	(=)	(-)	
Expected Changes	(+)	f_{++}	$f_{+=}$	f_{+-}	f_{+j}
	(=)	$f_{=+}$	$f_{==}$	$f_{=-}$	$f_{=j}$
	(-)	f_{-+}	$f_{-=}$	f_{--}	f_{-j}
		f_{i+}	$f_{i=}$	f_{i-}	f_{ij}

(b)

Generating Forecast Errors (Surprises)

		Realised Changes		
		(+)	(=)	(-)
Expected Changes	(+)	(=)	(+)	(+)
	(=)	(-)	(=)	(+)
	(-)	(-)	(-)	(=)

Figure 2.1


LABOUR TURNOVER
(ENGAGED - DISMISSED)
DoE
CBI EXP
30
0
-30
-60
-90
PERCENT
1974:2
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985

Chapter 3

'When I use a word', Humpty Dumpty said, in a rather scornful tone , 'it means exactly what I choose it to mean, neither more nor less.'

(Lewis Carroll: Alice Through the Looking Glass)

Modelling Demand for Labour and Employment Using Survey Data

3.1 Introduction

In this paper we estimate a reduced form equation, based on Sargent's, 1978, dynamic optimisation model for firms' employment plans (demand for labour) and employment outturns as recorded in the Confederation of British Industry's Industrial Trends Surveys. Having data for both expectations and "realizations" for individual firms allows us to ask:

- what role do expectations of product demand and factor costs play in explaining employment plans and actual hirings?
- is it a different role in each case?
- can lagged values of output and costs proxy for expectations?

The models are estimated by ordered probit techniques (see Maddala, 1983) using individual firms' responses. The results show that demand for labour responds positively to changes in expected demand. A real wage proxy does not give the expected negative effect, though we have reservations about the proxy available from our data. The model is also adapted to show that lags of output and costs do not adequately proxy expectations, once actual (lagged) expectations of these variables are included in the model of employment outturns.

We start by reviewing empirical work on firms' employment behaviour, especially studies using survey data at the firm level to study hirings. Section 3.3 looks briefly at the data set we will use and Section 3.4 presents the model. Results for employment planning and hiring equations are discussed in Sections 3.5 through 3.8. Section 3.9 summarizes the findings and suggests some conclusions.

3.2 Models of Employment Using Survey Data[1]

The pioneering papers using quantitative time-series data to explain employment behaviour are Brechling (1965), and Ball and St. Cyr (1965). Useful summaries of the literature are Killingsworth (1970), Briscoe and Peel (1975), and Hazeldine (1981). Both these studies, and those they spawned, focus on short-term employment behaviour. The principle issues they addressed were:

- the counter-cyclical nature of employment and the pro-cyclical nature of output, and;
- the implied short-run elasticity of labour demand, which is often found to be greater than 1, implying increasing rather than decreasing returns to factors.

Brechling (1965, p.187) considers a model "...which contains an underlying employment demand function and a short-term employment adjustment process." The employment demand function relates the desired level of employment to a number of exogenous variables and the adjustment process describes the adjustment of actual to desired employment. The desired level of employment is that level which minimises costs. Given adjustment costs, desired employment may not be achieved immediately but this level is approached gradually using a partial adjustment mechanism. Brechling is agnostic about the specific technology linking employment and output. The work presented by Ball and St. Cyr can be seen as a rigorous implementation of the ideas underlying Brechling employment equation, specifying *a priori* a functional form for the firm's production function and using this to derive a reduced form equation.

Interestingly, this early work on employment functions clearly delineated between the ***desired*** level of employment and the ***realised*** level of employment. However absence of data on desired employment means that the demand for labour function cannot be estimated; instead the employment adjustment equation is used. Costs of adjustment combined with uncertainty about the future (see Brechling, 1975 and Nickell, 1981), implying a lagged response in behaviour, is used to justify estimating the latter in place of the former. Expected demand for the firm's product is usually proxied in these early employment functions by the first difference in output and a four quarter moving average of output. Neither adds significantly to the fit of the employment function, which may imply that lagged output is a poor proxy of expected output. Indeed, our results show that direct data on output expectations do enter the employment and demand for labour functions significantly.

The availability of data from expectational surveys allows us to consider separate "*ex ante*" and "*ex post*" employment equations. Even existing work using surveys has been slow to exploit the feature of the data, but see Nerlove (1983). Challen and Hagger (1980), reviewing employment equations, argue:

> "... none of the [demand for labour] functions under discussion have been subjected to a pure test. In most countries the econometric testing of the [demand for labour] function faces the obvious difficulty that the demand for labour is not directly observed."

Unfortunately the solution Challen and Hagger suggest still involves a method for converting data for unfilled vacancies, registered unemployed, and actual employment into a series proxying excess-demand for labour.

As far as the author is aware, only three studies (published in English) use survey data in qualitative form to model firms' hiring decisions. Konig and Zimmermann (1986) and Zimmermann (1986) use individual firm level responses from the Munich Ifo Test data for

West Germany, while Rahiala, Terasvirta and Kanniainen (1986) use the Confederation of Finnish Industry surveys. Other authors using survey data, some of which will be discussed in Chapter 5, use aggregate time-series data derived from the survey results, facilitating traditional econometric modelling (see for example Wren-Lewis, 1986).

The Ifo questionnaire in October 1980 asked firms to select two factors from a list of five which explained their plans to hold labour constant or to decrease their employment over the coming year. The choice of factors was:

- (i) no permanent employment possible;
- (ii) insufficient demand;
- (iii) wage and non-wage labor costs too high;
- (iv) skilled workers not available, and;
- (v) labor-saving technical progress.

Given that the data result from a special question, the authors have only a cross-section of firms at a point in time (1980). In contrast, our CBI survey data yields a set of six cross-sections and a panel of firms who answer all 6 surveys. Also note that the time span is 12 months for the Ifo screening question rather than four months for the equivalent question in the CBI surveys. Hazledine, 1981 suggests that the relevant time horizon for labour force planning is about six months.

Konig and Zimmermann (1986, p. 635) argue that this cross-sectional approach is

> "...preferable to other approaches like vector autoregressive time series analysis because the questions are posed directly to firms and therefore, one is able to infer...the relative importance of the various determinants of labour demand from the viewpoints of the firm".

Given that 1980 was the middle of a European recession, it is not surprising that only four per cent of firms answered they planned to increase their employment, leaving a sample of 33,374 firms. Nevertheless, ignoring the firms who plan to increase their employment introduces a sample selection bias (see Heckman, 1979).[2] Konig and Zimmermann (1986) deal with this by estimating a probit selection function. To predict the probability of planning to increase employment based on determinants such as capacity utilisation and expected changes in demand. The result is a hazard function, the ratio of the density and the distribution function of the standard normal distribution. The value derived from the hazard function for each firm is used to adjust for any sample selection bias in the subsequent probit equation explaining the probability of not changing or decreasing employment. The results show that insufficient demand is most likely to affect employment plans, followed by technical progress and then costs of labour.

Zimmermann (1986) uses the same data but concentrates on the effects across industrial groupings to consider the sectoral differences in employment decisions. In probit equations, (though not through a two step probit process discussed above) insufficient demand proved by far the dominant factor explaining the probability of holding employment constant; labour costs came next, followed by technical progress. The remaining two factors played a significant role in only two or three industries.

Rahiala, Terasvirta and Kanniainen (1986) use continuation ratio models (see Maddala, 1983) on data from the Confederation of Finnish Industry to test whether failure to fulfill employment plans in the sense that the realized outturn falls in a different category than expected one quarter earlier (see Chapter 2), can be explained by Keynesian versus Neo-classical "shocks". The basic conclusion is that demand shocks provide a better explanation of revisions in employment plans than cost shocks. Broadly, therefore, the German and Finnish results offer support for the prevalence of Keynesian factors in the labour market over Neo-classical determinants of employment.

3.3 The CBI Industrial Trends Survey

As discussed in Chapter 2, the Confederation of British Industry (CBI) has conducted its survey continuously since June 1958, canvassing over 2000 firms each quarter (3 times a year prior to 1972).[3] In general, about 1600 firms, covering all major Standard Industrial Classifications (SIC) in manufacturing, respond in each quarter. Only recently has the CBI released the firm level responses. In general, only aggregate percentages of firms in each response category are made public. The data available therefore cover only a relatively short period; consecutive surveys from October 1982 to January 1984, or 6 quarters in all. While this is a short time horizon, a total of 9809 individual firms responded, with roughly 1600 or more each quarter. Further, a total of 551 firms answered all 6 surveys, thus forming a substantial panel through which we can assess the stability of our results over time.

Further, having a firm's responses from consecutive surveys allows us to match its expectation from one survey to its outturn in the next. This allows us to generate "forecast errors", instances in which expectations are not fulfilled as well as indicators that a firm did not follow its plan for hiring/firing labour. For example, a firm might have indicated its intention to shed labour during period t+1, when asked in the CBI survey at time t. Subsequently, in the survey conducted in period t+1, the firm might record that its labour force was unchanged or increased, contrary to its plan. Having consecutive surveys also allows us to consider expected demand for t+1 and the subsequently recorded outturn; the firm's forecast error. Having these forecast errors allows us to test whether the firm's failure to fulfill its plan is explained by the fact that its expectation of market conditions was unfulfilled, as economic theory would predict.

Note that we drop those firms who reply 'not applicable' but this is rarely more than 2% of the sample. It is assumed that there is a minimal bias resulting from the omission of these firms' responses.

Availability of a panel of firms from business intentions surveys is also quite unique. Having the same firms' responses over a number of periods allows us to confirm the stability of the general results. These firms are spread across all industrial and size (employment) classifications and their distribution follows that of the sample of all firms answering at least two consecutive surveys. We now turn to a model of labour demand based on micro-level data of intentions and expectations.

3.4 A Dynamic Model of Labour Demand

The model presented is very simple, incorporating a linear production function with labour the only input, and a linear demand function (see Sargent, 1978 for a similar model). This simplicity requires a number of strong assumptions but also allows us to move quickly to a set of equations for estimation which address the interesting questions outlined above. The firm is assumed to operate in an imperfectly competitive market for its output, so that it faces a downward sloping demand function. The demand function includes a shift parameter which represents expectations of demand conditions. Hence the firm decides its output on the basis of the price it will face and anticipated exogenous shocks that may affect demand.

The production function is simply

$$Q_t = f_0 + f_1 N_t \qquad (1)$$

(Q is output and N is employment) which satisfies the usual condition that $\Delta Q/\Delta N > 0$. The firm's demand function is given by

$$Q_t = a[D_t - P_t] \qquad (2)$$

where D is a shift parameter affecting the intercept of the demand curve and P is product price. This can be re-written as

$$P_t = [(D_t - Q_t)/a] \qquad (3)$$

The firm faces quadratic costs of adjusting its labour force (see Brechling, 1975 or Nickell, 1978) and maximises the expected present value of discounted profits which are

$$E_t \{ \sum_{i=0}^{\infty} b^{t+i} [P_{t+i}Q_{t+i} - w_{t+i}N_{t+i} - (k/2)(N_{t+i} - N_{t+i-1})^2] \} \qquad (4)$$

where b is a constant rate of discount.

The solution to problems of this type are discussed at length in Sargent (1979, Chap. 14) and so will only be outlined below. Maximising with respect to N leads to the following set of Euler equations,

$$E_t\{(-2f_1{}^2/a)N_{t+i} - k(N_{t+i} - N_{t+i-1}) + kb(N_{t+i+1}1 - N_{t+i})\}$$

$$= E_t((2f_0f_l/a) - (f_l/a)D_{t+i} + w_{t+i}) \qquad (5)$$

Gathering terms, we can write these as second order difference equations in N, where L is a lag operator. Thus,

$$b[l - (\varphi/b)L + (l/b)L^2]\, E_{t+i}N_{t+i+1} = (l/k)[F - (f_l/a)E_{t+i}D_{t+i} + E_{t+i}w_{t+i}] \qquad (6)$$

where $\varphi = [(2f_1{}^2/ak) + 1 + b]$ and $F = (2f_0f_1)/a$. We can write this as a quadratic equation

$$(1 - \lambda_1 L)(1 - \lambda_2 L)E_{t+i}N_{t+i+1} = (l/bk)[F - (f_l/a)E_{t+i}D_{t+i} + E_{t+i}w_{t+i}] \qquad (7)$$

where the roots of the equation satisfy:

$$\lambda_1 + \lambda_2 = \varphi/b \neq 1 \qquad \text{and} \qquad \lambda_1\lambda_2 = l/b \neq 1.$$

Solving to give a single linear decision rule for each period t which satisfies the Transversality Condition (see Sargent, 1979) gives, after some rearrangement

$$E_{t+i}N_{t+i+1} = \lambda_1 N_{t+i} - (\lambda_1/k)\{\sum_{i=1}^{\infty} (1/\lambda_2)^i[F - (f_1/a)E_{t+i}w_{t+i+1} + E_{t+i}D_{t+i+1}]\} \quad (8)$$

So employment plans depend on the entire future path of expected demand shocks and the real wage. The firm's employment plan for t+i+l is positively related to the actual level of employment in the past period (N_{t+i}) and expectations of demand levels (D_{t+i+1}) but is negatively related to expectations of the real wage. Most early studies discussed in Section 3.2 contain both demand and cost conditions. Studies which emphasise the "Neoclassical" labour demand function, eschewing demand conditions, are Sargent (1978), Neftci (1978) and Symons (1985).

3.5 Empirical Implementation

The CBI data available do not lend themselves immediately to estimating an equation such as (8) where expectations beyond one quarter ahead affect employment plans and so we will simplify our equation accordingly. Evidence from many earlier studies (summarised in Hazeldine, 1981) indicate that short-run employment adjustment occurs within about six months. Further, one could assume that costs and demand can be described by a simple first order autoregressive process. In this case the expectations for the next four months summarise all the relevant information necessary to forecast the entire future of the variables. Thus, limiting the models to one quarter ahead expectations is both pragmatic and reasonable. This leads us to a simplified estimating equation:

$$\Delta N_{t+i+l} = \beta_1 + \beta_2 \Delta N_{t+i} + \beta_3 \Delta D^*_{t+i+l} - \beta_4 \Delta w^*_{t+i+l} \quad (9)$$

where $\beta_1 = -(\lambda_1/k)F$, $\beta_2 = \lambda_1$, $\beta_3 = (f_l/\lambda_2 a)$, $\beta_4=(1/\lambda_2)$. The asterisks denote expectations formed one period before and the delta denotes the change expected over period t+l, since the CBI questions should be interpreted as referring to changes in the variables rather than levels.

The model is estimated by ordered probit (Amemiya, 1981; Maddala, 1983). Let y^* be a latent random variable related to an explanatory variable x. Here y^* is an unobservable tendency to change employment. What is observed instead is x, which falls into three categories - decrease, no change and increase - so

$$y = \begin{cases} 1 & \text{if } y^* \leq a \\ 2 & \text{if } a < y^* \leq b \\ 3 & \text{if } b < y^* \end{cases}$$

where a and b are unknown thresholds. If we assume that y^* is independently normally distributed ($y^* \sim N(\mu,\sigma^2)$), the probabilities of being in each category, $p_i(x)$, are given by:

$$\begin{aligned} p_1(x) &= \Phi[(a - \beta_0 - \beta_1 x)/\sigma] \\ p_2(x) &= \Phi[(b - \beta_0 - \beta_1 x)/\sigma] \\ p_3(x) &= 1 - p_1(x) - p_2(x) \end{aligned}$$

where Φ is the standard normal distribution function. In order to identify the parameters of the ordered probit model, we arbitrarily set $\sigma = 1$ and $a = 0$. This normalisation allows us to proceed with estimation.

Note that there are really two coefficients attached to each explanatory variable, resulting from the trichotomous nature of each response. Thus, our ordered probit model estimates separate coefficients if firms expect demand (real wages) to rise or to fall. The case of no change in the exogenous variable is captured in the constant. The interpretation is then that, compared to the base case (a firm in "Other Manufacturing" with over 500 workers which expects no change in any of the exogenous variables), a positive (negative) and significant coefficient on expected demand (costs) implies that firms would be more likely to plan to increase (decrease) employment as a result. To fit with the theoretical model, the second coefficient should be negative (positive), that is, firms would plan to decrease (increase) employment if demand (cost) is expected to fall.

Finally, our cost information is drawn for the CBI survey question which refers to unit costs of output - labour, materials and capital costs - without specifying real or nominal values (see Ballance and Burton, 1983). Unfortunately this is the only cost proxy available.[4] In order to proxy real wages, we construct a product wage variable by combining the responses to the unit cost and unit price questions as in Figure 1 below (see also Nerlove, 1983). If the firm expects costs to rise but price to stay constant, or to fall, we assume that the product wage is expected to rise. That is, if the cost variable exceeds the price variable in ordinal terms, the product wage rises and vice versa. The most unsatisfactory aspect of "ordinal mathematics" occurs when both responses fall in the same category (the diagonal in the diagram), in which case the product wage is assumed to be constant.

		ΔC^*_t		
		+	=	-
ΔP^*_t	+	=	+	+
	=	-	=	+
	-	-	-	=

We also experimented with the expected unit cost and expected unit price of output variables entering separately to avoid the complications of combining the two to form a real wage proxy. Hazeldine (1981) has even suggested that the two should enter the equation separately, rather than in ratio form, to test which variable might be "doing the work".

3.6 Employment Plans

The fact that over 500 firms replied to six consecutive surveys allowed us to experiment somewhat with longer "leads". We used a firm's expected employment from the October 1982 survey as the dependent variable, and include expectations of demand and wages (proxied by the product wage discussed above) from each of the six surveys. The results in Table 3.1 confirm a lagged response in employment plans, the two coefficients on ΔN_t are positive and negative and both significant. Of the six variables representing expected demand, only expectations formed at t for t+l (ΔD^*_{t+1}) have two significant coefficients with the expected signs. Unfortunately, none of the expected real wage proxies is significant.

As a result, we reduce the model to one demand and cost variable only and estimate our model of employment plans for all sectors and size classes, for each survey separately and pooled over all six quarters. The results are remarkably robust for all the subsets of data we have used. The results shown in Table 3.2 are representative. We have considered three proxies of expected demand conditions: new orders; output; and business optimism. Hazeldine (1981) has argued that economists must search for better proxies of demand since output is likely to be an endogenous variable.

Consider the results using expected new orders in the first two columns of the table. This model indicates that firms are likely to respond to increases in future demand (ΔD^*_{t+1}) by planning to hire new workers ($\beta_3(+) = 0.3$, t = -23.1) and to decrease employment if demand is expected to fall ($\beta_3(-) = -.32$, t = -18.3). The cost of adjustment dummies, lagged employment changes (ΔN_t), enter with the expected signs and both are highly significant. Unfortunately, our real wage proxy gives mixed results. The first dummy is correctly signed (-.06) and significant, that is, firms plan to decrease employment if the product wage is expected to rise. However, the dummy for expected real wage decreases is incorrectly signed and not significantly different from zero. We might interpret this as asymmetric behaviour in the labour market.

Both expected output and business optimism also work well in the model; these proxies of expected demand enter with theoretically correct signs and are highly significant. Therefore simultaneity between output and employment need not worry us, since alternative "exogenous" proxies of demand conditions support the contention that employment plans are positively related to demand expectations. The interaction between employment and output plans is investigated in Chapter 5 (see also Wren-Lewis, 1984, 1989; or Nickell, 1984). Somewhat disappointingly, the product wage variable is unsuccessful in all three equations.

Each model included dummies to account for the firms' industrial and size classifications, and time dummies when the data are pooled over all six surveys. It is difficult to interpret these coefficients in a straightforward manner, given the sheer number and the diversity of signs and significance levels. The coefficient estimates are presented but we will not analyse them in any detail. Instead we now consider a selection of sectoral and firm size equations.

Table 3.3 presents selected results pooled over all survey dates using the new orders demand proxy. First, the smallest firms (1-199 employees) stand out, showing the strongest effect for expected wage increases. The coefficient has the expected sign (-.07) and is highly significant ($t = -3.7$). The coefficient representing expected real wage decreases is in this case correctly signed but not statistically significant at even a ten per cent level. The results may indicate that smaller firms are more sensitive to real wage rises than firms employing more workers. In contrast, the largest firms show negative and significant coefficients for expected real wage increases and decreases (see columns 3 and 4 of Table 3.3). This latter result in particular is difficult to explain. Why should large firms decrease employment when factor costs are expected to decrease? The lack of a question on wage changes alone and the need to combine variables to generate a real wage proxy again means drawing conclusions is difficult. Past changes in employment and expectations of demand conditions again enter with the correct signs and are highly significant in all size classes.

Disaggregated by industry, firms in the Food, Drink and Tobacco sector stand out. Table 3.4 shows that pooled over all six surveys, employment plans in this sector do not respond positively to expected demand. While none of the demand proxies works well, in particular we note that only the increase coefficient for expected new orders is statistically significant (column 1) while expected output is insignificant in both cases. In all other sectors and size classes and for all survey dates, the expected output proxy enters with the strongest effect. Demand in this sector may in general be quite stable as consumption of these goods would be less prone to cyclical fluctuations, being deemed "necessities" and having low price per unit. Mass production by assembly line techniques may imply that capacity can be taken out of, or brought into, use quickly without having to adjust the work force in response to demand shifts.

In addition, the lagged employment variable, being only marginally significant, performs poorly by comparison with other sectors. This feature is shared by the shipbuilding and marine vehicles sector (not shown in the table: $\beta_2(+) = .001$, $t = .007$), to which the former sector has little in common. One might hazard that building to order with respect to ships may imply these firms are less likely to take on workers slowly over time, but rather would need them at specific times to complete specific jobs. The foods sector may find it simpler to hoard labour, explaining the weak effect of demand fluctuations noted above. The real wage proxies perform universally poorly in all industrial sectors.

The model was also estimated for the panel of firms replying in all six surveys and pooled over all firms at each survey date. These results are not presented in separate tables but are summarised below.

Firms that are ever-present in the sample display the same positive response to expected demand as discussed above. A partial adjustment process appears to operate, while the real wage variable has a statistically insignificant effect on employment plans. Therefore the panel is not noticeably different from firms that respond fewer times in our sample period. Finally, pooling over all firm sizes and sector classifications and estimating an equation for each survey shows that the responses are stable over the six quarters. The parameter estimates themselves change slightly in value but the presence of a strong positive effect of demand expectations, and partial adjustment, and the lack of a real wage response are repeated.

Therefore, based on a model emphasising the effect of expected demand and cost conditions on firms' employment plans over the coming four months, the CBI data confirm the importance of expectations in employment behaviour. Firms wish to forecast the expected trend in demand (whether represented by incoming orders, output or general business optimism) in order to decide on their future hirings and firings.

Results from the CBI survey data reinforce earlier survey based work on the importance of demand expectations. In the Ifo and Confederation of Finnish Industry surveys, demand conditions proved the strongest determinants of employment behaviour. Thus those authors cautiously suggest that the Keynesian employment function is supported from expectational data at a firm by firm level.

The failure of the real product wage proxy to explain employment plans, and the evidence cited in other studies, led us drop this variable from the equation and to estimate a "Keynesian" model which has only lagged employment and demand conditions. These results are given in Table 3.5. Dispensing with the real wage effect has virtually no effect on the parameter estimates; the coefficients values are almost identical and are all strongly significant. However, a likelihood ratio test between the expected employment equations using expected new orders as a demand proxy, see tables 3.2 and 3.5, gives weak evidence that some form of real wage proxy may have a role in explaining employment plans. The dropping the real wage variable and using this test implies the wage terms may effect the fit of the employment plans equation.

In contrast, the "Neoclassical" equation presented in Table 3.6 which omits demand-side variables is not successful in explaining the data. The first two columns of the table show an equation using the expected unit cost variable directly from the survey. This has been interpreted as representing nominal unit costs of labour, materials and capital. Neither dummy enters significantly into the equation, based on the t-ratios. The middle two columns use the product wage variable discussed above, but leave out the expected demand variable. Here the increase category of the product wage enters with a strongly significant negative effect but the decrease proxy is insignificant. The last two columns separate the unit cost and unit price variables that make up the product wage variable. This equation shows some interesting but inconclusive results. The increase dummy of the unit cost variable is now significant and negative. Thus firms which expect unit cost to rise will plan to shed labour, as theory would predict. The decrease dummy for unit price indicates that firms expecting price to fall will also shed labour. Both are consistent with profit maximisation. However the problem is that neither of the dummies that should indicate when firms will hire labour turns out to be significant. Firms may, however, be increasing profit margins by avoiding hirings when costs fall or prices rise.

Based on a number of models of employment plans, the British data appear to confirm the conclusions reached by other authors using German and Finnish data and support the "Keynesian" view of the primacy of expected demand conditions in employment planning.

3.7 Employment Outturns

In this section, a model of actual employment behaviour as opposed to employment plans, is presented. The simplest case relates employment outturns to the contemporaneous outturns of demand and real wages. This is the conventional model estimated in early quantitative time-series data studies (see Hazledine, 1981 or Briscoe and Peel, 1975). Whilst starting with a model of "desired" employment, these early studies replace the dependent variable with employment outturns by substituting out the unobservable desired employment variable. *Ex post* employment is explained by *ex post* data on the relevant exogenous variables. The equivalent of equation (9) in this context would therefore be

$$N_t = \beta_1 + \beta_2 N_{t-1} + \beta_3 D_t - \beta_4 w_t \qquad (10)$$

Even the earliest exponents of labour functions such as Brechling (1965) emphasised the role that expectations play. In the absence of direct observations of expectations, lags of demand and cost outturns were used to proxy expectations. The presence of contemporaneous output as an explanatory variable may cause severe simultaneity problems, posing even worse problems when dealing with realised changes in employment and output than with employment plans and expected output. The model therefore benefits greatly if new orders can proxy demand.

Again, we cannot include infinite lags of the exogenous variables but results(not shown in a separate table) from our panel of firms indicate that, using survey responses rather than time-series data, only the contemporaneous demand variable exerts any influence on changes in employment over the past four months. The first lag enters with a positive and significant coefficient for the increase category but the decrease category while negative as predicted by theory, does not have a significant coefficient. Subsequent lags are insignificant for both dummies. The lagged employment outturn N_{t-1} again indicates a positive lagged response of employment. The real wage proxy is not successful whether it enters as either contemporaneous or lagged variables.

Hence survey data ***do not*** support a model of employment where expectations of demand and costs are proxied by lags. A firm's employment outturn over the last four months is explained by the changes in demand over those same four months. Unless the latter is also the best guess of future demand, employment outturns seem not to depend on expectations proxied by lagged variables.

Now consider a variant of model (10) where employment ***outturns*** are explained by ***past expectations*** of demand and costs for our panel of firms. In other words, the data set allows us to ask, do lags of reported expectations help us to understand realised employment behaviour at any time t? The appropriate variant of (10) is then

$$N_t = \beta_1 + \beta_2 N_{t-1} + \beta_3 \sum_{i=1}^{\infty} D^*_{t-i} - \beta_4 \sum_{i=1}^{\infty} w^*_{t-i} \qquad (11)$$

Results for this model appear in Table 3.7. Using the employment outturn from the January 1984 survey to maximise the available “lags”, we found only the expected new orders variable fits the role of expected demand conditions. Business optimism and output were also tested, entering with appropriate signs but in each case the decrease dummy is not significant. Both new orders dummies are correctly signed and significant. Lags of employment outturns continue to play the expected role. The Neoclassical assumptions about expectations of real wages are, again, not supported. Therefore, unlike the results just discussed using lagged outturns to proxy for expectations, these results reaffirm the importance of expectations in explaining not only employment plans (Section 3.6 above) but employment outturns as well.

3.8 Unfulfilled Plans and Unanticipated Shocks

Using employment plans as the dependent variable and relating the anticipated changes in the labour force to expectations of demand and cost conditions demonstrates the ex ante importance of expectations in hiring decisions. Similarly, expectations of new orders formulated in period t-1 for period t can explain the employment outturn at time t, offering further (though more limited) evidence of the importance of demand expectations. By contrast, only contemporaneous demand is positively related to employment outturns. Thus, the practice of proxying expectations by lags of exogenous variables is not supported in a model using survey responses at the firm level. This calls into question the conventional modelling of employment behaviour using time-series data as if lagged values adequately proxy expectations.

As a result, we consider an alternative use of the employment outturns data. In this section, we explain the failure of firms to fulfill their plans. Aggregate quantitative data on employment will comprise firms which did and did not fulfill their hiring intentions. The CBI survey data allow us look at these "categories" of firms separately and to relate the success or failure of employment planning to unanticipated changes in the exogenous variables.

Just as with the construction of a real wage proxy, the data on "shocks" requires manipulation of qualitative data, which implies severe simplifications and (possibly) loss of information. Define a forecast error as occurring when the expectation for t recorded at t-1 falls in a different category than the subsequent realisation recorded at time t. Hence Figure 2.2 below represents the collapsing of information from two variables in two consecutive surveys into a new variable. $U\Delta D^{*}_{t}$ is the forecast error the firm makes in demand conditions. If expected change exceeds the realised change, in ordinal terms, then $U\Delta D^{*}_{t}$ is defined as positive (an over-estimate) and vice versa. When both expectations and outturn fall in the same category, the forecast is defined as fulfilled. The same procedure is applied to generate real wage shocks. Clearly the usable sample of data is reduced in that only firms that respond in consecutive surveys can be used to generate these shocks.

The models outlined in sections 3.4 and 3.6 above do not translate simply into an unanticipated shocks model. The hypotheses being tested cannot easily be modelled as an optimisation problem that generated the earlier models. Yet the hypotheses are interesting and further our understanding of the role of expectations in economics. Specifically, we would believe that if a firm correctly forecasts the exogenous variables, it should be more likely to fulfill its plans than not. However, if the firm experiences an unanticipated shock (forecasts prove incorrect) it is more likely not to fulfill its original plan. Hence the data allows us to test whether firms that "exceed" their hiring plans (the outturn is greater in ordinal terms than the expectation) experienced positive (negative) unanticipated demand (cost) shocks. The simple form of the model is then,

$$(\Delta N^{*}_{t-1} - \Delta N_{t}) = \beta_{1}(\Delta D^{*}_{t-1} - \Delta D_{t}) - \beta_{2}(\Delta w^{*}_{t-1} - \Delta w_{t}). \qquad (4.15)$$

or

$$U\Delta N^{*}_{t} = \beta_{1}U\Delta D^{*}_{t} - \beta_{2}U\Delta w^{*}_{t} \qquad (4.15a)$$

$U\Delta D^{*}_{t}$ and $U\Delta w^{*}_{t}$ will again be represented by pairs of dummies. The demand shock dummies should have a priori positive and negative signs, and the cost shock dummies should reverse this sign pattern.

Results for this "surprise" model are presented in Table 3.8 below, where the demand proxies are unexpected shocks to new orders and output. The first two columns tabulate the new orders case and the last two columns, the output case. The "optimism" question does not lend itself to modelling shocks as there is no question about whether a firm's optimism (or lack of) was subsequently justified. Pooled across all firms over all five pairs of surveys, the results are once again poor with respect to the real wage proxy. The coefficients fail to display the expected signs, nor are they significant. However, the demand dummies indicate that firms are more likely to over-fulfill their employment intentions if demand (either new orders or output) is unexpectedly higher than anticipated, and to hire fewer than planned if demand forecasts prove overly optimistic.

3.9 Conclusions

We now summarise the results and consider their implications for further work on expectations and survey data in economic models of employment decisions.

1. The role of expectations when represented by direct data available from surveys is strongly confirmed. Therefore economic theory is correct to emphasise expectations in economic behaviour but existing theories of expectations formation, which use lags to proxy expectations, may be inadequate.

2. An ***ex ante*** labour demand model strongly supports the view that expected demand conditions will positively influence firms' employment plans, and there is a positive lagged response in employment changes. Unfortunately, our estimates of the effect of lagged employment changes cannot be interpreted as the speed of adjustment. Costs of adjustment theory suggests a coefficient less than one, with most studies indicating implausibly long periods of adjustment. We cannot add to this debate.

   Neither can the coefficient estimates resolve the controversy over increasing returns to labour or to scale. We cannot disentangle the reduced-form coefficients to derive estimates of the structural parameters of the production function.

3. The data available in the CBI surveys are not ideal for testing the Neoclassical view that labour demand will fall (rise) if real wages are expected to rise (fall). Subject to this, we conclude that the models do not indicate an expected negative effect of real wage rises on employment plans.

4. The results are consistent across all the size and industry classifications, and across each quarter for which survey data can be obtained. Models for UK firms are consistent with studies using German and Finnish data.

5. Further effort is required to gather better survey data. Better wage data in particular would help resolve some of the uncertainties left by this and other studies. More access to disaggregated survey data could confirm the stability of results over time and across countries. An advantage of quantifying survey data (as in Carlson and Parkin, 1975), instead of using firm by firm responses, might be to combine information from different surveys on wages, employment, etc.

Footnotes:

1. The discussion that follows draws heavily on Hazeldine (1981).

2. Heckman's (1979) work indicates a possible sample selection bias of omitting some cases. Konig and Zimmermann (1986) deal with omitting firms planning to increase their employment by first estimating a probit selection function. Our probit models do not account for any possible selectivity bias of omitting firms who respond 'not applicable'.

3. The contents of the CBI surveys are described in more detail by Klein and Moore (1981) and McWilliams (1983).

4. The West German studies mentioned use a labour cost variable but this could be nominal rather than real costs. The Finnish study uses changes in profitability to proxy labour cost shocks.

TABLE 3.1

Univariate Ordered Probit Models for Employment Plans

Panel of firms answering all six surveys: No. of Cases = 551: Demand Proxy: New Orders

	ΔN^*_{t+1} (+)	ΔN^*_{t+1} (-)
ΔN_t	0.08	-0.35
	(11.2)	(6.6)
ΔD^*_{t+1}	0.19	-0.33
	(2.9)	(5.3)
ΔD^*_{t+2}	0.02	-0.03
	(0.4)	(0.4)
ΔD^*_{t+3}	-0.04	-0.15
	(0.9)	(1.7)
ΔD^*_{t+4}	0.18	0.08
	(3.2)	(1.0)
ΔD^*_{t+5}	0.12	0.03
	(2.1)	(0.4)
ΔD^*_{t+6}	0.01	0.14
	(0.3)	(1.6)
ΔW^*_{t+1}	-0.07	-0.34
	(1.3)	(0.2)
ΔW^*_{t+2}	0.02	-0.13
	(0.3)	(1.7)
ΔW^*_{t+3}	-0.03	0.002
	(0.5)	(0.02)
ΔW^*_{t+4}	0.04	0.07
	(0.7)	(0.9)
ΔW^*_{t+5}	0.06	-0.02
	(1.0)	(0.2)
ΔW^*_{t+6}	-0.01	-0.11
	(0.2)	(1.4)
Constant	0.8	
	(1.0)	
Value of the Likelihood	-352.8	
Percentage of Correct Predictions(ii)	71.6	
McFadden's R	0.88	

Notes to Table:

(i) The terms in brackets are the absolute values of the ratio of each coefficient to its asymptotic standard error.
(ii) All the measures of goodness of fit are defined in Amemiya (1981, pp.1504-5).

TABLE 3.2

Univariate Ordered Probit Models for Employment Plans

Pooled over all six surveys: No. of Cases = 9637: Dependent variable: ΔN^*_{t+1}

Demand Proxy:	New Orders		Output		Optimism	
Exog. Variable:	(+)	(-)	(+)	(-)	(+)	(-)
ΔN_t	0.24	-0.34	0.22	-0.34	0.22	-0.33
	(15.8)	(25.5)	(14.2)	(25.6)	(14.1)	(24.6)
ΔD^*_{t+i}	0.30	-0.32	0.32	-0.40	0.26	-0.32
	(23.1)	(18.3)	(24.5)	(22.0)	(19.2)	(18.6)
Δw^*_{t+i}	-0.06	-0.03	-0.06	-0.03	-0.06	-0.01
	(4.4)	(1.6)	(-4.4)	(1.6)	(3.9)	(0.8)
Constant	0.19		0.19		0.25	
	(8.9)		(8.7)		(11.0)	
Sector 1[(ii)]	-0.09*		-0.06*		-0.08*	
2	-0.03		-0.005		-0.001	
3	-0.05*		-0.02		-0.05*	
4	-0.02		0.01		0.006	
5	0.05*		0.07*		0.07*	
6	0.03		0.01		0.02	
7	0.01		0.02		0.01	
8	0.07*		0.08*		0.06*	
Size Class: 1-199	0.24*		0.23*		0.23*	
200-499	0.15*		0.15*		0.14*	
Time: (Jan. 1984)	0.11*		0.12*		0.06*	
(Oct. 1983)	0.06*		0.06*		0.03*	
(July 1983)	0.12*		0.13*		0.07*	
(Apr. 1983)	0.11*		0.11*		0.04*	
(Jan. 1983)	0.04*		0.05*		0.02	
Value of the Likelihood	-7110.2		-7013.4		-7242.7	
Percentage of Correct Predictions[(iii)]	68.5		69.0		65.7	
McFadden's R^2	0.91		0.912		0.909	

Notes to Table:

(i) The terms in brackets are the absolute values of the ratio of each coefficient to its asymptotic standard error.

(ii) The sectors are: (1) Food, Drink and Tobacco; (2) Chemicals, Coal and Petroleum; (3) Metal manufacture; (4) Mechanical engineering; (5) Electrical engineering; (6) Shipbuilding, Marine and Vehicles; (7) Metal Goods; (8) Textiles, Clothing, Footwear and Leather; and (9) Other Manufacturing. An asterisk denotes significant at the 5% level, t-ratios greater than 1.7.

(iii) All the measures of goodness of fit are defined in Amemiya (1981, pp.1504-5).

TABLE 3.3

Univariate Ordered Probit Models for Employment Plans: Size by Numbers Employed

Pooled over all six surveys: Demand Proxy: Expected New Orders

	(1-199 Employees)		(500+ Employees)	
	ΔN^{*}_{t+1}		ΔN^{*}_{t+1}	
Exog. Variable:	(+)	(-)	(+)	(-)
ΔN_t	0.23	-0.2	0.34	-0.52
	(12.1)	(10.9)	(8.8)	(19.9)
ΔD^{*}_{t+i}	0.32	-0.36	0.21	-0.29
	(18.7)	(16.2)	(7.9)	(22.0)
ΔW_{t+i}	-0.7	0.1	-0.05	-0.07
	(3.7)	(0.5)	(1.9)	(2.1)
Constant	0.41		0.30	
	(15.3)		(7.0)	
Sector 1(ii)	0.0003		-0.12*	
2	0.005		-0.03	
3	0.002		-0.09	
4	0.001		-0.01	
5	0.07*		0.06	
6	0.06		0.01	
7	0.02		0.03	
8	0.04		0.17*	
Time: (Jan. 1984)	0.11*		0.08*	
(Oct. 1983)	0.06*		0.06*	
(July 1983)	0.1*		0.15*	
(Apr. 1983)	0.11*		0.12*	
(Jan. 1983)	0.05*		0.01	
No. of Cases	4830		2225	
Value of the Likelihood	-3342.5		-1886.1	
Percentage of Correct Predictions (%)(iii)	72.7		67.3	
McFadden's R^2	0.909		0.894	

Notes to Table:
(i) The terms in brackets are the absolute values of the ratio of each coefficient to its asymptotic standard error.
(ii) The sectors are: (1) Food, Drink and Tobacco; (2) Chemicals, Coal and Petroleum; (3) Metal manufacture; (4) Mechanical engineering; (5) Electrical engineering; (6) Shipbuilding, Marine and Vehicles; (7) Metal Goods; (8) Textiles, Clothing, Footwear and Leather; and (9) Other Manufacturing. An asterisk denotes significant at the 5% level, t-ratios greater than 1.7.
(iii) All the measures of goodness of fit are defined in Amemiya (1981, pp.1504-5).

TABLE 3.4

Univariate Ordered Probit Models for Employment Plans: Food, Drink and Tobacco Firms (Sector 1)

Pooled over all six surveys: No. of firms = 463: Dependent variable = ΔN^*_{t+1}

Demand Proxy:	New Orders		Output		Optimism	
	(+)	(-)	(+)	(-)	(+)	(-)
ΔN_t	0.16	-0.49	0.19	-0.49	0.19	-0.49
	(1.8)	(8.2)	(2.1)	(8.1)	(2.0)	(8.1)
ΔD_{t+1}(i)	0.19	-0.10	0.09	-0.12	0.06	-0.10
	(3.1)	(1.3)	(1.3)	(1.6)	(0.9)	(1.3)
ΔW_{t+1}	0.02	0.04	0.04	0.06	0.04	0.07
	(0.3)	(0.1)	(0.6)	(1.6)	(0.6)	(0.8)
Constant	0.25		0.27		0.29	
	(3.4)		(3.6)		(3.7)	
Size Class: 1-199	0.28*		0.28*		0.28*	
200-499	0.18*		0.18*		0.18*	
Time: (Jan. 1984)	0.01		0.02		-0.01	
(Oct. 1983)	-0.08		-0.09		-0.09	
(July 1983)	0.03		0.03		0.02	
(Apr. 1983)	-0.05		-0.04		-0.04	
(Jan. 1983)	-0.21*		0.17*		-0.20*	
Value of the Likelihood	-313.2		317.6		-318.8	
Correct Predictions (%)(iii)	73.9		75.8		74.7	
McFadden's R^2	0.87		0.87		0.869	

Notes to Table:
(i) The terms in brackets are the absolute values of the ratio of each coefficient to its asymptotic standard error.
(iii) All the measures of goodness of fit are defined in Amemiya (1981, pp.1504-5)

TABLE 3.5

Univariate Ordered Probit: Keynesian Model

Pooled over all six surveys: No. of Cases = 9637: Dependent variable: ΔN^*_{t+i}

Demand Proxy:	New Orders		Output		Optimism	
Exog. Variable:	(+)	(-)	(+)	(-)	(+)	(-)
ΔN_t	0.24	-0.34	0.22	-0.34	0.22	-0.33
	(15.8)	(25.7)	(14.2)	(25.6)	(14.1)	(24.6)
ΔD^*_{t+i}	0.30	-0.32	0.32	-0.40	.26	-0.32
	(23.2)	(18.8)	(24.5)	(22.0)	(19.2)	(18.6)
Constant	0.19		0.19		0.25	
	(8.9)		(8.7)		(11.0)	
Sector 1	-0.09		-0.06*		-0.08	
2	-0.03		-0.005		-0.001	
3	-0.05		-0.02		-0.05	
4	-0.02		0.01		0.006	
5	0.05		0.07		0.07	
6	0.03		0.01		0.02	
7	0.01		0.02		0.01	
8	0.07		0.08		0.06	
Size Class: 1-199	0.24		0.23		0.23	
200-499	0.15		0.15		0.14	
Time: (Jan. 1984)	0.11		0.12		0.06	
(Oct. 1983)	0.06		0.06		0.03	
(July 1983)	0.12		0.13		0.07	
(Apr. 1983)	0.11		0.11		0.04	
(Jan. 1983)	0.04		0.05		0.02	
Value of the Likelihood	-7120.2		-7024.6		-7250.2	
Percentage of Correct Predictions	68.5		69.0		65.7	
McFadden's R^2	0.91		0.91		0.91	

Notes to Table:
(i) The terms in brackets are the absolute values of the ratio of each coefficient to its asymptotic standard error.
(ii) The sectors are: (1) Food, Drink and Tobacco; (2) Chemicals, Coal and Petroleum; (3) Metal manufacture; (4) Mechanical engineering; (5) Electrical engineering; (6) Shipbuilding, Marine and Vehicles; (7) Metal Goods; (8) Textiles, Clothing, Footwear and Leather; and (9) Other Manufacturing. An asterisk denotes significant at the 5% level, t-ratios greater than 1.7.
(iii) All the measures of goodness of fit are defined in Amemiya (1981, pp.1504-5).

TABLE 3.6

Univariate Ordered Probit: Neoclassical Model

Pooled over all six surveys: No. of Cases = 9637: Dependent variable: ΔN^*_{t+i}

Cost Proxy:	Unit Cost		Product Wage		Unit Cost and Unit Price	
	(+)	(-)	(+)	(-)	(+)	(-)
ΔN_t	0.28	-0.35	.28	-.35	0.27	-0.35
	(16.9)	(25.3)	(17.0)	(25.2)	(16.8)	(25.2)
ΔC^*_{t+i}	-0.01	-0.05	-0.1	.02	0.03	-0.005
	(0.7)	(1.8)	(6.6)	(1.3)	(2.5)	(0.2)
ΔP^*_{t+i}	---	---	---	---	0.06	-0.27
					(0.4)	(0.1)
Constant	0.18		0.20		0.20	
	(7.7)		(8.5)		(8.4)	
Sector 1	-0.11		-0.11*		-0.12	
2	0.006		-0.001		-0.004	
3	-0.07		-0.07		-0.06	
4	-0.02		-0.02		-0.01	
5	0.07		0.06		0.07	
6	-0.009		-0.01		0.01	
7	0.007		0.04		0.002	
8	0.07		0.07		0.06	
Size Class: 1-199	0.23		0.23		0.23	
200-499	0.14		0.14		0.14	
Time: (Jan. 1984)	0.20		0.20		0.18	
(Oct. 1983)	0.12		0.12		0.11	
(July 1983)	0.21		0.21		0.20	
(Apr. 1983)	0.21		0.21		0.19	
(Jan. 1983)	0.08		0.08		0.07	
Value of the Likelihood	-7687.6		-7663.8		-7250.2	
Percentage of Correct Predictions(iii)	66.1		66.0		65.7	
McFadden's R^2	0.90		0.90		0.90	

Notes to Table:
(i) The terms in brackets are the absolute values of the ratio of each coefficient to its asymptotic standard error.
(ii) The sectors are: (1) Food, Drink and Tobacco; (2) Chemicals, Coal and Petroleum; (3) Metal manufacture; (4) Mechanical engineering; (5) Electrical engineering; (6) Shipbuilding, Marine and Vehicles; (7) Metal Goods; (8) Textiles, Clothing, Footwear and Leather; and (9) Other Manufacturing. An asterisk denotes significant at the 5% level.
(iii) All the measures of goodness of fit are defined in Amemiya (1981, pp.1504-5).

TABLE 3.7

Univariate Ordered Probit Models for Employment Outturns

Panel of firms answering all six surveys: No. of Cases = 542: Demand Proxy: New Orders

	ΔN_{t+6} (+)	(-)
ΔN_{t+5}(i)	0.34	-0.35
	(4.8)	(6.6)
ΔD^*_{t+6}	0.17	-0.33
	(2.9)	(2.6)
ΔD^*_{t+5}	0.14	-0.06
	(2.2)	(0.8)
ΔD^*_{t+4}	0.06	0.03
	(1.0)	(0.4)
ΔD^*_{t+3}	0.05	-0.03
	(0.8)	(0.4)
ΔD^*_{t+2}	-0.02	-0.1
	(0.2)	(0.02)
ΔD^*_{t+1}	0.02	-0.03
	(1.2)	(0.5)
ΔW^*_{t+6}	-0.04	-0.05
	(0.7)	(0.6)
ΔW^*_{t+5}	-0.06	-0.15
	(0.9)	(1.8)
ΔW^*_{t+4}	0.06	-0.05
	(0.9)	(0.6)
ΔW^*_{t+3}	0.01	-0.03
	(0.2)	(0.3)
ΔW^*_{t+2}	0.06	0.05
	(1.1)	(0.5)
ΔW^*_{t+1}	0.005	-0.09
	(0. 1)	(1.0)
Constant	0.39	
	(4.0)	
Value of the Likelihood	-4014	
Percentage of Correct Predictions(ii)	68.5	
McFadden's R^2	0.86	

Notes to Table:

(i) The terms in brackets are the absolute values of the ratio of each coefficient to its asymptotic standard error.
(ii) All the measures of goodness of fit are defined in Amemiya (1981, pp.1504-5).

TABLE 3.8

Univariate Ordered Probit Models of Unfilled Employment Plans

Pooled over all six surveys: No. of Cases = 5821: Dependent Variable: $U\Delta N^*_t$

Demand Proxy:	New Orders		Output	
	(+)	(-)	(+)	(-)
$U\Delta D^*_t$	0.22 (11.4)	-0.17 (8.6)	0.24 (11.9)	-0.22 (11.1)
$U\Delta w^*_t$	0.006 (0.3)	0.03 (1.7)	0.005 (0.3)	0.02 (1.0)
Constant	0.41 (15.3)		0.30 (7.0)	
Sector 1	0.0003		-0.12*	
2	0.005		-0.03	
3	0.002		-0.09	
4	0.001		-0.01	
5	0.07		0.06	
6	0.06		0.01	
7	0.02		0.03	
8	0.04		0.17	
Time: (Jan. 1984)	0.11		0.08	
(Oct. 1983)	0.06		0.06	
(July 1983)	0.1		0.15	
(Apr. 1983)	0.11		0.12	
(Jan. 1983)	0.05		0.01	
Value of the Likelihood	-3342.5		-1886.1	
Percentage of Correct Predictions	72.7		67.3	
McFadden's R^2	0.91		0.89	

Notes to Table:
(i) The terms in brackets are the absolute values of the ratio of each coefficient to its asymptotic standard error.
(ii) The sectors are: (1) Food, Drink and Tobacco; (2) Chemicals, Coal and Petroleum; (3) Metal manufacture; (4) Mechanical engineering; (5) Electrical engineering; (6) Shipbuilding, Marine and Vehicles; (7) Metal Goods; (8) Textiles, Clothing, Footwear and Leather; and (9) Other Manufacturing. An asterisk denotes significant at the 5% level, t-ratios greater than 1.7.
(iii) All the measures of goodness of fit are defined in Amemiya (1981, pp.1504-5).

Chapter 4

'That's a great deal to make one word mean,' Alice said in a thoughtful tone.
'When I make a word do a lot of extra work like that,' said Humpty Dumpty, 'I always pay it extra.'

(Lewis Carroll: Alice Through the Looking Glass)

Price and Output Decisions in a Production Smoothing Model[1]

4.1 Introduction

The previous chapter on modelling labour demand has helped to confirm the role attributed to expectations in economic theory; firms anticipate future trends and these are reflected in their plans and current actions in the labour market. In this chapter, we study the determinants of firms' price and output decisions within a model of production smoothing. In particular, we are interested in:

- the extent to which firms use quantity versus price changes in response to expected demand and cost shocks;
- the role played by inventories in the adjustment process, and;
- how firms revise their plans in light of unanticipated shocks.

The model used assumes monopolistic competition so that firms determine prices, permitting a production smoothing role for inventories. Production smoothing models have been discussed and tested in a number of recent papers, such as Blinder (1982, 1986), Eichenbaum (1984), West (1986), and Miron and Zeldes (1988). The role of inventories in the adjustment of prices and output has also been discussed by Maccini (1977, 1978). In general, the production smoothing role of inventories has not been confirmed by the data. However, these studies all used industry level or economy-wide aggregate level data. Our results are based on individual firm level data and therefore offer new evidence on the role of inventories in the adjustment of prices and output.

The research discussed in this chapter builds on and extends a related strand of literature which uses qualitative data to analyse firms' decisions. This includes Koenig et al (1981a, 1981b), Nerlove (1983), Koenig and Nerlove (1985), Kawasaki et al (1982,1983), and Voung (1982), who use French and/or German data. In this group of studies, the basic method used to test the role of inventories as a determinant of output and prices has been to assess the significance of the correlation between planned changes in output or prices and the firm's evaluation of the adequacy of the existing level of inventories, a piece of information usually contained in business surveys but unavailable if one uses aggregate time-series data. The adequacy of existing inventories is taken to be related to the shadow value of inventories. Although we will discuss this method of testing the influence of inventories, and will review the evidence provided by U.K. data, we rely on a different approach. As explained in Section 4.3 below, we derive reduced form decision rules for output and prices. These involve not an inventory appraisal variable, but the past level of inventories. This results in a more direct test of the importance of inventories in pricing and output decisions.

Moreover, the CBI survey are richer than the other business surveys in that it contains data on costs. Maccini (1978) notes "the impact of cost-push factors on prices where 'normal' unit labor costs and some measure of raw materials prices have consistently played an important role in explaining movements in prices." The information on costs, although imperfect for testing employment plans (see Chapter 3), allow us to test more general models than corresponding survey based studies and to address the relative importance of cost and demand conditions as determinants of production decisions as well. We also discuss evidence relating to asymmetries in pricing and to nominal price rigidities.

The empirical results suggest that expected costs and demand conditions are important determinants of pricing and production plans. The existing level of inventories of finished goods, however, appears to have little effect on either decision. Firms appear to react more often with quantity adjustments, as opposed to price adjustments, when faced with demand shocks. Conversely, price adjustments prevail when firms are faced with changes in costs. Finally, the data confirm, as one would expect, that errors in forecasting exogenous variables are important in explaining the discrepancy between planned output/prices and their actual values, as we found with employment earlier in this thesis.

Two distinct methods of estimation are employed here:

- bivariate and univariate ordered probit models for prices and output, and
- conditional log-linear models applied to the cell probabilities in the contingency table formed by the set of explanatory variables.

Ordered probit models (as used to estimate single equation labour demand models in Chapter 3) have the potential to account for the qualitative nature of the data available. However, in order to maintain computational tractability, we do not fully utilize the ordinal nature of the explanatory variables, as well as of the dependent variables. Log-linear models abstract altogether from the ordinal nature of the survey responses and have been the standard econometric method applied to business surveys. We use both methods of estimation since it is important to check the robustness of our empirical results and to compare our conclusions with those reached in other studies. The latter tells us only about the correlations between variables.

The chapter is organised in the following way. Section 4.2 contains a brief description of the data set used, largely to describe variables not used in Chapter 3. In Section 4.3 the theoretical model is described. It is assumed here that an imperfectly competitive firm faces stochastic shocks to its demand and cost functions and can use inventories as a buffer between production and sales. Sections 4.4 and 4.5 contain a summary of our empirical results concerning price and output plans based respectively upon the ordered probit model and the conditional log-linear model. In Section 4.6 we also discuss the relationship between plans and subsequent realisations. Section 4.7 concludes the paper.

4.2 The Data

We are now interested in information from the C.B.I. surveys regarding prices and inventories, in addition to variables discussed in Chapter 3. Given our assumption of an imperfectly competitive firm, both output and price expectations are taken to represent the plans formulated by firms for the next four months. We again interpret the question

> "Are you more or less optimistic than you were four months ago about the general business situation in your industry?"

as conveying information about the expected change in demand for the firm's product. This is confirmed by the fact that there is a high correlation over time between the rate of growth in manufacturing output and the aggregate balance statistic (the difference in the frequency of "increase" and "decrease" answers; see Chapter 2) for the "optimism" question In production smoothing models using aggregate time-series data, demand conditions have been proxied by a variety of variables, including capacity utilization, unfilled order-shipment ratios, inventory-sales ratios, etc. (Maccini, 1978, p. 135).

The questionnaire also includes expectations (seasonally adjusted) about unit costs, which refer to both labour and materials costs (McWilliams, 1983, p.17).[2] The correlation coefficient, for the period 1966-1983, between the balances for the realised unit cost question and the rate of growth in unit costs (drawn from CSO data) for manufacturing is approximately 0.5. The correlation coefficient of the survey's cost variable with the rate of growth in nominal labour costs remains fairly high (0.4). The correlation with the rate of growth in real labour costs (the product wage used previously in Chapter 3) is much lower.

Finally the survey contains information that allows us to assess both whether firms judge the level of inventories to be more or less than adequate and whether the backlog of orders is above or below normal.

4.3 A Simple Model of Pricing and Production Decisions

In this section we analyse a simple theoretical model to answer two questions:

- What is the role of expectations about demand and cost in pricing and production decisions?
- How do firms' past choices, embodied in the initial level of inventories, affect today's plans?

We derive a pair of equations for prices and output that can be estimated using the CBI business survey data. The theoretical model is based on Blinder (1982, 1986) and describes the behaviour of an imperfectly competitive firm that can hold inventories of its finished goods. Similar models have also been discussed by Koenig and Nerlove (1985) and McTaggart (1985).

The firm is assumed to face quadratic inventory holding costs. Technology is characterised by decreasing returns to scale and production costs are quadratic in output. The demand function is assumed to be linear. Both the demand and the cost functions contain a stochastic element. Negative levels of inventories, representing unfilled orders, are allowed in the model.

Denote by P, Q and I respectively the firm's price, output and inventories and let V be the average price level. Sales (X_t), production costs (PC_t), and inventory holding costs (HC_t), can be written as:

$$X_t = a_0 + a_1 D_t - a_2 (P_t/V_t) \qquad (1)$$

$$PC_t = [b_0 + b_1 Q_t C_t + (b_2/2) Q^2{}_t] V_t \quad (2)$$

$$HC_t = [c_0 I_t + (c_1/2) I^2{}_t] V_t \quad (3)$$

All the coefficients are positive, with the exception of c_0. A sufficiently negative c_0 guarantees the existence of a positive steady state level of inventories in the certainty version of the model. The average price of the firm's competitors, V, is assumed for simplicity to be known at the beginning of the period. D_t is a random shock that affects the position of the demand function, while C_t is a real random shock to production costs.

The firm maximises the expectation of the present value of cash flow:

$$E_t \sum_{s=t}^{\infty} \mu^s [((X_s P_s)/V_s) - (PC_s/V_s) - (HC_s/V_s)] \quad (4)$$

subject to (1), (2), (3) and to the inventory accumulation equation:

$$I_s = I_{s-1} + Q_s - X_s \quad (5)$$

In (4), μ is the real discount factor, assumed for simplicity to be fixed, and X is sales. In (5), I_s represents end of period inventories. After some rearranging, the first order conditions are:

$$-(a_0/a_2) - (a_1/a_2) E_t D_s + a_2 E_t (P_s/V_s) = b_1 E_t C_s + b_2 E_t Q_s \quad (6)$$

$$c_0 + c_1 E_t I_s + b_1 E_t C_s + b_2 E_t Q_s = \mu(b_1 E_t C_{s+1} + b_2 E_t Q_{s+1}) \quad (7)$$

In (6), marginal revenue is equated to marginal production cost, while (7) implies that marginal production cost today plus inventory holding costs must equal the discounted value of marginal production costs tomorrow. It is easy to show that using (1), (5) and (7) one can obtain a second order difference equation in inventories that yields the following decision rule for inventories in the t^{th} period:

$$E_tI_t = \lambda_1 I_{t-1} - (b_1\lambda_1/b_2)E_tC_t + (b_1/b_2)(1-\lambda_1)\sum_{s=t+1}^{\infty}(1/\lambda_2)^{(s-t)}E_tC_s$$

$$- (a_1\lambda_1/2)E_tD_t + (a_1/2)(1-\lambda_1)\sum_{s=t+1}^{\infty}(1/\lambda_2)^{(s-t)}E_tD_s \qquad (8)$$

where $0 < \lambda_1 < 1$ and $\lambda_2 > 1$. It equals E_tI_t if the demand shock is known at the beginning of the period. From (8) the expected level of inventories is positively associated with its own past level, with future expected demand, and with costs shocks. It is negatively associated with demand and cost shocks expected for the incoming period. Using equations (1), (5), (6) and (8) one can derive the following output and pricing rules:

$$Q_t = -(2/\delta)(1 - \lambda_1)I_{t-1} - (b_1/\delta)[a_2 + (2\lambda_1/b_2)]E_tC_t$$

$$+ (2b_1/\delta b_2)(1-\lambda_1)\sum_{s=t+1}^{\infty}(1/\lambda_2)^{(s-t)}E_tC_s$$

$$+ (a_1/\delta)(1-\lambda_1)E_tD_t + (a_1/\delta)(1-\lambda_1)\sum_{s=t+1}^{\infty}(1/\lambda_2)^{(s-t)}E_tD_s \qquad (9)$$

$$P/V_t = -(b_2/\delta)I_{t-1} + (b_1/\delta)(1-\lambda_1)E_tC_t + (b_1/\delta)(1-\lambda_1)\sum_{s=t+1}^{\infty}(1/\lambda_2)^{(s-t)}E_tC_s$$

$$+ (a_1/2)((b_2/\delta)(1-\lambda_1)+(1/a_2))E_tD_t$$

$$+ (b_2a_1/2\delta)(1-\lambda_1)\sum_{s=t+1}^{\infty}(1/\lambda_2)^{(s-t)}E_tD_s \qquad (10)$$

where $\delta = 2 + a_2b_2$.

According to (9) and (10) firms will react to a positive demand shock or to a decrease in the initial level of inventories by increasing prices and output. Higher expected present or future cost shocks increase prices. Higher expected costs for this period reduce output, but an increase in future costs induce firms to expand their production today. An increase in cost now that is expected to be permanent causes, on balance, a decrease in the optimal level of output.

In order to obtain equations that lend themselves to empirical estimation a few additional assumptions are necessary. Equations (9) and (10) suggest that pricing and production decisions depend upon the entire future path of the exogenous variables. As in Chapter 3, we assume that costs and demand can be described by a simple first order autoregressive process. The expectations for the next four months are assumed to summarise all the relevant information necessary to forecast the entire future of the variables.

Let $\Delta Q^*_{t+1} = E_tQ_{t+1} - Q_t$. The same notation is used for expected changes in relative prices, end of period inventories, demand, and cost conditions; this follows the notation employed in chapter 3. Assume also that both the contemporaneous demand and cost shocks for each period are known at the time expectations are formed. After leading eqs. (9) and (10), taking first differences, and using the assumption about expectations, we can write the following two equations for output and prices:

$$\Delta Q^*_{t+1} = -\alpha_{11}\Delta I_t + \alpha_{12}\Delta D^*_{t+1} - \alpha_{13}\Delta C^*_{t+1} \qquad (11)$$

$$\Delta (P/Q)^*_{t+1} = -\alpha_{21}\Delta I_t + \alpha_{22}\Delta D^*_{t+1} - \alpha_{23}\Delta C^*_{t+1} \qquad (12)$$

where all the α's are positive. The coefficients for lagged inventories, expected demand, and expected cost are functions of the structural parameters of the model. The latter two also depend upon parameters in the autoregressive process generating expectations. In both equations

$$\Delta I_t = I_t - I_{t-1}$$

is an exogenous variable expressed (using (8) and our assumption about expectations) as a function of past changes of inventories, ΔI_{t-1}, and of past actual changes in the demand and cost shocks, ΔD_t and ΔC_t. Substituting for ΔI_t in (11) and (12) one can derive:

$$\Delta Q^*_{t+1} = -\beta_{11}\Delta I_{t-1} + \beta_{12}\Delta D^*_{t+1} - \beta_{13}\Delta C^*_{t+1} + \beta_{14}\Delta D_t - \beta_{15}\Delta C_t \qquad (13)$$

$$\Delta(P/Q)^*_{t+1} = -\beta_{21}\Delta I_{t-1} + \beta_{22}\Delta D^*_{t+1} + \beta_{23}\Delta C^*_{t+1} + \beta_{24}\Delta D_t - \beta_{25}\Delta C_t \quad (14)$$

All the β's are positive. Equations (13) and (14) are very convenient to estimate because expected changes in output and prices are written only as a function of predetermined variables and expectations and realizations of exogenous variables. Therefore, this representation avoids the problem of endogeneity of ΔI_t encountered in the equations (11) and (12).

Since the data do not contain any information concerning the average price level, a final approximation is needed. For instance, if one takes a linear approximation of the relative price term in equation (14), then the expected average price appears as an additional determinant of the firm's own price. Changes in the firm's own price will depend therefore not only upon changes in inventories, demand, and cost, but also upon changes in the average price level. We will assume here that the actual and the expected value of the latter variable is the same for firms in the same industry and of the same size, but may vary across industries and size classes.

4.4 Bivariate Ordered Probit Models

In this section we describe the estimation of the output and price equations presented in (13) and (14), on the basis of ordered probit models. Estimation of (11) and (12), in which ΔI_t has not been substituted out, yields very similar qualitative conclusions, and, therefore, the results are not reported here.

A bivariate ordered probit model for prices and output is a useful tool for analysing business survey data. Firstly it recognises the ordered nature of the answers, at least concerning the dependent variables. Secondly the model assumes a non-zero contemporaneous correlation between the error term in the price and output equations, allowing for a common set of unobservable factors that affect both variables. Computational considerations on the other hand make it extremely difficult to account for the ordered nature of the independent variables or to estimate an n-dimensional multivariate normal distribution defined over all the ordered variables. All the trichotomous independent variables are represented in this paper by pairs of dummy variables, one for the "increase" category and the other for the "decrease" category. The "no change" case is captured by the general constant. This choice does not allow us to recover estimates of the reduced form coefficients in our output and price equations.

Assume that stochastic error terms $u^{Q}{}_{i,t}$ and $u^{P}{}_{i,t}$ are added to the output and price equations, respectively, to capture optimization errors and/or the effect of a set of explanatory variables not explicitly included in the analysis. Assume as well that there exist two positive constants, c_q and c_p, such that firm i plans to decrease, maintain unchanged, or increase its output (price) over the next four months if:

$$\Delta Q^{*}{}_{i,\, t+1} < -c_Q, \qquad (15)$$

$$-c_Q \leq \Delta Q^{*}{}_{i,\, t+1} \leq c_Q, \text{ or} \qquad (16)$$

$$\Delta Q^{*}{}_{i,\, t+1} \geq c_Q \qquad (17)$$

respectively. The distribution of u^Q and u^P at each point in time is taken to be jointly normal, with mean equal to zero, variances equal to unity, and a correlation coefficient equal to ρ. Under these conditions, the parameters of the model can be easily estimated by maximum likelihood for each of the six sample surveys available from the CBI.

As a proxy for the expected change in the position of the demand curve, $\Delta D^{*}{}_{t+1}$, we again have a choice between expected new orders and the change in the degree of optimism about the business situation in the industry. Either variable serves adequately to proxy expected demand, as was confirmed in Chapter 3. To proxy expected demand, we have chosen "business optimism", assuming that it is a more exogenous variable than new orders. However, realised changes in new orders are employed as the empirical equivalent of past changes in demand, ΔD_t, since there is no equivalent 'realised' business optimism.

Expected and realised changes in unit cost are used as proxies for the real cost shocks, ΔC^*_{t+1} and ΔC_t. This last choice is dictated by data availability.[3] In each equation we also include, in addition to a constant term, a set of industry and size dummies. They reflect, among other factors, differences in the (unobservable) average price level faced by firms according to industry and size.

Since the qualitative results are quite similar across surveys, Table 4.1 presents an example from the January 1984 survey.[4] As a guide to interpreting the results, look at the first column (where ΔQ^*_{t+1} is the endogenous variable) in the row corresponding to ΔD^*_{t+1}. The positive coefficient (0.65) in the (+) column indicates that being more optimistic about general business conditions increases the probability of producing more over the next four months. Similarly, the second coefficient (-0.98)in the (-) column says that being less optimistic increases the probability of producing less. We also report the estimate for the correlation coefficient, ρ, which suggests that there is a significant but small correlation between the disturbances in the output and price equations.

The sign pattern in Table 4.1 is generally consistent with the predictions of the theory as far as the demand variables are concerned. An increase in actual or expected demand makes it more likely that an increase is observed in output. Demand changes from the last quarter do not affect prices whereas demand changes expected next quarter do; the effect is negative. In the time-series work discussed by Maccini (1978), demand conditions were an important determinant in pricing decisions, however, he notes (p. 142) that the results are not "stable" in that different proxies of demand perform differently across equations estimated for various industrial sectors. Therefore, our results are not necessarily out of keeping with existing work; one coefficient is marginally insignificant and the other is significant.

The performance of the cost variables is also mixed. Cost shocks have a powerful effect on output decisions. If costs are expected to decrease, there is a positive effect on output and this effect is statistically significant. Unfortunately, firms expecting costs to increase seem also to plan to raise production. Firms expecting higher unit costs would not necessarily wish to increase production unless this is demand driven, pushing the firm further up its supply curve as the demand curve shifts. It also assumes the firm can pass on the higher costs through higher prices, consistent with our price equation results. If the firm expects a positive cost shock, the probability increases that the firm will plan to increase prices, and vice versa, although the effect of a fall in prices is not statistically significant. The realised cost variable does not fit with theory in the output equation giving lower production plans when last period costs fell, and we get only one significant coefficient. These results may be due to the fact that the cost variable used for estimation is a rather imperfect substitute for the theoretical variable.

Changes in the past level of inventories do not play an important role in determining production, while in the price equation the results are ambiguous. Neither inventory proxy is significant for output, implying firms are not following on from plans such that expecting higher inventories does not lead to a decrease in planned output two quarters hence, or vice versa. A decrease in the level of inventories is significant (though marginally), implying firms are not following on from plans such that expecting higher inventories does not lead to a decrease in planned output two quarters hence, or vice versa. A decrease in the level of inventories is significant (though marginally), implying firms plan higher prices when inventory levels fall. Conversely, an increase in stock levels does not increase the probability of observing lower prices in future. On the basis of the χ^2 test, one cannot reject the hypothesis that the coefficients on prices and inventories are jointly significant. Therefore, the evidence that inventories plays a role in pricing decisions is weak.

The same pattern of interactions between variables is observed from a bivariate probit model applied to our panel of 551 firms answering all six surveys (Table 4.2). These results are also repeated for each quarterly survey (results have not been presented for each survey) and on the pooled sample (see Table 4.3). This is comforting evidence of the robustness of the conclusions drawn above. All firms answering any one of the surveys and those who answered all six surveys respond strongly to expected demand conditions in setting their output plans and to expected cost conditions in setting their pricing strategies.[5] This robustness was also observed in our model of labour demand in Chapter 3.

Finally, the results for inventories do not sit comfortably with our theoretical model. For instance, if there are constant returns to scale in production ($b_2 = 0$ in (2)), then equation (6) implies that prices do not depend upon the past level of inventories. However, using (1), (5), (6) and (7), it is easy to show that output is determined by the past level of inventories. Our results suggest instead that past inventories are not a significant determinant of output. Nor can the results be rationalized by constant marginal inventory holding costs ($c_1 = 0$ in (3)). In this case, equations (1), (5), (6) and (7) can be shown to imply that output does not depend upon demand or the past level of inventories, but only upon present and future cost shocks. Using (6), prices are then seen to depend only upon present and future cost shocks and the contemporaneous demand shock. The importance of demand as a determinant of output in our results rejects this version of the model.

A possible explanation for the lack of empirical success of the model based on the production smoothing role of inventories could be that some firms in our sample produce mainly to order (e.g. ship-building) and not to stock. In this case, the relevant explanatory variable is the level of unfilled orders. Unfortunately, the CBI survey does not contain information about the change in the backlog of orders. In order to explore this possibility, we have re-estimated the ΔP^*_{t+1} and ΔQ^*_{t+1} models for each industry in order to isolate firms producing to stock rather than to order. This exercise did not, however, improve the explanatory power of the past level of inventories. In all cases, on the basis of the $\chi^2(2)$ test of joint significance of the coefficients, one cannot reject (at the 5% significance level) the hypothesis that past inventories do not matter.

These results, though disappointing given the theoretical model, are consistent with those obtained using aggregate quantitative data. Maccini (1977, 1978) used industry level data from U.S. manufacturing and concluded that the stock of inventories are not an important determinant of output and price decisions. Miron and Zeldes (1988) found that inventories (in addition to input prices and interest rates) are not statistically significant in their model explaining the growth rate of output. Moreover, in their study, the over-identifying restrictions, implied by the production smoothing model cum rational expectations, are rejected by the data.

Two other interesting cases merit further discussion. In Table 4.4, we consider the model applied to the Food, Drinks and Tobacco industry. Two points should be noted. First, expected cost conditions no longer have as clear an impact on pricing decisions. The coefficient for expected cost increases remains positive and significant, that is, if firms expect unit costs to rise, they are more likely to plan price increases. The reverse is no longer the case however, perhaps an indication of downward rigidities in pricing. Second, expected "demand" conditions are no longer significant determinants of future output. However, lagged demand conditions are significant predictors of future output; if demand rose last quarter, these firms plan to raise production (and vice versa) while at the same time the inventory proxy is significantly different from zero (though incorrectly signed when past inventories fell (column 2 under the "-" sign). So, though we have some weak indication that long-run demand conditions may play a role in planning, the Food, Drink and Tobacco firms are no more likely than other sectors to plan according to the production smoothing model.

Table 4.5 presents results for firms employing over 500 employees. The notable feature of "large" firms is again the possibility of downward price rigidities. These firms are not likely to plan price decreases in the face of unexpected fall in unit costs. While we assumed that all firms operate in imperfectly competitive markets, size may, of course, be a good indicator of market power over prices.

4.5 Log-Linear Probability Models and a Comparison with Previous Studies using Business Survey Data on Inventories

Most of the analysis of business surveys based on firm level data have been based on log-linear probability models. In order to facilitate a comparison with the existing literature, we apply log-linear probability models to the CBI data.[6] This also allows us to check the robustness of our conclusions with respect to the method of estimation.

A basic difference between ordered probit models and log-linear probability models is that the latter do not take into account the ordinal nature of the data. The joint probability of observing each qualitative variable falling into a given category is specified is such a way to obtain an analytically convenient form for both the joint and conditional probabilities (see Nerlove and Press, 1976). The joint normality assumption used in the ordered probit model yields instead a convenient form for the marginal probabilities (see Amemiya, 1981). As in the case of the ordered probit model, estimation of log-linear probability models does not allow us to recover the parameters of the price and output equations. However, one can test for the strength and significance of the association between variables.

In log-linear probability models, the logarithm of each probability is represented in a form similar to the analysis of variance combining a grand mean, main effects and interaction effects of different order. To illustrate this model, suppose there are three random variables X, Y and Z, which take three values i, j, and k. Then a log-linear probability representation would have the form:

$$\log \Pr(X=i, Y=j, Z=k) = m + \lambda^{X}(i) + \lambda^{Y}(j) + \lambda^{Z}(k) + \lambda^{XY}(i,j) + \lambda^{XZ}(i,k) + \lambda^{YZ}(j,k) + \lambda^{XYZ}(i,j,k) \quad (18)$$

where i, j, k all take on the values 1, 2, and 3. In our empirical application we will assume that the trivariate interaction term, λ^{XYZ}, is zero. The bivariate term $\lambda^{XY}(i,j)$ is a measure of the increase in the probability of observing X in the i^{th} category given that Y belongs to the j^{th} category. This interpretation applies to all the bivariate interaction terms. The specification of the model is completed by imposing the usual analysis of variance restrictions that the λ's for the main effects (e.g. λ^{X}) sum to zero across all the indices, as do the sum of the bivariate and trivariate interactions. As mentioned above, the log-linear probability model is very useful if one is interested in the conditional probabilities because these have a log-linear form (see Nerlove and Press, 1976). For instance, the conditional probability statement $\log \Pr(X=i \mid Y=j, Z=k)$ is obtained by setting $\lambda^{Y}(j)$, $\lambda^{Z}(k)$, and $\lambda^{YZ}(j,k)$ equal to zero in equation (18).

A conditional log-linear probability model has been estimated for each survey date, the pooled sample, and the panel of firms, obtaining similar results. Corresponding models estimated by univariate ordered probit confirm the results and attest to their robustness (but are not reported in detail here). Because of the presence of sampling zeroes and of the sheer size of the contingency table for this model, we were not able to include all the conditioning variables appearing in equations (13) and (14). We present in Table 4.6 the result obtained when ΔC_t is excluded; the results from this variable proved highly problematic with respect to the theoretical model in the last section. For each set of bivariate interaction terms we report the χ^2 test of the hypothesis that the λ's are jointly zero, together with the associated upper tail probability. The χ^2 test has four degrees of freedom because, given the analysis of variance restrictions, there are four free parameters to be estimated that represent the bivariate interaction between each pair of variables. As discussed above, the χ^2 statistic provides a test of conditional independence between two variables, given the values of the other variables. The value of the Goodman-Kruskal γ for the component probabilities is also presented as a summary measure of the direction and strength of correlation between pairs of variables. Like an ordinary correlation coefficient, γ varies between plus one and minus one.

Component probabilities for pairs of variables represent ceteris paribus probabilities in the sense that the effect of interactions with other variables is removed (see Kawasaki and Zimmermann (1983) for details). For instance, the interaction between output and demand (all else constant) can be represented in a 3x3 matrix of component probabilities. Each element denotes the ceteris paribus probability that output will increase, stay the same, or decrease when demand rises, stays constant, or falls. The absolute value of the ratio of the γ's to their asymptotic standard errors appear in brackets.

The χ^2 test suggests that the most important and significant bivariate effects are, in order, between prices and costs, output and expected (or actual) demand, prices and expected demand, and output and costs. The sign pattern for the γ 's is the one suggested by economic theory. The fact that ΔP^*_{t+1} and ΔQ^*_{t+1} are not conditionally independent suggests that treating these two variables as jointly dependent, through a bivariate probit model as above, was the correct choice. Considering the interaction between expected cost and output, we can reject the hypothesis of no association on the basis of the χ^2 test. The γ coefficient has the expected negative sign (though the asymptotic t-statistic is only 1.58). Changes in the past levels of inventories are not significant determinants of price and production plans, supporting our ordered probit results.

An interesting feature of the results reported in Table 4.6 is the fact that the γ coefficient for the association between output and demand is greater than the one for the association between prices and demand. The opposite is true for the γ relative to changes in cost. This suggests that anticipated demand shocks cause more frequent variations in output plans than in price plans. Cost shocks induce, instead, more frequent variations in future prices. In Kawasaki et al (1982), it is argued that firms react to disequilibrium (measured by firms' appraisals of the adequacy of inventories or order backlog) with quantity adjustment rather than with price adjustment. Our results imply that the type of adjustment that prevails depends upon the nature of the perceived shock.

Moreover, the component probability (not reported in Table 4.6) for a planned decrease in prices following a fall in expected demand (0.22) exceeds the component probability for an increase in prices when demand increases (0.15). This implies that, all else equal, firms are somewhat more likely to plan price decreases, if they expect an adverse demand shock, than they are to increase prices following a favourable demand shock. We obtained the same result in our ordered probit models; the increase dummy $\Delta D^*_{t+1}(+)$, in Table 4.1 is a stronger influence in the model than the decrease dummy, $\Delta D^*_{t+1}(-)$, which is only marginally significant. It appears that firms are willing to cut prices if they perceive poor sales opportunities, but they are reluctant to try to improve profitability by raising prices when demand increases. This result was also observed by Kawasaki et al. (1983) for German firms.

Our ordered probit models hint at downward price inflexibility, but this is not reinforced by the log-linear probability model results. In fact, the component probability for price (again not separately reported in the table) increases when demand increases as well (0.13) never exceeds the component probability for price decreases when demand falls (0.36). It is possible that the lack of a significant effect for the cost decrease variable in the ordered probit model in Table 4.1 is explained by the fact that very few firms report price decreases (see Chapter 2) so that the coefficient for the decrease dummy is difficult to accurately estimate.

In spite of some differences, on the whole the results obtained from the conditional log-linear models are similar to those obtained using the bivariate ordered probit model. Because of the lack of appropriate data, none of the studies mentioned above has analysed the importance of expected costs. We now consider how our results on the role of inventories compare with those obtained by other researchers. In Kawasaki et al. (1982), prices and output are explained only in terms of expected demand. The inventory (or backlog) appraisal variable is used by Koenig and Nerlove (1985) and Kawasaki et al (1982) as a conditioning variable together with expected demand, and can be thought of capturing (changes in) the shadow value of inventories, Ω_t. The appraisal variables are then explained by Koenig and Nerlove in terms of past levels of stocks and unfilled orders, and by expected demand. Estimation of the model involves a two step recursive structure, analysing the effect of past levels of inventories on firms' output and price decisions.

Moreover the first step of the process can be interpreted as an attempt to estimate directly the first order conditions of the maximisation problem. On the optimal path, the shadow value of inventories, Ω_t, must equal future discounted marginal cost savings net of marginal inventory carrying cost;

$$\mu(b_1 E_t C_1 + b_2 E_t Q_{t+1}) - c(E_t I_t - I^*) \qquad (19)$$

in our notation. Replacing this last expression in (6) with the shadow value of inventories, Ω_t, (6) and (7) can be solved for Q_t and P_t as a function of Ω_t, C_t and D_t. It is easy to see that prices depend only upon Ω_t and D_t, while output depends upon Ω_t and C_t. Our approach is different in the sense that we have directly estimated the reduced form expressions for prices and output.

The results in Koenig and Nerlove suggest that a firm's appraisal of the adequacy of inventories is in general a significant determinant of price and output plans of German firms. For French firms inventory appraisal affects production but not prices. Past levels of inventories are a significant determinant of inventory appraisal for both countries. In Kawasaki et al (1982) the appraisal of the backlog of orders tends to have a greater effect than inventory appraisal on prices and output.

Since the CBI survey contains a question concerning the adequacy of existing stocks of inventories and another asking if the backlog of orders is above, below or just normal, it is possible to implement the approach outlined above using U.K. data. Denote by $A^I{}_t$ the inventory appraisal variable and by $A^0{}_t$ the order backlog appraisal. Then the (log) probability statement that can be derived from (6) and (7) has the form:

$$\log \Pr(\Delta Q^*{}_{t+1}, \Delta P^*{}_{t+1} \mid I_t, A^0{}_t, A^I{}_t, \Delta D^*{}_t, \Delta C^*{}_t) \qquad (20)$$

where indices for each category have been omitted for convenience. Results are presented in Tables 4.8 and 4.9. In general, the inventory appraisal variable is significantly related to production but not with price plans. The results from the January 1984 survey show $\chi^2(4) = 8.42$, which is marginally rejected at the 5% level, but $\gamma = -0.27$, t-statistic = 2.3 for output, while $\chi^2(4) = 3.07$, $\gamma = 0.01$, t-statistic = 0.07 for prices. The level of orders backlog relative to normal is also significantly related to production ($\chi^2(4) = 45.6$, $\gamma = 0.45$, t-statistic = 5.0) but again it is not a factor in pricing decisions ($\chi^2(4) = 5.79$, $\gamma = .01$, t-statistic = 0.1). These conclusions are confirmed when the data were pooled across all the surveys available (see Table 4.9).

These results imply a role for inventories (and an even greater one for the backlog of orders) in production plans not observed in our previous results above, and so are encouraging.[7] However they are predicated upon the appraisal question being a good proxy for the change in the shadow value of inventories and this is certainly open to question. Some legitimate doubts are generated for instance by the result that, contrary to what equations (6) and (7) imply, prices and cost on the one hand and output and demand on the other, are not conditionally independent given the appraisal variables.

4.6 Plans, Revisions and Expectation Formation

How do firms revise their plans in the light of new information? Is information used efficiently in forming firms' expectations as implied by the rational expectations hypothesis? These are the two questions we will try to answer in this section.

In general the discrepancy between expectations and realisations for prices and output will depend upon unanticipated cost and demand changes. For the models described in section 3, we can easily show that:

$$Q_{t+1} - E_tQ_{t+1} = \beta_{11}(D_{t+1} - E_tD_{t+1}) - \beta_{12}(C_{t+1} - EtC_{t+1}) \qquad (21)$$

$$\frac{P_t}{V_t} - E_t\left(\frac{P_{t+1}}{V_{t+1}}\right) = \beta_{12}(D_{t+1} - E_tD_{t+1}) - \beta_{22}(C_{t+1} - E_tC_{t+1}) \qquad (22)$$

All of the β's are positive. In the context of our qualitative data, a variable is assumed to have been correctly predicted if the forecast made at time t-1 and the realisation reported at time t fall in the same category. A positive (negative) forecast error occurs when the category for the realisation is smaller (greater) in an ordinal sense than the one for the expectation. The pitfalls in the definition of surprises using categorical data are transparent, as noted in Chapter 3, and should be kept in mind in interpreting the empirical results. Nevertheless, this model leads to some interesting and revealing results.

In Table 4.10 we summarise the percentages of correct predictions, underpredictions and overpredictions of $(\Delta P^*_{t+1}, \Delta Q^*_{t+1}, \Delta D^*_{t+1}, \Delta C^*_{t+1})$ for the five pairs of surveys available to us. As a standard against which the accuracy of forecasts can be evaluated, we report in brackets the percentage of correct predictions that would occur if firms sample at random from the actual distribution for realisations. The data suggest that firms are correct more often than they would be if they followed the sampling scheme just outlined. Moreover, in terms of percentage of correct predictions, price forecasts are the most accurate, followed by forecasts about cost, output and demand. However, there is a tendency to overestimate both price and cost changes for all survey dates. For changes in output and demand, there is no systematic tendency for the percentage of overpredictions to exceed (fall short of) the percentage of underpredictions (overpredictions). In the case of random sampling from the correct distribution of realisations, there would obviously be no bias and the percentage of underpredictions and overpredictions would be equal to each other.

In most business surveys available for other countries the tendency is to underestimate both price and output changes (see Koenig et al, 1981b). Without further analysis it is nevertheless impossible to say if this reflects a difference in the way expectations are formed or simply changing economic circumstances. For instance, a tendency to overpredict price changes in a situation of rising inflation is consistent with a tendency to underestimate price changes when inflation is slowing down, if expectations are formed adaptively. A systematic comparison of results on expectations across different business surveys goes beyond the scope of this paper and would require access to data for different countries from the same time period. In what follows we will concentrate on a more formal analysis of the role anticipation errors play in pricing and output decisions of UK firms, much as we did in Chapter 3 for employment plans.

In order to assess the relationship between forecast errors for the endogenous variables and those for the exogenous variables, Tables 4.11 and 4.12 report the results for the conditional log-linear model

$$\log \Pr(U\Delta Q^*_{t+1}, U\Delta P^*_{t+1} \mid U\Delta D^*_{t+1}, U\Delta C^*_{t+1}) \qquad (23)$$

where U is the forecast error operator. Once again, univariate ordered probit models result in similar conclusions, while the log-linear models allow for direct comparison to existing studies which use this methodology. The results refer to variables created by matching a firm's expectation in survey t with its realisation in survey t+1, using all firms that answered consecutive surveys. Similar results hold for the each pair of surveys estimated separately (not reported here). It is clear that the discrepancy between planned and realised output is explained mainly by demand surprises, while the discrepancy between planned and actual prices is due mainly to unanticipated costs shocks. Both the χ^2 test and the asymptotic t ratio for the β coefficients indicate that these two interactions are significant. Cost surprises do not appear to affect unanticipated output changes and demand surprises are not a significant determinant of unanticipated variations in prices. These results for the discrepancies between plans and realisations suggest a greater sensitivity of output to demand and prices to costs, and confirm the conclusion we have already suggested for firms' plans.

In the context of the surprise model it is also possible to explore the issue of rationality of firms' expectations. We would anticipate that if firms use all available information efficiently, no variable known at the time plans were formed should be correlated with the discrepancy between plans and realisations.

We have added to the surprise model presented in Table 4.11, various elements of the information set available in October 1983. such as demand and cost expectations held at that time and past demand and cost realisations.[9] The results show that price and output surprises are often significantly correlated with expectations held at the time plans are formed. There is some evidence of association with past actual values of demand and cost known at the time of plans formation but it is weaker. For instance the χ^2 test statistic (with 4 degrees of freedom) for the interaction between price and output surprises respectively with demand expectations formed the previous period are equal to 163.00 and 76.1.

Expected costs are significantly correlated with price surprises ($\chi^2 = 55.90$) and not with output surprises ($\chi^2 = 6.80$). The χ^2 statistic for the interaction between price surprises and realised new orders from the past period is 35.80. The interaction between output surprises and past actual orders is instead marginally insignificant with a χ^2 of 7.40. Past changes in costs do not significantly affect the forecast errors.

On balance, there is therefore some evidence that expectations about prices and output are not formed rationally. When the test of efficient use of information is applied to expected demand and expected costs, the significance of past changes in demand or costs or of previously held expectations is found for all the adjacent pairs of surveys. For instance, demand surprises (calculated using expected and realised new orders) are significantly related both to realised and expected new orders in the previous period (the χ^2 test equals 27.2 and 16.2 respectively). Cost surprises are not independent of past cost changes with a χ^2 test of 10.3. These results should be interpreted with some caution given the approximations involved in the arithmetic of qualitative data. Clearly this is a topic that deserves further investigation using, for instance, data over longer time periods.

Our results, however, are consistent with the conclusions reached in studies that have used quantitative or qualitative survey data (Gourieroux and Pradel, 1986). However, also recall the evidence from our employment model which indicated that expectations formed in period t-i for period t-i+1 do not affect plans for period t when i is greater than two; firms appear to act on new information each quarter to draw one quarter ahead expectations. Nonetheless, the weight of the empirical evidence on firms' sales and price expectations, summarised and discussed in Lovell (1986), is not supportive of the validity of the rational expectations assumption.

4.7 Conclusions

The results discussed in this chapter reinforce the conclusions reached earlier in this thesis that qualitative survey data on individual firms can provide useful insight into the role of expectations in micro-level decisions (here for prices and output). In general the conclusions derived from the bivariate ordered probit models coincide with those obtained from the log-linear probability model; the latter methodology has been widely adopted for estimating the interactions between expectational data from business surveys. We find that both demand and cost expectations are crucial determinants of firms' decisions.

Specifically, the data support the proposition that firms tend to react more frequently to changes in demand conditions with output adjustment and, when faced with expected variations in costs, to react with price adjustment. The empirical support for the importance of the existing stock of inventories in pricing and production is much weaker.

While there is some evidence of asymmetric price responses in the ordered probit model, this is not sufficient to suggest generalised downward price sluggishness. The results of the log-linear models do not provide support for downward price stickiness either.

Finally, demand surprises are an important determinant of the discrepancy between output plans and realisations, while cost surprises explain such discrepancy for prices, just as they were useful in explaining the failure to fulfill hiring plans in Chapter 3. The data also suggest further evidence against the hypothesis that expectations are formed rationally since unanticipated changes in prices, output, demand and cost are correlated with some elements of the information set available to firms.

Footnotes:

1. This chapter is based on work conducted jointly with J.P. McIntosh and F. Schiantarelli (then both at University of Essex). A part of this work has appeared in the Review of Economics and Statistics, Nov. 1993, pp. 657-63.

2. See McWilliams (1983) and Price (1983) for additional information on firms' answering practices.

3. The choice of changes in unit cost as a proxy for ΔC^*_{t+1} and ΔC_t is correct if one is willing to assume that fixed cost are not important ($b_0 = 0$) and there is no quadratic term in the cost function ($b_2 = 0$). In this constant returns to scale case one still obtains (13) and (14) as a reduced form (although the analogues of (8), (9) and (10) are now different). Alternatively, one can think of taking a first order expansion of the real cost term and notice that the answers provide a good proxy for the change in nominal costs, while changes in the general price level are subsumed in the industry specific constants.

4. The program PSA written by S Addanki has been used to estimate the bivariate ordered probit models.

5. The importance of demand expectations is confirmed if we use expected orders as a proxy for demand over the next quarter instead of the firm's view about the general business situation in their industry. The significance of the demand variable is independent of industrial classification and all classes of firms seem to be well described by the imperfectly competitive paradigm. We have obtained similar results to those reported above when the equations are estimated for each industrial sector separately. Moreover if we add a proxy for the state of demand expectations (relative to capacity) over the next twelve months, it appears to be a significant determinant of output but not of pricing decisions.

6. For a detailed description of the approach the reader is referred to the contributions, among others, by Birch (1963), Goodman (1970), Bishop et al (1975), Nerlove and Press (1976), Upton (1977), Vuong (1982) and Agresti (1984). The results presented in this section have been obtained using the programme CALM.

7. The lack of strong evidence in our data in favour of the importance of beginning of period inventories is consistent however with the results obtained using aggregate data. In the work by Maccini (1977, 1978), for instance, estimates based on quantitative data for the manufacturing sector and for selected industries do not suggest an important role for inventories.

TABLE 4.1

Bivariate Ordered Probit Models for Price and Output Plans:

January 1984 Survey: No. of Cases = 1450

Explanatory Variables[i]	Endogenous Variables			
	ΔQ^*_{t+1}		ΔP^*_{t+1}	
	(+)	(-)	(+)	(-)
ΔI_{t-1}	0.01 (0.1)	0.04 (0.5)	-.009 (0.09)	.16 (1.9)
ΔD^*_{t+1}	0.65 (9.1)	-0.98 (7.5)	0.14 (1.8)	-0.66 (5.7)
ΔC^*_{t+1}	0.14 (1.9)	0.66 (4.6)	1.18 (15.4)	-0.02 (0.2)
ΔD_t	0.24 (3.2)	-0.20 (2.1)	-0.03 (0.3)	-0.10 (1.0)
ΔC_t	-0.07 (1.0)	-0.32 (2.4)	-0.13 (1.7)	0.12 (0.9)
ρ		0.12 (3.1)		
Value of Likelihood[ii]	-1074.18		-1011.0	
Percentage Correct Predictions[ii]	65.1		70.9	
McFadden R^2 [ii]	0.88		0.89	

Notes to Table:

(i) Dummies for sector, size and time period were estimated in the model but are not reported here. The terms in brackets are the absolute values of the ratio of each coefficient to its asymptotic standard error.

(ii) All the measures of goodness of fit refer to the univariate probit models obtained when $\rho=0$ and are defined in Amemiya (1981, pp.1504-5).

TABLE 4.2

Bivariate Ordered Probit Models for Price and Output Plans:

Panel of firms answering all six surveys: No. of Cases = 551

Explanatory Variables(i)	Endogenous Variables ΔQ^*_{t+1} (+)	ΔQ^*_{t+1} (-)	ΔP^*_{t+1} (+)	ΔP^*_{t+1} (-)
ΔI_{t-1}	0.02 (0.3)	0.01 (0.2)	-0.09 (1.2)	0.10 (0.2)
ΔD^*_{t+1}	0.32 (7.0)	-0.56 (6.1)	0.18 (2.6)	-0.44 (4.9)
ΔC^*_{t+1}	0.04 (0.6)	0.23 (2.2)	0.66 (12.4)	-0.02 (0.3)
ΔD_t	0.12 (2.4)	-0.03 (0.5)	-0.02 (0.3)	-0.09 (1.1)
ΔC_t	-0.02 (0.7)	-0.07 (0.8)	-0.1 (2.1)	0.08 (1.1)
ρ		0.09 (3.0)		
Value of Likelihood(ii)	-574.3		-511.2	
Percentage Correct Predictions(ii)	67.1		73.6	
McFadden R^2 (ii)	0.88		0.90	

Notes to Table:

(i) Dummies for sector, size and time period were estimated in the model but are not reported here. The terms in brackets are the absolute values of the ratio of each coefficient to its asymptotic standard error.

(ii) All the measures of goodness of fit refer to the univariate probit models obtained when $\rho=0$ and are defined in Amemiya (1981, pp.1504-5).

TABLE 4.3

Univariate Ordered Probit Models for Price and Output Plans:

Pooled over all six surveys: No. of Cases = 8570

Explanatory Variables[i]	Endogenous Variables ΔQ^*_{t+1} (+)	ΔQ^*_{t+1} (-)	ΔP^*_{t+1} (+)	ΔP^*_{t+1} (-)
ΔI_{t-1}	-0.002	-0.02	0.02	-0.02
	(0.1)	(1.3)	(1.1)	(2.1)
ΔD^*_{t+1}	0.33	-0.40	0.10	-0.20
	(22.2)	(20.7)	(6.5)	(10.9)
ΔC^*_{t+1}	0.01	0.12	0.41	-0.08
	(1.1)	(4.6)	(31.8)	(-3.0)
ΔD_t	0.11	-0.11	0.02	-0.04
	(7.7)	(7.3)	(1.1)	(2.5)
ΔC_t	0.01	-0.04	-0.03	-0.01
	(0.9)	(1.5)	(2.2)	(0.6)
Value of Likelihood[ii]	-6493.8		-6195.5	
Percentage Correct Predictions[ii]	64.7		69.5	
McFadden's R^2 [ii]	0.91		0.91	

Notes to Table:

(i) Dummies for sector, size and time period were estimated in the model but are not reported here. The terms in brackets are the absolute values of the ratio of each coefficient to its asymptotic standard error.

(ii) All the measures of goodness of fit refer to the univariate probit models obtained when ρ=0 and are defined in Amemiya (1981, pp.1504-5).

TABLE 4.4

Univariate Ordered Probit Models for Price and Output Plans: Food, Drinks and Tobacco Industry

January 1983 Survey: No. of Cases = 80

Explanatory Variables[i]	Endogenous Variables ΔQ^*_{t+1} (+)	ΔQ^*_{t+1} (-)	ΔP^*_{t+1} (+)	ΔP^*_{t+1} (-)
ΔI_{t-1}	-0.37	-0.34	-0.44	-0.03
	(2.1)	(2.1)	(2.2)	(0.2)
ΔD^*_{t+1}	0.15	0.20	0.21	-0.08
	(1.1)	(0.8)	(1.3)	(0.3)
ΔC^*_{t+1}	-0.19	-0.1	0.53	0.43
	(1.5)	(0.3)	(3.7)	(1.0)
ΔD_t	0.3	-0.5	0.14	-0.15
	(2.3)	(2.0)	(0.9)	(0.6)
ΔC_t	0.07	-0.04	0.13	-0.22
	(0.5)	(0.2)	(0.9)	(0.9)
Value of Likelihood[ii]	-493.5		-476.7	
Percentage Correct Predictions[ii]	78.7		73.7	
McFadden's R^2 [ii]	0.91		0.83	

Notes to Table:

(i) Dummies for firm size (by employment) were estimated in the model; neither proved significant. The terms in brackets are the absolute values of the ratio of each coefficient to its asymptotic standard error.

(ii) All the measures of goodness of fit are defined in Amemiya (1981, pp.1504-5).

TABLE 4.5

Univariate Ordered Probit Models for Price and Output Plans: Firms employing 500 or more

January 1983 Survey: No. of Cases = 395

Explanatory Variables[i]	Endogenous Variables ΔQ^*_{t+1} (+)	ΔQ^*_{t+1} (-)	ΔP^*_{t+1} (+)	ΔP^*_{t+1} (-)
ΔI_{t-1}	-0.1	-0.02	-0.16	0.03
	(1.3)	(0.2)	(1.8)	(0.4)
ΔD^*_{t+1}	0.2	-0.4	0.18	-0.2
	(3.6)	(3.3)	(2.6)	(1.5)
ΔC^*_{t+1}	-0.08	0.5	0.49	0.003
	(1.4)	(3.3)	(7.2)	(0.02)
ΔD_t	0.08	-0.1	-0.03	-0.04
	(1.4)	(1.7)	(0.5)	(0.3)
ΔC_t	0.1	-0.4	0.003	-0.05
	(1.9)	(3.5)	(0.04)	(0.4)
Value of Likelihood[ii]	-3544.8		-3443.11	
Percentage Correct Predictions[ii]	70.0		66.6	
McFadden's R^2 [ii]	0.87		0.85	

Notes to Table:
(i) Dummies for industrial sectors were estimated in the model; dummies for sectors 1 and 6 were significant (at a 5% level of confidence in the Q equation and sector 5 was significant in the P equation. The terms in brackets are the absolute values of the ratio of each coefficient to its asymptotic standard error.
(ii) All the measures of goodness of fit are defined in Amemiya (1981, pp.1504-5).

TABLE 4.6

Conditional Log-Linear Probability Model for Output and Prices

January 1984 Survey: No. of cases = 1450

Model: $Pr(\Delta Q^*_{t+1}, \Delta P^*_{t+1} \mid \Delta D^*_{t+1}, \Delta I_{t-1}, \Delta C^*_{t+1}, \Delta D_t)$

Bivariate Interactions	γ (i)	χ^{2}(ii)	Upper Tail Probability
$(\Delta Q^*_{t+1}, \Delta P^*_{t+1})$	0.19 (1.6)	13.6	0.009
$(\Delta Q^*_{t+1}, \Delta D^*_{t+1})$	0.77 (14.8)	121.0	0.0
$(\Delta Q^*_{t+1}, \Delta I_{t-1})$	.002 (2.9)	1.94	0.747
$(\Delta Q^*_{t+1}, \Delta C^*_{t+1})$	-0.19 (1.6)	18.5	0.01
$(\Delta Q^*_{t+1}, \Delta D_t)$	0.28 (3.9)	32.6	0.00001
$(\Delta P^*_{t+1}, \Delta D^*_{t+1})$	0.51 (5.1)	19.8	0.0006
$(\Delta P^*_{t+1}, \Delta I_{t-1})$	-0.07 (0.8)	7.31	0.121
$(\Delta P^*_{t+1}, \Delta C^*_{t+1})$	0.6 (8.3)	333.0	0.0
$(\Delta P^*_{t+1}, \Delta D_t)$	0.1 (1.1)	4.6	0.331

Notes to Table:
(i) Absolute value of the ratio of each coefficient to its asymptotic standard error in brackets.
(ii) All χ^2 tests have 4 degrees of freedom (critical $\chi^2(4) = 9.49$ at 5% level of significance).

TABLE 4.7

Conditional Log-Linear Probability Model for Output and Prices

Pooled over all six surveys: No. of cases = 8571

Model: $Pr(\Delta Q^*_{t+1}, \Delta P^*_{t+1} \mid \Delta D^*_{t+1}, \Delta I_{t-1}, \Delta C^*_{t+1}, \Delta D_t)$

Bivariate Interactions	γ (i)	χ^2(ii)	Upper Tail Probability
$(\Delta Q^*_{t+1}, \Delta P^*_{t+1})$	0.23 (0.04)	44.4	0.0
$(\Delta Q^*_{t+1}, \Delta D^*_{t+1})$	0.78 (0.02)	930	0.0
$(\Delta Q^*_{t+1}, \Delta I_{t-1})$	0.29 (0.03)	22.1	0.002
$(\Delta Q^*_{t+1}, \Delta C^*_{t+1})$	-0.12 (0.04)	107	0.0
$(\Delta Q^*_{t+1}, \Delta D_t)$	0.32 (0.03)	242	0.0
$(\Delta P^*_{t+1}, \Delta D^*_{t+1})$	.44 (.04)	130	0.0
$(\Delta P^*_{t+1}, \Delta I_{t-1})$	-0.05 (0.04)	12	0.02
$(\Delta P^*_{t+1}, \Delta C^*_{t+1})$	0.61 (0.03)	1620	0.0
$(\Delta P^*_{t+1}, \Delta D_t)$	0.13 (0.04)	13.1	0.01

Notes to Table:

(i) Absolute value of asymptotic standard error in brackets.
(ii) All χ^2 tests have 4 degrees of freedom (critical $\chi^2(4)$ = 9.49 at 5% level of significance).

TABLE 4.8

Conditional Log-Linear Model for Output and Prices With Inventory and Order Backlog Appraisal Variables

January 1984 Survey: No. of cases = 1436

Model: $Pr(\Delta Q^*_{t+1}, \Delta P^*_{t+1} \mid A^O_{t+1}, A^I_{t+1}, \Delta D^*_{t+1}, \Delta C^*_{t+1})$

Bivariate Interactions	γ (i)	χ^2(ii)	Upper Tail Probability
$(\Delta Q^*_{t+1}, \Delta P^*_{t+1})$	0.16 (0.12)	11.1	0.03
$(\Delta Q^*_{t+1}, A^O_{t+1})$	0.45 (0.08)	45.6	0.0
$(\Delta Q^*_{t+1}, A^I_{t+1})$	-0.27 (0.12)	8.42	0.08
$(\Delta Q^*_{t+1}, \Delta D^*_{t+1})$	0.76 (0.05)	142	0.0
$(\Delta Q^*_{t+1}, \Delta C^*_{t+1})$	-0.14 (0.12)	21.1	0.003
$(\Delta P^*_{t+1}, A^O_{t+1})$	0.01 (0.11)	5.79	0.22
$(\Delta P^*_{t+1}, A^I_{t+1})$	0.01 (0.13)	3.07	0.55
$(\Delta P^*_{t+1}, \Delta D^*_{t+1})$	0.51 (0.09)	22.7	0.002
$(\Delta P^*_{t+1}, \Delta C^*_{t+1})$	0.59 (0.08)	330	0.0

Notes to Table:
(i) Absolute value of the [illegible] asymptotic standard error in brackets.
(ii) All χ^2 tests have 4 degrees of freedom (critical $\chi^2(4) = 9.49$ at 5% level of significance).

TABLE 4.9

Conditional Log-Linear Model for Output and Prices with Inventory and Order Backlog Appraisal Variables

Pooled over all six surveys: No. of cases = 8512

Model: $Pr(\Delta Q^*_{t+1}, \Delta P^*_{t+1} \mid A^O_{t+1}, A^I_{t+1}, \Delta D^*_{t+1}, \Delta C^*_{t+1})$

Bivariate Interactions	γ (i)	χ^2(ii)	Upper Tail Probability
$(\Delta Q^*_{t+1}, \Delta P^*_{t+1})$	0.22 (0.04)	35.6	0.0
$(\Delta Q^*_{t+1}, A^O_{t+1})$	0.44 (0.04)	238	0.0
$(\Delta Q^*_{t+1}, \Delta A^I_{t+1})$	-0.26 (0.05)	52.3	0.0
$(\Delta Q^*_{t+1}, \Delta D^*_{t+1})$	0.78 (0.02)	1010	0.0
$(\Delta Q^*_{t+1}, \Delta C^*_{t+1})$	-0.12 (0.04)	116	0.0
$(\Delta P^*_{t+1}, A^O_{t+1})$	0.03 (0.05)	13.2	0.01
$(\Delta P^*_{t+1}, A^I_{t+1})$	-0.05 (0.05)	6.33	0.18
$(\Delta P^*_{t+1}, \Delta D^*_{t+1})$	0.46 (0.04)	143	0.0
$(\Delta P^*_{t+1}, \Delta C^*_{t+1})$	0.6 (0.03)	1610	0.0

Notes to Table:
(i) Absolute value of the [illegible] asymptotic standard error in brackets.
(ii) All χ^2 tests have 4 degrees of freedom (critical $\chi^2(4) = 9.49$ at 5% level of significance).

TABLE 4.10

Frequencies of Correct Forecasts and Forecast Errors (Percentages)

Period	Correct Predictions(i)	Underestimates	Overestimates
Oct 83-Jan 84			
ΔP^*_{t+1}	62.4 (52.2)	13.7	23.9
ΔQ^*_{t+1}	57.8 (41.9)	24.2	18.0
ΔD^*_{t+1}	49.7 (37.0)	29.4	20.9
July-Oct 83			
ΔP^*_{t+1}	67.0 (53.1)	13.2	19.8
ΔQ^*_{t+1}	55.6 (41.4)	19.9	24.5
ΔD^*_{t+1}	49.5 (36.0)	21.4	29.1
ΔC^*_{t+1}	61.6 (48.7)	17.7	20.7
Apr-July 83			
ΔP^*_{t+1}	67.1 (53.3)	10.3	22.6
ΔQ^*_{t+1}	57.4 (42.5)	18.1	24.5
ΔD^*_{t+1}	50.1 (35.4)	22.0	27.9
ΔC^*_{t+1}	60.7 (46.4)	14.6	24.7
Jan-Apr 83			
ΔP^*_{t+1}	65.1 (49.6)	13.1	21.8
ΔQ^*_{t+1}	57.9 (41.9)	24.0	18.1
ΔD^*_{t+1}	46.0 (35.5)	29.7	24.3
ΔC^*_{t+1}	59.4 (45.7)	16.4	24.2
Oct 82-Jan 83			
ΔP^*_{t+1}	67.9 (57.4)	9.8	22.3
ΔQ^*_{t+1}	57.2 (40.4)	21.1	21.7
ΔD^*_{t+1}	62.4 (48.9)	14.4	22.0

Notes to Table:
(i) The numbers in brackets represent the percentage of correct predictions that would occur if firms sample at random from the actual distribution.

TABLE 4.11

Conditional Log-Linear Models for Price and Output Surprises

Model: $Pr(U\Delta Q^*_{t+1}, U\Delta P^*_{t+1} \mid U\Delta D^*_{t+1}, U\Delta C^*_{t+1})$

October 1983 - January 1984 Surveys: No. of cases = 968

Bivariate Interactions	γ (i)	χ^2(ii)	Upper Tail Probability
$(U\Delta Q^*_{t+1}, U\Delta P^*_{t+1})$	0.45 (7.26)	58.80	0.0
$(U\Delta Q^*_{t+1}, U\Delta D^*_{t+1})$	0.53 (9.60)	65.90	0.0
$(U\Delta Q^*_{t+1}, U\Delta C^*_{t+1})$	0.05 (0.72)	8.17	0.09
$(U\Delta P^*_{t+1}, U\Delta D^*_{t+1})$	0.09 (1.16)	4.59	0.33
$(U\Delta P^*_{t+1}, U\Delta C^*_{t+1})$	0.63 (12.4)	200.0	0.0

Notes to Table:
(i) Absolute value of the ratio of each coefficient to its asymptotic standard error in brackets.
(ii) All χ^2 statistics have 4 degrees of freedom (critical $\chi^2(4)$ = 9.49 at 5% level of significance).

TABLE 4.12

Conditional Log-Linear Models for Price and Output Surprises

Model: $Pr(U\Delta Q^*_{t+1}, U\Delta P^*_{t+1} \mid U\Delta D^*_{t+1}, U\Delta C^*_{t+1},)$

Pooled over All 5 Pairs of Surveys: No. of cases = 4842

Bivariate Interactions	γ (i)	χ^2(ii)	Upper Tail Probability
$(U\Delta Q^*_{t+1}, U\Delta P^*_{t+1})$	0.24 (0.02)	215	0.0
$(U\Delta Q^*_{t+1}, U\Delta D^*_{t+1})$	0.69 (0.01)	2740	0.0
$(U\Delta Q^*_{t+1}, U\Delta C^*_{t+1})$	0.16 (0.02)	75.9	0.0
$(U\Delta P^*_{t+1}, U\Delta D^*_{t+1})$	0.14 (0.02)	64.1	0.0
$(U\Delta P^*_{t+1}, U\Delta C^*_{t+1})$	0.58 (0.02)	1820	0.0

Notes to Table:
(i) Absolute value of the asymptotic standard error in brackets.
(ii) All $\chi 2$ statistics have 4 degrees of freedom (critical $\chi^2(4)$ = 9.49 at 5% level of significance).

Chapter 5

Here the Red Queen began again. 'Can you answer useful questions?' she said. 'How is bread made?'
'I know that!' Alice cried eagerly. 'You take some flour -'
'Where do you pick the flower?' the White Queen asked: 'In the garden or in the hedges?'

(Lewis Carroll: Alice Through the Looking Glass)

Models of Output and Employment[1]

5.1 Introduction

In Chapter 3 of this thesis, we presented a dynamic model of employment plans. This reinforced the importance of expectations in explaining firm's decisions to hire workers, as well as suggesting that only truly anticipatory data, rather than lagged values, can adequately explain the role of expectations. Chapter 4 went on to examine the production smoothing model of output and pricing decisions, rejecting the suggested role for past inventories in the plans of U.K. firms but further reinforcing the potential of anticipatory data from business surveys in explaining firms' decision-making.

The rejection of the production smoothing model and the relative success of the short-run employment function leads us to consider a model which brings together production and employment decisions. Once again, we consider the planning process observable only through survey data, offering a unique test of the economic determinants of production and employment suggested by theory. We begin by considering whether production and employment plans are jointly determined. This may seem obvious but need only hold via the production function for <u>actual</u> output and employment, not for the firm's <u>plans</u>. We also consider the role of expectations of demand and cost conditions on these plans, as well as the response to unexpected changes in these crucial variables.

The model used here is similar to that described in Chapter 3, which is based on the hypothesis of convex adjustment costs associated with changes in production and the level of employment. It will be assumed that the firm is imperfectly competitive and maximizes the present value of a stream of discounted uncertain future profits subject to a downward sloping demand curve for its product. The availability of anticipatory data makes it possible to assess directly the effect of expectations about demand and cost on firms' output and employment plans. Furthermore, both expectations or intentions, and actual values of the variables are reported in the survey, so that one can examine why plans diverge from realizations.

A related literature has attempted to integrate expectations of output derived from survey data into single equation models of employment behaviour. These models are argued to represent the data generating process for employment better than instances where a distributed lag structure is used to proxy for expectations, thus lending further support to the argument that survey expectations have a useful role to play in understanding economic behaviour. Another strand of the literature tests the rational expectations hypothesis using output expectations drawn from business surveys.

Our approach is quite different. We assess the role of expected demand conditions based on exogenous indicators of demand rather than output because we wish to consider both production and employment plans. Following on from Chapter 4, we estimate both bivariate and univariate ordered probit models to consider the interaction of output and employment decisions. We will see that the data reject the notion that these plans are jointly determined but support the overall thrust of the thesis that having direct data on expectations demonstrates their role in planning key economic variables such as production and employment.

The empirical results obtained are broadly consistent with the theoretical model: both planned output and employment respond positively to increases in expected demand, and there is weak evidence that these two variables respond negatively to expected increases in labour costs. It should come as no surprise that managers form expectations about the business situation in their industry and these influence almost everything they do. The importance of the expectations about the strength of demand suggests that the most appropriate way of looking at British firm behaviour involves a model of an imperfectly competitive firm facing a downward sloping demand curve.

The paper is organized in the following way. Section 5.2 reviews the literature using survey data to explore the employment-output decision made by firms and to test of expectations formation with respect to output. Section 5.3 briefly describes the data used in this model; most variables have already been described in Chapters 3 and 4. Our simple model of output and employment is developed in Section 5.4. Section 5.5 contains the empirical results of testing this model on ordered categorical sample survey data. Discussion and concluding remarks end the paper.

5.2 Models of Output and Employment

There has not been a systematic attempt to use firm level survey data to study U.K. firms' decisions in output and labour markets, although there are two strands of related work which we discuss below. Chapter 4 has already mentioned work by Konig, Nerlove and Oudiz (1981), (1985), Kawasaki, McMillan and Zimmermann (1983), and Nerlove (1983) who have used the individual responses of German and French firms to analyse pricing and output decisions (amongst others) in a production smoothing context.

A number of authors have used aggregate measures derived from surveys to explore the interaction between output expectations and employment behaviour. Ilmakunnas (1989) and

Pehkonen (1992) use the Finnish Confederation of Business survey, while Wren-Lewis (1986) has examined U.K. firms' employment and production decisions via the CBI surveys. These latter models are actually quite close to the model of employment discussed in Chapter 3 but are relevant here as well, since they explicitly attempt to integrate expectations of output (as opposed to demand) from survey data into the employment function.

Wren-Lewis (1986) argues that "modellers have traditionally estimated reduced form relationships in which expected output is some unspecified function of current and lagged output"(p. 298), with this inadequate treatment of expectations in part explaining the resulting poor forecasting performance of employment functions. He also suggests that having direct observations on expectations (albeit in aggregated form rather than at the firm level, using techniques suggested by Carlson and Parkin (1975) and Batchelor (1982)) help to explain the fall in UK productivity growth during the late 1970s and its rising trend during the early 1980s. These are argued to result from overly-optimistic output expectations during the 1970s which led to over-staffing. Further, Wren-Lewis notes that having direct expectational data means the researcher does not have to resort to imposing rational expectations on the modelling process.

Wren-Lewis contrasts an employment equation which tests the influence of lagged values of employment and output expectations derived from the CBI surveys, as well as a time trend to proxy technological change, with a "standard model" that uses lagged values of output to proxy expectations. He concludes that "the forecasting performance...based on CBI expectations is exceptional" (p. 308). In further testing to incorporate cost conditions, the author chooses to use lagged values to proxy expectations. The cost information available from the CBI surveys is imperfect but could be used as an alternative and tested, as we do here and in Chapter 3. The cost variables prove highly unsatisfactory; even up to four lags of a real wage variable are rejected as insignificant.

Wren Lewis concludes:

> 'A particularly demanding test of U.K. manufacturing employment equations is their ability to forecast the unprecedented decline in jobs during 1980/1. In this respect our equations perform well, both in absolute terms and in comparison to alternative models based on reduced forms or the rational expectations hypothesis.' (p. 312)

Ilmakunnas (1989) sets out "to estimate a labour demand function for Finnish manufacturing using both business survey data and rational expectations" (p. 297). He notes that "when survey data are used for the expectations of future variables...no serially correlated error is created and consistent estimation is possible using simpler methods than is the case of rational expectations." The approach taken is to estimate the Euler equation resulting from the optimisation problem directly, hence capitalizing on the one-period ahead expectations available from survey data; this limited information approach to expectations was also used in the earlier chapters of this thesis. The author uses the methodology suggested by Carlson and Parkin to "quantify" the survey data, via the balance statistic, creating quarterly data on expectations.

Comparing a rational expectations model and a model using survey expectations, the latter model is preferred on a number of counts. First, parameters which capture the dynamic process of adjustment of labour are in keeping with theory when survey expectations are employed. Secondly, the survey expectations model captures the structural shift in employment that occurred in Finland in 1982. Thus, the modeling strategy using direct expectational information is both computational simpler and performs better than the rational expectations alternative.

Pehkonen (1992) estimates three different models of the employment-output relationship, including one using forward-looking expectations proxied by survey responses from the Finnish CBI data. While Pehkonen finds that a statistically satisfactory equation can be estimated for Finnish manufacturing using lagged output variables to proxy for output expectations (the model fits the data well and is robust), the author finds far superior results when the model includes expectations derived from survey data. In a third model, Pekhonen adds a stochastic trend to explain technological change, rather than the usual simple deterministic time trend, to the survey-based expectations model. This does not significant improve the model, unlike the initial U.K study which found a significant effect for a stochastic trend term (see Harvey et al., 1986). Once again, the survey data are "quantified" to form a time-series representing output expectations.

A second set of studies has examined the Rational Expectations Hypothesis applied to output expectations using survey data. This literature includes Rahiala and Terasvirta (1986), Hanssens and Abeele (1987), Buckle, Assendelft and Jackson (1990), and Buckle and Meads (1991).

Only Rahiala and Terasvirta (1986) use micro-level survey responses, from the Finnish CBI, to study the determinants of production plans in manufacturing. And rather than using the "conventional" approach of conditional log-linear models (nor the ordered probit approach adopted here), the authors use continuation ratio models (see Agresti, 1984, pp. 114-117). The authors note that studies of production smoothing have looked at the interaction between pricing and production decisions, however, since the Finnish survey data on prices is deemed "too recent" (the question regarding prices was added only in 1980) and therefore possibly unreliable, only an output equation is estimated. However, since "quantities and prices are jointly endogenous...if prices are omitted the formation of production plans can still be studied." (p. 5)

The model of production "surprises", or forecast errors, is similar to that described, in other contexts, in Chapters 3 and 4 of this thesis. An important issue in handling the data should be noted. The authors maintain the "distance" in their derivation of forecast errors. Thus, separate indices are employed to denote cases where, for example, the forecast was for an increase and the realisation was a decrease, rather than giving this the same value as the case where the forecast was for an increase and the realisation was no change. In other studies (see Nerlove, 1983, as well as the work already presented in this thesis), the "severity" of the forecast error did not affect the results. Conversely, Rahiala and Terasvirta find this distinction useful.

Further, Rahiala and Terasvirta use expected changes in exports to proxy demand, arguing that exports are such a large part of total business for Finnish manufacturing that this question will capture demand effects. We have not employed this variable in our studies, in part because many U.K. firms would not have export business. Further, we found the results from other available demand proxies warranted their use, making undesirable the reduction in the sample size that would result from using a comparable export variable.

Hanssens and Abeele (1987) use the European Community Business Survey to examine production plans in Belgium, France, Germany, Holland and Italy. The survey data are used in a "quantified" form as suggested by Carlson and Parkin (1975). The authors compare a model relating current production decisions to a distributed lag of past production, with a model that uses past orders and past expectations of production drawn from business surveys. The authors find that survey data on realised orders and output expectations recorded at time t are useful for predicting realised production recorded in period t+1. However, when actual production levels recorded in official statistics are used as the dependent variable, the survey data have only a weak explanatory power. The conclusion the authors draw is that survey data may be biased; managers may strive for internal consistency, so that survey expectations explain survey outturns, but not "actual" production. We return to this issue later in our own estimation.

Buckle, Assendelft and Jackson (1990), and Buckle and Meads (1991) use the New Zealand Institute of Economic Research's quarterly surveys. The former study tests for unbiasedness and orthogonality in expectations formed by New Zealand manufacturing firms; Rational Expectations is rejected on both counts. Both New Zealand studies use the bias measures devised by Kawasaki and Zimmermann (1986). These measures are derived first by constructing the forecast errors (as discussed in Chapters 3 and 4) and then summarising the information across the micro-level observations in a single index of bias: the index takes on a value +1 if all bias results from over-predictions and -1 if all bias results from under-predictions. Note that the "distance" or severity of forecast errors (as discussed by Rahiala and Terasvirta) could potentially be incorporated into the construction of the bias index but is ignored by Kawasaki and Zimmermann (1985) and those who have subsequently used this methodology.

The earlier study of New Zealand firms rejects both the unbiasedness and the orthogonality assumptions of rational expectations of prices and output. The latter study applies vector autoregressions to examine the pricing and production responses of firms to surprises in demand. The results indicate that New Zealand manufacturers are more likely to adhere to the new-Keynesian view of adjustment to demand surprises: price expectation errors do not translate into output and employment adjustments.

The work presented earlier in this thesis has demonstrated the importance of demand conditions in explaining employment plans and the failure of the production smoothing model to explain output plans. What follows is an attempt to explore further the influence of demand and cost conditions on production, ignoring the role of prices and inventories but accounting for the interaction with employment. Instead of using output expectations as a dependent variable in a short-run employment function, we model both production and employment plans.

5.3 Description of the Data

The data set is again drawn from the quarterly surveys which the Confederation of British Industry collects on a sample of firms. The available subset, in the form ordered categorical variables for individual firms, covers six consecutive surveys from October 1982 to January 1984. We recap briefly.

The sample covers approximately 1600 firms in each survey, about half the manufacturing sector in the U.K. Firms completing the survey differ from sample to sample but there are more than five hundred firms which returned all six questionnaires.

Unlike the work presented in Chapter 3 above, the answers regarding the volume of output are treated as information regarding an endogenous decision about production, rather than as a exogenous demand proxy. While expected output entered the employment function (Chapter 3) in the manner suggested by theory, and with significant coefficients, we also found that alternative demand proxies could explain employment plans. In the current model, demand conditions (ΔD) are proxied by the level of optimism that managers have about business conditions. One can interpret this variable as an indicator of current business conditions. Equally plausibly, it could refer to future business conditions and we have followed this interpretation in the text. For past demand conditions, one must again rely on realisations of new orders.

We therefore treat changes in output and employment as decision variables. Although this seems to be a sensible interpretation of the data not everyone, Wren-Lewis (1986) and Pesaran (1985) for example, takes this approach.

Unlike the case of the short-run employment demand function estimated in Chapter 3, there is reason to believe that expectations of demand conditions beyond the next quarter will affect production plans. The data available on medium-run demand conditions is somewhat sketchy in the CBI surveys, certainly not as obvious as the question regarding new orders. The question on business optimism is somewhat open ended since it simply asks about conditions compared to four months previous. Given that so many of the questions in the survey deal with four month periods, there may be reason to suspect that managers may also consider their outlook on business conditions by comparing the coming four months relative to the past four months in determining whether they are more or less optimistic (Price, 1983).[2]

Another alternative exists. The survey includes the question:

> "In relation to expected demand over the next twelve months is your present fixed capacity more than adequate, less than adequate or adequate?"

We will use this question to proxy medium-term demand expectations in explaining output plans. While the question may capture views about capacity and thus willingness or interest in investment, rather than demand conditions, this is the only "obvious" proxy available in the data set.

This question clearly differs from the majority of those used, the expectation/outturn questions, by referring to a twelve month time horizon rather than four months. Nonetheless, the responses can be categorized into a trichotomous qualitatitive variable. Capacity being deemed more than adequate relative to demand is interpreted as evidence of relatively low and stable demand. Conversely, the firm reporting fixed capacity was less than adequate relative to demand over the next twelve months implies that the firm felt demand conditions were improving.

An additional point about the data is worth re-emphasising. The surveys contain a question concerning expected unit costs. There is evidence that firms interpret it as referring to labour and material costs (McWilliams, 1983, p.17). This probably refers to the nominal cost of production. There is no direct information in the surveys concerning firms' expectations of the average price level and hence there is no information on relative prices. We have tried to address this by constructing the "real factor" cost variable discussed in Chapters 3 and 4.

5.4 A Simple Model of the Firm

Let Q_t, N_t, P_t and w_t be output, employment, the relative price of the firm's product, and the real wage (in terms of the average price level), respectively. As in Chapter 3, we assume

$$Q_t = f_0 + f_1 N_t \qquad (1)$$

$$P_t = [(D_t - Q_t)/a] \qquad (2)$$

Equation (1) is a linear production function; output depends only on employment. The relative price of the firm's product is described by (2) which is the inverse of a linear downward sloping demand function. The random variable D_t, the intercept of the demand function, represents "expected demand conditions" in the industry to which the firm belongs. Each firm maximizes

$$E_t \{ \sum_{i=0}^{\infty} b^{t+i} [P_{t+i}Q_{t+i} - w_{t+i}N_{t+i} - (k/2)(N_{t+i} - N_{t+i-1})^2] \} \qquad (3)$$

knowing D_t, w_t and N_{t-1}. The terms in square brackets are period profits less labour adjustment costs and b (< 1) is the real discount rate.

Instead of the production function containing a random shock (as in Sargent, 1979, Ch. 14) this appears in the demand function. In each case a quadratic stochastic revenue function results. Real adjustment costs are constant. While somewhat arbitrary, this is not unusual in this type of model. In order to get results which can be tested empirically specific assumptions must be made about the stochastic processes. This is done below.

The solution method for this class of models is well known and consequently only the briefest sketch is included here. Assuming that D_t and w_t are first order auto-regressive stochastic processes it can be shown that the Euler conditions for this problem yield the following set of equations:

$$\Delta Q^*_{t+1} = \beta_1 \Delta N_t + \beta_2 \Delta D^*_{t+1} - \beta_3 \Delta w^*_{t+1} \quad (4)$$

$$\Delta N^*_{t+1} = \beta_4 \Delta N_t + \beta_5 \Delta D^*_{t+1} - \beta_6 \Delta w^*_{t+1} \quad (5)$$

Therefore, production plans are positively influenced by expected demand conditions, with the lagged employment term capturing the adjustment process. Expectations of real factor costs/wages are negatively related to production plans. The variables enter the employment function in the same manner, so (5) is equivalent to our short-run labour demand function in Chapter 3. However, in this chapter, we consider whether employment and production decisions are made jointly. We now turn to this question.

4.4 Estimation

As in Chapter 3, we apply ordered probability models to equations (4) and (5). We assume that

$$\Pr(\Delta Q^*_{t+1} < 0) = \Phi(-a-\lambda z_t)$$
$$\Pr(\Delta Q^*_{t+1} = 0) = \Phi(a-\lambda z_t) - \Phi(-a-\lambda z_t) \quad (6)$$
$$\Pr(\Delta Q^*_{t+1} > 0) = 1 - \Phi(a-\lambda z_t)$$

where a > O, Φ is the cumulative normal distribution function with mean equal to zero and variance (a), λ is a vector of parameters common to all firms and z_t is the vector:

$$\{\Delta N_t(+,-), \Delta D^*_{t+1}(+,-), \Delta w^*_{t+1}(+,-), DUM, 1)\}.$$

As in Chapter 3, $\Delta N_t(+,-)$ is a pair of dummy variables representing the three possible values of actual changes in employment experienced in period t: up or "+", the same or "=" and down or "-" (likewise for $\Delta D^*_{t+1}(+,-)$ and $\Delta w^*_{t+1}(+,-)$).

For ΔD^*_{t+1} there are two variables which could represent demand expectations, business optimism and expected new orders. In practice we found little difference in the results using both measures. For estimating probabilistic analogs for equations (4) and (5) it was necessary to use realised new orders since there is no information on realised business conditions.

For Δw^*_{t+1} the situation is more complex. As we have already mentioned the appropriate real wage variable is not available. Ideally, one should define $w_t = W_t/V_t$ and $p_t = P_t/V_t$ where V_t is a price index of all goods, P_t is the firm's output price, and w_t is <u>nominal</u> labour cost. Each survey contains nominal costs and prices, but not a general price index. As a proxy for w_t we again propose the firm's own product wage. This is not ideal since P_t is endogenous but it is the only "real" measure of labour cost. There is also some approximation involved since the data are qualitative.

The variable DUM in z_t is a vector of eight industry, two size, and five time dummies. Since all of the explanatory variables are represented by dummies a constant term is required. This is facilitated by the last component of z which takes on the value 1 for all t.

Note also that the vector of parameters (β, a, σ) is not identified and a normalization is required. This is achieved by setting $\sigma = 1$. Notice that there is no loss of generality here since the asymptotic t-ratios are invariant to the normalization rule although the individual parameter estimates will not be.

In order to obtain more efficient estimates we could also specify that the error terms in the employment and output equations are jointly normally distributed with mean zero and unit variances and apply a bivariate ordered probit model, as discussed in Chapter 4. Maximum likelihood estimates of β using bivariate ordered probability models corresponding to equations (4) and (5) are shown in Table 5.1, along with several goodness of fit statistics. All firms that answered at least one survey are included in this sample. The coefficients displayed in brackets below each β_i are asymptotically normally distributed with mean zero and unit variance.

Table 5.1 reveals that, unlike the model presented in Chapter 4 of price and output decisions, output and employment plans do not appear to be simultaneous decisions. It is true that by definition, the firm's production technology immediate creates a link between actual employment and output, a fact exploited to specify the short-run employment function discussed by Wren-Lewis, Ilmakunnus and Pehkonen. However, the coefficient (ρ) representing correlation between the error terms in the two equations in our bivariate probit model is not significant at the 5% level of confidence.

This is an interesting result that has been possible because of the direct data on production and employment expectations from surveys. Firms consider demand and cost conditions in planning output for the coming quarter. However, since short-run production can be raised through increased work intensity or hours without necessarily expanding numbers employed, the two decisions are not immediately linked at the planning phase. Nor does this necessarily contradict the fact that firms take short-run demand expectations into account when making plans regarding numbers employed. Expected increases in business optimism proves highly significant in both equations. For example, consider the pair of entries in the equation for output plans (signified by the dependent variable ΔQ^{*}_{t+1}) corresponding to ΔD^{*}_{t+1} (1.47 and -1.44). These coefficients indicate firms are more likely to report plans to raise output if they expect an improvement in business conditions, and vice versa; the "t-statistic" indicates that the coefficients are significant at the 5% level. As well, firms which expect business conditions to improve are more likely to plan to hire more workers, and vice versa.

The coefficients for the past change in employment are significant and correctly signed in both the employment and output equations, confirming the lagged effect of adjustment costs. As in Chapter 3, the product wage coefficients do not enter the employment equation in the manner theory would suggest, entering with the wrong sign when costs are expected to fall(as well as being insignificant at the 5% level). Conversely, the real wage variable works well in the production equation. Expecting higher costs leads to a decrease in production while expecting lower costs leads to a rise in planned output. Some industry, size and survey dummies are significant but the pattern is not consistent across the two equations.

The story may be different for actual production and employment, or when using demand (cost) surprises to explain unanticipated changes in output and employment. We address these possibilities in due course.

Before that, and given the "independence" of output and employment plans in our bivariate probit model, we have re-estimated equations (4) and (5) using univariate probit models, see Table 5.2. Note that estimates based on univariate ordered probit models are consistent despite significant correlation between the error terms (which the bivariate model has rejected). The coefficient estimates are almost entirely unchanged (identical in terms of signs, and whether coefficients are significant or not) from the bivariate model, as we would expect if the two equations are indeed independent.

An alternative means of addressing the "simultaneity" of output and employment decisions is to recognize that the model is recursive in the sense that ΔQ^*_{t+1} may depend only on ΔN^*_{t+1}. Having estimated the ordered probability model for equation (4) one could have run an ordered probability model of ΔQ^*_{t+1} on ΔN^*_{t+1} and the industry and size dummies. This, in fact, was done and, not surprisingly, the coefficients for the planned employment (ΔN^*_{t+1}) dummies are highly significant and have the right sign. Thus, dropping the information on expected demand and cost conditions and substituting expected employment might have led us to the conclusion that production depends (can be explained by) employment plans. Our bivariate model cautions against this. Furthermore, equation (5) is much more interesting since it provides direct empirical support for two well known textbook propositions:

1. the firm will increase its output if there is an upward shift in its demand curve, and
2. it will reduce its output if there is an increase in one of its factor prices.

Next we consider the role of medium term demand conditions on production and employment plans. The results presented in Table 5.3 for univariate probit estimates of equations (4) and (5) offer only limited evidence that firms look beyond a four month time horizon. While the signs and significance of lagged employment and the real wage proxy are effectively unchanged compared to Tables 5.1 and 5.2, the medium-term demand variable does not appear to be as useful an explanatory variable in either production of employment plans, compared to expected new orders or business optimism. The expected demand dummies enters with the incorrect sign in both cases for the production decision and the coefficients are not significant at the 5% level of confidence in the employment equation.

Note immediately, that the question on demand relative to capacity may deal in "levels" rather than changes, which may help account for its failure to explain expected changes in production and employment. Problems with this demand proxy lead us to abandon it.

For completeness (and symmetry), we also included the medium-term demand proxy in the employment equation, despite evidence that short-run labour adjustment occurs within six months (see Hazledine, 1981). The demand proxy fares even worse when used to explain employment plans, entering with the wrong sign when firms expect higher future demand. Neither dummy for this variable is significant at the 5% level. The other variables in the equation are essentially unchanged from the earlier case using expected business optimism, though overall the performance of this equation must be deemed inferior give the failure of the otherwise vital expected demand proxy. Note that despite pooling over all six surveys, our sample size has fallen somewhat since not all firms respond to this question. These conclusions were confirmed when the medium-term demand proxy was used to estimate models for each available survey, size classification and industrial sector separately.

If production and employment plans "fail" the test of joint determination outlined above, what about realized production and employment? Table 5.4 presents results for bivariate probit models, pooled across all six surveys, using equivalent forms of equations (4) and (5) where expectations are replaced by realisation:

$$\Delta Q_t = \beta_1 \Delta N_{t-1} + \beta_2 \Delta D_t - \beta_3 \Delta w_t \quad (4a)$$

$$\Delta N_t = \beta_4 \Delta N_{t-1} + \beta_5 \Delta D_t - \beta_6 \Delta w_t \quad (5a)$$

That is, the changes in production (employment) reported in survey t are explained by the changes in demand and cost conditions experienced in period t (with a lagged adjustment effect ΔN_{t-1}). The coefficient ρ is not significantly different from zero, though this test only marginally rejects at the 5%. Thus there is at best weak evidence from survey information that firms conform to the production function constraint that link production and employment. Recall, however that our employment variable refers to number employed, rather than hours or indeed a more subtle notion of work effort or intensity. Short-term adjustment of the labour force is also costly, as reflected by the significant coefficients on ΔN_{t-1}. Firms may have scope to raise production without taking on more labour in the short-run (i.e. four months).

So far the tests of the model have utilized data on what firms say they intend to do or what they expect to happen to variables which are exogenous to them. It is important if one is to have any confidence in the data set as a whole to ascertain whether firms act on their stated intentions. As we did in previous chapters, testing the accuracy of plans requires matching responses across consecutive surveys.

Consider the output decision. The sample survey for period t contains ΔQ^*_{t+1} and ΔQ_t. Likewise the survey for period (t-1) contains ΔQ^*_t and ΔQ_{t-1}. The accuracy of firms plans can be ascertained by combining adjacent surveys and seeing how well ΔQ^*_t, the planned change in production formed at t-1 for period t, explains the actual change in production (ΔQ_t). Thus we estimated equations:

$$\Delta Q_t = \beta_1 \Delta N_{t-1} + \beta_2 \Delta Q^*_t \quad (6)$$

$$\Delta N_t = \beta_4 \Delta N_{t-1} + \beta_5 \Delta N^*_t \quad (7)$$

As Table 5.5 shows the ΔQ^*_t and ΔN^*_t dummies are highly significant predictors of the probabilities of ΔQ_t and ΔN_t and all estimated coefficients have the right sign. Thus, a firm which planned in period to increase (decrease) its output in period up to t+1 is more likely to have actually raised (lowered) output when it responds to the "past trend" in the subsequent survey.. The same applies to the firm's employment plans at t and its realisations at t+1.

Lack of success with the wage/cost proxy has led us to discard this variable in the model just discussed. Further, the interesting issue is the likelihood that firms follow up on their plans; ample evidence has already been presented regarding the relative roles of demand and cost conditions in explaining the plans and realisations of firms. We have also discussed elsewhere, and rejected, the notion that firms strive for internal consistency between surveys in their answering practices. A priori there seems little to be gained from this consistency, nor is it clear in practice that the same person answers the CBI surveys from quarter to quarter and so would need to refer to a copy of past responses in order to ensure consistent answers across surveys.

This particular method of generating data sets from adjacent samples provides two further interesting insights. First, it allows the model to be tested in a slightly different fashion which permits it to be nested in a more general framework. Second, it allows the testing of the rationality of expectations of exogenous variables by analyzing the correlation between expectation errors and the information set available to firms when the expectations were formed. This latter is once again a test of the "efficient" use of information implied by rational expectations. We have not tested unbiasedness or orthogonality of the expectations.

We define the forecast errors for employment and output as in Chapters 3 and 4. This gives:

$$U\Delta Q^*_t = \beta_1 U\Delta D^*_t - \beta_2 U\Delta w^*_t \qquad (8)$$

$$U\Delta N^*_t = \beta_3 U\Delta D^*_t - \beta_4 U\Delta w^*_t \qquad (9)$$

Equations (8) and (9) simply say that differences between realizations and expectations - planning errors in this case - are due to forecast errors in the exogenous variables.

The test results for this system are contained in Table 5.6. Note that, as before, new orders is used for demand expectations, since the survey does not ask for "past" optimism. The product wage is used for w_t. A bivariate probit model is applied to determine whether adjustments to unexpected changes in demand and cost conditions might be jointly determined, e.g. if demand was higher than expected, firms both produce more output and hire more workers more than planned. Unlike our previous bivariate models, this model indicates that the response in output and labour markets to unanticipated conditions is a joint decision. We hasten to emphasise that the variables are constructed from questions gathered in separate surveys, not answers to direct questions about firm behaviour in instances where demand and cost "surprises" are encountered. Further, the bivariate probit results are not particularly robust; ρ is only significant in the pooled sample consisting of five "pairs of surveys needed to yield comparisons between expected and realised values to generate unexpected changes in demand and costs. In three of the five cases generated by combining data from pairs of consecutive surveys (e.g. Oct. 1993 and January 1984), rho was insignificant.

Nonetheless, the estimates provide further evidence in support of the findings of Chapters 3 and 4 that firms respond to unexpected changes in demand conditions in the manner that dynamic economic modelling suggests. The dummies for demand surprises are strongly significant in both the output and employment equations. Thus, firms produce (hire) more than planned when demand conditions are better than anticipated, and vice versa.

According to theory, planning errors should only depend on expectational errors. In particular they should not depend on the information set which is used to calculate ΔQ^*_t and ΔN^*_t. Adding some of the variables which make up the observable part of the information set at (t-1) to the list of explanatory variables leads to a significant increase in the maximum value of the likelihood function, as the bottom half of Table 5.6 shows. For example, adding dummies for the variables (ΔQ_{t-1}, ΔD_{t-1}, ΔP_{t-1}, ΔC_{t-1}, ΔN_{t-1}) to industry, size, and sample survey dummies to equation (8) raises the likelihood function for -5040.9 to - 4977.4.

Twice this increase (127.0) is significantly greater than the tabulated chi-square statistic, with 10 degrees of freedom, 18.31. This suggests that while firms may respond to demand and cost conditions in the way theory suggests, they are not fully efficient in utilizing the information available at the time the plans are made. This is not, in itself, evidence against the rationality of expectations formation; ours is at best a weak test of rational expectations, encompassing only the efficient use of information. Firms may be learning from their mistakes and adjusting accordingly. However, the limited evidence presented earlier (see Chapter 2) on this implies that learning may not occur. Furthermore, some caution should be exercised here since there are approximation errors in $U\Delta D^*_t$ and $U\Delta w^*_t$, the product wage is only a proxy for the real wage, and the list of exogenous variables suggested in the information set available when expectations were formed may not be complete.

Our results therefore indicate that U.K. firms' expectations of exogenous variables are not fully rational in the sense that variables observable at time (t-1) significantly improve the explanatory power of ordered probability models of $U\Delta D^*_t$ and $U\Delta w^*_t$. The rationality postulate requires that there be no systematic component in forecast errors of exogenous variables.

These conclusions are drawn from much weaker evidence than the specific unbiasedness and orthogonality tests employed elsewhere (see Lovell, 1986 for a survey), but have utilised the individual firm level responses unavailable in most studies. Though Kawasaki and Zimmermann (1985) or Buckle, Assendelft and Jackson (1990) start with micro-level data, the actual tests employ aggregate versions of these data in the form of a bias statistic.

5.5 Discussion and Concluding Remarks

The model developed in section 5.3 and estimated in section 5.4 is a variant of the standard cost of adjustment model. Although the model is a drastic simplification it is so by necessity. The absence of any numerically valued data makes testing non-linear first order conditions impossible and the fact that the data on plans and expectations covers only the next period eliminates the possibility of all but very simple stochastic processes for the exogenous variables.

In spite of the model's simplicity, it is not wildly inconsistent with the data. With the exception of the weak and sometimes perverse response of employment to changes in our proxy of expected real labour costs, UK firms appear to behave consistently and broadly in accord with conventional microeconomic theory. The idea that managers plan ahead and base their plans on what they think will happen to key exogenous variables is confirmed by the data. Although their plans and forecasts are subject to error they are quite a good guide as to what actually happens. Furthermore, planning errors or revisions are partly explained by forecast errors in the exogenous variables. The picture that emerges is one of approximately rational sequential decision making. In short, managers of firms in the sample appear to be acting in the way economic theory suggests they do.

The production-employment model reinforces the earlier evidence in this thesis of the overwhelming importance of business optimism as a determinant of firms' output and employment decisions. As mentioned in section 5.1, this supports the view that U.K. firms operate in imperfectly competitive markets. In a perfectly competitive economy all market information, including the state of business conditions in the firm's industry, is contained in the product wage or expectations thereof. The importance of ΔD^{*}_{t+1} (whether new orders or business optimism) indicates very clearly that British managers do not see their markets as being perfectly competitive in the sense that they cannot sell all they want at the market price.

These conclusions have been confirmed for output and employment separately in other studies, some of which were discussed in this chapter and others in Chapters 3 and 4. In particular, the large relative effects for demand variables is ubiquitous. The influence of cost conditions is mixed, but in most surveys the available information regarding costs, and especially labour costs, is limited at best.

Our results cannot be taken as conclusive that output expectations should be treated as a separate decision variable and so not enter into the short-run employment function. The bivariate model which assumes the joint determination of these planning decisions is rejected. Nonetheless, there is still an a priori rationale for preferring exogenous demand conditions when explaining employment plans, as opposed to modelling employment levels. The production function clearly links the latter, whereas understanding employment and output plans may require additional information about demand and cost expectations. Survey data confirm the role of the former but provide only weak evidence that the latter enter the equation for output plans.

Our results questioning the rational expectations hypothesis have also been duplicated elsewhere. While only a weak test of the rationality hypothesis is imposed, this simply adds to the contrary evidence found in other studies involving both expectations and their realizations drawn from survey data. The survey based results, using the only available source of data on expectations thus strongly reinforce the results against rational expectations presented elsewhere (see for example Lovell (1986) and Pesaran (1984, 1987) and the references cited there).

Finally, much of the research using qualitative data have employed log linear modelling (see Nerlove, 1983 and the discussion in Chapter 4 of this thesis). We employed this methodology to estimate our production and employment equations as a test for robustness but have not presented these results separately. Briefly, the results from estimating conditional log linear probability models confirm our conclusions regarding the role of demand and cost expectations in determining output and employment plans. Table 5.7 shows just one representative case, which can be directly compared with Table 5.2.

The signs of the coefficient estimates and their significance are essentially unchanged under this alternative method of estimation. Demand conditions are again the most strongly correlated with output and employment plans. The log linear model implies a weak relationship between output and employment plans, which is contrary to our bivariate model where we rejected the notion that the error term between the equations were uncorrelated and so proceeded on the basis of independence of the planning decisions. The relationship between employment and output was earlier noted in our single equation demand for labour function in Chapter 3 as well as by other researchers using expected output as a proxy of expected demand conditions. We would not reverse our judgement regarding the independent determination of output and employment plans, since log linear modelling, in general does not distinquish dependent and independent variables in its pairings. A final cautionary note: log linear modelling fails to make full use of information contained in the data because it ignores the ordering inherent in the responses (see Ivaldi, 1990).

Footnotes:

1. This chapter is based on work conducted jointly with J.P. McIntosh and F. Schiantarelli (then both at University of Essex). A part of this work has appeared in the Journal of Applied Econometrics, Vol. 4, 1989, pp. 251-64.

2. See McWilliams (1983) and Price (1983) for more information on firms' answering practices. Note also there is a one month overlap on each survey. Firms are asked to give predictions over a four month period four times a year. However, the consequences of this are not likely to be important since the answers are qualitative.

3. For example, an increase in ΔW_t and no change in ΔP_t generates a qualitatively smaller increase in Δw_t than an increase in ΔW_t and a decrease in ΔW_t. Increasing the number of categories from three to five for Δw_t does not change any of the results.

4. The statistical package PSA and Questat were used in these calculations.

5. The representation of industry effects by dummy variables is quite restrictive since slope coefficients could also be different across industries. As an empirical issue this turns out not to be very important. A number of probability models were run at the industry level and we found nothing that would alter the conclusions presented in the text.

Table 5.1

Bivariate Probit Model of Expected Output and Employment

Pooled over all six surveys: No. of observations = 9542.

Explanatory Variable	ΔQ^*_{t+1} (+)	ΔQ^*_{t+1} (-)	ΔN^*_{t+1} (+)	ΔN^*_{t+1} (-)
ΔN_t	0.32	-0.09	0.56	-0.76
	(8.8)	(2.7)	(16.0)	(26.8)
ΔD^*_{t+1}	1.47	-1.44	0.68	-0.72
	(48.6)	(40.2)	(24.3)	(18.7)
Δw^*_{t+1}	-0.08	0.15	-0.14	-0.06
	(2.4)	(3 9)	(4.5)	(1.7)
Constant	0.06		-0.72	
	(1.2)		(12.7)	
ρ	0.15			
	(0.9)			
Sector(i) 1	-0.42*		-0.26	
2	-0.13*		-0.08	
3	-0.24*		-0.10	
4	-0.22*		-0.04	
5	0.09*		0.12	
6	0.02		0.06	
7	-0.08		0.02	
8	-0.05		0.15	
Size: 1-499	0.04		0.53	
500+	-0.05		0.33	
Time: Jan 1984	0.18*		0.25	
Sep 1983	0.21*		0 14	
July 1983	0.21*		0.28	
Apr 1983	0.24*		0.24	
Jan 1983	0.05		0.09	
Sep 1982	0.05		-0.65	
Percentage of Correct Predictions(ii)	68.7		75.2	
McFadden's R^2(ii)	0.91		0.92	

(i) An asterisk next to a sector, size or time dummies implies it is significant at the 5% level.
(ii) See Amemiya (1981 page 1504-5) for definitions.

Table 5.2

Univariate Probit Models of Expected Output and Employment

Pooled over all six surveys: No. of observations = 9542.

Explanatory Variable	ΔQ^*_{t+1} (+)	ΔQ^*_{t+1} (-)	ΔN^*_{t+1} (+)	ΔN^*_{t+1} (-)
ΔN_t	0.3	-0.07	0.6	-0.68
	(8.8)	(2.5)	(16.2)	(25.6)
ΔD^*_{t+1}	1.37	-1.4	0.71	-0.74
	(47.8)	(41.2)	(24.0)	(18.5)
Δw^*_{t+1}	-0.06	0.11	-0.11	-0.07
	(2.3)	(3 8)	(4.2)	(1.5)
Constant	0.03		0.62	
	(0.7)		(11.5)	
Sector(i) 1	-0.41*		-0.22*	
2	-0.16*		-0.07*	
3	-0.23*		-0.17	
4	-0.28*		-0.03	
5	0.04		0.18*	
6	0.07		0.06	
7	-0.8		0.04	
8	-0.15*		0.13	
Size: 1-499	0.02*		0.57	
500+	-0.08		0.36	
Time: Jan 1984	0.15*		0.24*	
Sep 1983	0.24*		0 17*	
July 1983	0.26*		0.24	
Apr 1983	0.23		0.26	
Jan 1983	0.07		0.07*	
Sep 1982	0.05		-0.66	
Percentage of Correct Predictions(ii)	67.6		75.5	
McFadden's R^{2}(ii)	0.9		0.9	

(i) An asterisk next to a sector, size or time dummies implies it is significant at the 5% level.
(ii) See Amemiya (1981 page 1504-5) for definitions.

Table 5.3

Univariate Probit Models of Expected Output and Employment: Long-Run Demand Case

Pooled over all six surveys: No. of observations = 9447.

	Endogenous Variable			
	ΔQ^*_{t+1}		ΔN^*_{t+1}	
Explanatory Variable	(+)	(-)	(+)	(-)
ΔN_t	0.19	-0.02	0.26	-0.46
	(6.1)	(4.7)	(6.0)	(6.8)
ΔLRD^*_{t+1}	-0.11	0.14	-0.68	-0.07
	(8.6)	(4.2)	(0.4)	(0.7)
Δw^*_{t+1}	-0.02	0.05	-0.12	-0.02
	(2.1)	(3 6)	(2.5)	(0.8)
Constant	0.01		-1.0	
	(0.9)		(12.2)	
Sector(i) 1	-0.09*		-0.06	
2	-0.09		-0.03	
3	-0.06		-0.1*	
4	-0.04		-0.01	
5	0.005		0.11*	
6	0.05		0.08	
7	0.09		-0.02	
8	-0.01		0.07	
Size: 1-499	0.09*		0.04	
500+	-0.1*		0.05	
Time: Jan 1984	0.22		0.25*	
Sep 1983	0.13*		0 11	
July 1983	0.20		0.17	
Apr 1983	0.15		0.16	
Jan 1983	0.16*		0.1	
Sep 1982	0.05		-0.06*	
Percentage of Correct Predictions(ii)	66.8		73.2	
McFadden's R^{2}(ii)	0.91		0.90	

(i) An asterisk next to a sector, size or time dummies implies it is significant at the 5% level.
(ii) See Amemiya (1981 page 1504-5) for definitions.

Table 5.4

Bivariate Probit Model of Realised Output and Employment

Pooled over all six surveys: No. of observations = 9542.

Explanatory Variable	Endogenous Variable ΔQ_t (+)	(-)	ΔN_t (+)	(-)
ΔN_{t-1}	0. 05 (2.5)	-0.04 (1.9)	0.47 (8.5)	-0.57 (11.4)
ΔD_t	1.1 (32.6)	-1.05 (43.2)	0.53 (21.6)	-0.67 (17.4)
Δw_t	-0.01 (2.7)	0.15 (2.4)	-0.06 (0.5)	-0.04 (0.7)
Constant	0.13 (0.7)		1.4 (3.2)	
ρ		0.05 (1.7)		
Sector(i) 1	-0.45*		-0.04*	
2	-0.12*		-0.1*	
3	-0.26*		-0.08*	
4	-0.23*		0.007	
5	0.09*		0.02	
6	0.03		0.02	
7	-0.08		0.1*	
8	-0.03		0.09	
Size: 1-499	0.04*		0.39	
500+	-0.07*		0.53	
Time: Jan 1984	0.13*		0.15*	
Sep 1983	0.27*		0 17*	
July 1983	0.23*		0.25*	
Apr 1983	0.17		0.17	
Jan 1983	0.05*		0.1	
Sep 1982	0.03		-0.35	
Percentage of Correct Predictions(ii)	68.7		75.2	
McFadden's R^{2}(ii)	0.91		0.92	

(i) An asterisk next to a sector, size or time dummies implies it is significant at the 5% level.
(ii) See Amemiya (1981 page 1504-5) for definitions.

Table 5.5

Univariate Ordered Probit Model: Realised Production and Employment

Pooled over six surveys: sample size = 5924.

Explanatory Variable[i]	Endogenous Variable ΔN_t (+)	ΔN_t (-)	ΔQ_t (+)	ΔQ_t (-)
ΔN_{t-1}	0.10 (15.7)	-0.12 (20.2)	0.72 (9.2)	-0.51 (12.7)
ΔQ^*_t			0.61 (17.5)	-0.58 (13.3)
ΔN^*_t	0.88 (20.4)	-1.13 (29.7)		
Percentage of Correct Predictions[ii]	57.6		64.5	
McFadden's R^2	0.88		0.89	

Notes:

(i) Sector, size and time dummies were included but are not reported here.
(ii) See Amemiya (1981 page 1504-5) for definitions.

Table 5.6

Bivariate Ordered Probit Models: Surprise Model and Test of Rationality of Expectations using Information Sets

Pooled over six surveys: No. of Cases = 5924.

	Endogenous Variable			
	$U\Delta Q^*_t$		$U\Delta N^*_t$	
Explanatory Variable[i]	(+)	(-)	(+)	(-)
$U\Delta D^*_t$	1.02 (13.3)	-1.07 (10.8)	0.42 (4.8)	-0.33 (4.8)
$U\Delta w^*_t$	-0.21 (1.22)	0.08 (0.49)	-0.12 (1.0)	0.13 (1.0)
ρ	0.12 (2.3)			
Percentage of Correct Predictions	64.2		66.9	
Log Likelihood Value	-5040.9		-4779.3	
Log Likelihood Value with following added to the information set:				
$(\Delta Q_{t-1}, \Delta N_{t-1}, \Delta D_{t-1}, \Delta P_{t-1}, \Delta w_{t-1})$	-4977.4		-4741.6	
$(\Delta N_{t-1}, \Delta D_{t-1}, \Delta P_{t-1})$	------		-4747.0	
$(\Delta Q_{t-1}, \Delta D_{t-1}, \Delta P_{t-1})$	-4978.1		-------	

Notes:
(i) Sector, size and time dummies were included but are not reported here.

Table 5.7

Conditional Log-Linear Probability Model for Output and Employment

Pooled over all six surveys: No. of cases = 8571

Model: $Pr(\Delta Q^*_{t+1}, \Delta N^*_{t+1} \mid \Delta D_t, \Delta D^*_{t+1}, \Delta w^*_{t+1})$

Bivariate Interactions	γ^2(i)	χ^2(ii)	Upper Tail Probability
$(\Delta Q^*_{t+1}, \Delta N^*_{t+1})$	0.3 (2.4)	4.4	0.03
$(\Delta Q^*_{t+1}, \Delta N_t)$	0.2 (3.0)	22.1	0.002
$(\Delta Q^*_{t+1}, \Delta D^*_{t+1})$	0.8 (9.2)	113	0.0
$(\Delta Q^*_{t+1}, \Delta w^*_{t+1})$	-0.1 (0.04)	7	0.3
$(\Delta N^*_{t+1}, \Delta N_t)$	0.5 (8.7)	93	0.0
$(\Delta N^*_{t+1}, \Delta D^*_{t+1})$	0.7 (9.6)	118	0.0
$(\Delta N^*_{t+1}, \Delta w^*_{t+1})$	0.05 (0.4)	8	0.1

Notes:

(i) Absolute value of the ratio of each coefficient to its asymptotic standard error in brackets.
(ii) All χ^2 tests have 3 degrees of freedom.

Chapter 6

'The time has come', the Walrus said,
'To talk of many things;
Of shoes - and ships - and sealing wax -
Of cabbages - and kings -
And why the sea is boiling hot -
and whether pigs have wings.'

(Lewis Carroll: Alice's Adventures in Wonderland)

6.1 General Conclusions

We began this thesis with an overview of economists' general aversion to survey data. The subsequent four chapters have presented a variety of circumstances and evidence to support the expanded use of business "test" surveys in economic modelling and analysis. Once again, one cannot simply ignore the fact that contrary evidence cannot dissuade those who have a priori reasons to believe their existing methods are correct. Nonetheless, the evidence must at least indicate that survey data can be integrated into economic analysis and should be taken seriously as an approach to understanding some fundamental underlying motivations of firm behaviour.

First, we have tried to show that firms are consistent in their responses to surveys, without necessarily imposing consistency on their answers in order to appear knowledgeable about the future. Indeed the evidence is that firms do indeed "get it wrong" in a way that Rational Expectations would not suggest. Far from being a short-coming, we suggest this only adds to the credibility of this sort of data as a truly independent test of economic theory. Firms may well act on their expectations in general, but also make forecasting errors and appear to make inefficient use of the available information when forming expectations. However, in the face of those forecasting errors and inefficiencies, firms do act as theory would predict: firms adjust employment, output and prices appropriately so as to adjust to shocks or errors in forecasts in the manner economic theory predicts. This should be seen as heartening to economic theorising in general. We did not however find support for the production-smoothing model of output behaviour.

Second, we have tried to show that direct data on expectations and the corresponding information on realisations allows for tests of the a priori plans that firms form about crucial endogenous variable such as employment, output and prices. It is true that the production-smoothing role of inventories was not supported, as has been found by other researchers using conventional time-series data. Nonetheless, the overall conclusion we draw from our models is that firms take expectations of exogenous variables into account when determining their plans for endogenous variables.

Third, the strongest effect overall is found for expectations of demand conditions. A variety of possible proxies was employed, as appropriate to the model at hand. In determining plans for employment and output, expected demand plays the role economic theory would suggest; firms plan to hire more workers and to expand production if they are optimistic about future demand conditions.

Fourth, we have also tried to include a cost proxy in all our models, something tried only sporadically in other studies using survey data. While there are serious reasons to doubt that the available proxy in the CBI surveys can adequately account for the specific cost conditions needed across the variety of models we have estimated, it was quite successful in explaining variations in pricing behaviour.

Fifth, the results presented in this thesis have been largely in keeping with those found in both other survey-based studies and those conducted using time-series data. This is generally comforting, even though one might hope instead that survey data might generate entirely new results. The "new" results probably again relate to the ability to model ex ante plans and responses to forecasting errors, not possible from conventional "official statistics".

6.2 Specific Conclusions

The individual models have led to a number of results that are worth re-emphasising.

First, in our model of short-run labour market responses, it appears that having expectations of demand conditions provides a better explanation of employment plans than using lagged realised values of demand conditions (or output). In this sense at least (though not necessarily conforming to rational expectations) firms are forward-looking in their behaviour. Indeed, our results suggest that lagged variables are inadequate proxies of the expectations formation process.

Second, the models of pricing and output and production and employment suggest that U.K. firms operate as imperfect competitors in output markets. There may be some evidence of pricing asymmetries so that firms are more likely to respond to expected cost increases and plan price rises than they are to plan lower prices when costs are expected to fall. This was particularly observed for large firms, i.e. employing over 500 workers.

Third, while one might expect that employment and output decisions would be jointly determined; our results suggest otherwise for plans about output and employment. On the other hand, the response of firms to forecast errors in demand conditions does indicate that the adjustments of employment and labour force are jointly determined. That is, the adjustment of employment and production in the face of unexpected demand or cost changes responds not only in the fashion theory predicts but these adjustments are correlated, whereas the initial plans for production and employment are essentially separate and determined by expected demand conditions.

6.3 Possible Extensions

The results ~ ~ encourage further work using survey data, whether in the firm by firm fashion using microeconometric techniques as in this thesis or in aggregated forms. The evidence above suggests that business surveys are indeed a source of useful and important data on firms' economic behaviour that should not be ignored if expectations are taken seriously in economic theory and analysis.

The principle concern future researchers must address is to find better proxies of cost conditions. Some researchers have already suggested profitability measures, though even these have been indirectly proxied from existing survey questions. The alternative, of course, is to encourage the surveying bodies to gather more direct data on cost conditions. Economists can play a useful role not necessarily through conducting specific surveys of their own but in ensuring the existing surveys better meet the needs of economic research by framing the questions to elicit the information theory suggests is crucial in explaining economic behaviour.

The work presented in this thesis only begins to model the various planning activities that firms undertake. The CBI surveys contain information about capital investment, exports, and capacity utilisation, for instance, which could also be examined. And the firm level data could be used to implement the more rigorous tests of the Rational Expectations Hypothesis; we were not aiming at testing alternative theories of expectations formation as much as we were interested in examining the role expectations play in the economic behaviour of firms

Finally, if managers' expectations about business conditions in their industry are as important as our results suggest, it is natural to ask how they are determined and, in particular, whether they are influenced by government monetary and fiscal policy. At the aggregate level Nickell (1984) shows that expectations are sensitive to government policy so the question is an interesting one to address with micro-level data. The data base used for this study is not really suitable for this type of analysis although acquiring qualitative information on firms responses to macro-policy is certainly feasible and might prove to be of considerable value. Based on time series data of the aggregate position of business expectations, namely the shares of firms who claim to be optimistic about business conditions in their industry, preliminary investigations reveal that businessmen do believe that their market opportunities depend on the way the government acts. This requires integrating micro-level data with aggregate data, a step beyond this thesis.

APPENDIX 1

CBI Industrial Trends Survey   Number 92: April 1984

Please tick appropriate answers: If question not applicable, tick N/A

Please use space overleaf for any comments you would like to make on points not covered by your replies.

1 Are you more, or less, optimistic than you were four months ago about THE GENERAL BUSINESS SITUATION IN YOUR INDUSTRY

More	Same	Less	
			11

2 Are you more, or less, optimistic about your EXPORT PROSPECTS for the next twelve months than you were four months ago

More	Same	Less	N/A	
				12

3 Do you expect to authorise more or less capital expenditure in the next twelve months than you authorised in the past twelve months on:

	More	Same	Less	N/A	
a. buildings					13
b. plant & machinery					14

4 Is your present level of output below capacity (i.e., are you working below a satisfactory full rate of operation)

Yes	No	N/A	
			15

5 Excluding seasonal variations, do you consider that in volume terms:

	Above Normal	Normal	Below Normal	N/A	
a. Your present total order book is					16
b. Your present export order book is					17

(firms with no order book are requested to estimate the level of demand)

	More than Adequate	Adequate	Less than Adequate	N/A	
c. Your present stocks of finished goods are					18
	1	2	3	4	

Excluding seasonal variations, what has been the trend over the PAST FOUR MONTHS, and what are the expected trends for the NEXT FOUR MONTHS, with regard to:

	Trend over PAST FOUR MONTHS				Expected trend over NEXT FOUR MONTHS				
	Up	Same	Down	N/A	Up	Same	Down	N/A	
6 Numbers employed									19-20
7 Volume of total new orders									21-22
of which: a. domestic orders									23-24
b. export orders									25-26
8 Volume of output									27-28
9 Volume of: a. domestic deliveries									29-30
b. export deliveries									31-32
10 Volume of stocks of: a. raw materials and brought in supplies									33-34
b. work in progress									35-36
c. finished goods									37-38
11 Average costs per unit of output									39-40
12 Average prices at which: a. domestic orders are booked									41-42
b. export orders are booked									43-44
	1	2	3	4	1	2	3	4	

13 Approximately how many months production is accounted for by your present order book or production schedule:

Less than 1	1-3	4-6	7-9	10-12	13-18	More than 18	N/A
1	2	3	4	5	6	7	8

45

14 What factors are likely to limit your OUTPUT over the next four months. *Please tick the most important factor or factors. If you tick more than one factor it would be helpful if you could rank them in order of importance*

Orders or Sales	Skilled Labour	Other Labour	Plant Capacity	Credit or Finance	Materials or Components	Other

46-52

15 What factors are likely to limit your ability to obtain EXPORT ORDERS over the next four months. *Please tick the most important factor or factors. If you tick more than one factor if would be helpful if you could rank them in order of importance*

Prices (compared with overseas competitors)	Delivery Dates (compared with overseas competitors)	Credit or Finance	Quotas & Import Licence Restrictions	Political or Economic Conditions Abroad	Other

53-58

16 a. In relation to expected demand over the next twelve months is your present fixed capacity:

More than adequate	adequate	less than adequate

59

b. What are the main reasons for any expected CAPITAL EXPENDITURE AUTHORISATIONS ON BUILDINGS, PLANT OR MACHINERY over the next twelve months. *If you tick more than one factor it would be helpful if you could rank them in order of importance.*

to expand capacity	☐ 60	other *(please specify)*	☐ 63
to increase efficiency	☐ 61	N/A	☐ 64
for replacement	☐ 62		

c. What factors are likely to limit (wholly or partly) your capital expenditure authorisations over the next twelve months. *If you tick more than one factor it would be helpful if you could rank them in order of importance.*

Inadequate net return on proposed investment	☐ 65	Uncertainty about demand	☐ 69
Shortage of internal finance	☐ 66	Shortage of labour including Managerial and Technical Staff	☐ 70
Inability to raise external finance	☐ 67	Other *(please specify)*	☐ 71
Cost of finance	☐ 68	N/A	☐ 72

Please enter here the code number of the main manufacturing activity covered by this return (See Standard Industrial Classification circulated previously). ☐ 73-76

How many EMPLOYEES are covered by this return

(a) 0 – 199 ☐ **(b) 200 – 499** ☐ **(c) 500 – 4,999** ☐ **(d) 5,000 and over** ☐ 77

What is the annual ex-works value of your direct EXPORTS

Nil – £75th	£75th – £1m	£1m – £3m	£3m – £8m	£8m – £15m	£15m – £25m	£25m – £40m	£40m – £60m	£60m – £100m	£100m – £150m	Over £150m
0	1	2	3	4	5	6	7	8	9	10

78

Signature ....

Company **(Block Capitals)** ....

Address ....

Note: **If you wish your reply to remain anonymous, please detach this slip and return it under separate cover**

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