
BANK OF FINLAND DISCUSSION PAPERS

21/94

Mika Kuismanen — Mikko Spolander

Economics Department
9.12.1994

Measuring Inflation Expectations in Finland — A Survey Data Approach

Suomen Pankki
Bank of Finland
P.O.Box 160, SF-00101 HELSINKI, Finland
☎ + 358 0 1831

Mika Kuismanen — Mikko Spolander

Economics Department

9.12.1994

**Measuring Inflation Expectations in Finland
— A Survey Data Approach**

ISBN 951-686-433-3
ISSN 0785-3572

Suomen Pankin monistuskeskus
Helsinki 1994

Abstract

This paper gives a short overview of how inflation expectations are measured in Finland and considers the possibilities of using such data to predict actual inflation.

In Finland, there are three regularly published surveys, which include questions on ex post perceptions and/or ex ante expectations of the direction of change in the general price level or in the inflation rate. They are conducted by Statistics Finland (TK), the Confederation of Finnish Industry and Employers (TT) and the newspaper Helsingin Sanomat (HS).

In the TK data expectations match realized rates of inflation quite well but the time series is too short. In the TT data the time series is long enough but the match between expectations and realized rates is poor. In HS data the match is quite good and the time series covers more than one business cycle.

According to the correlation analysis, it seems that the TK data and the HS data could be used to form some kind of estimate of the future rate of consumer price inflation. By contrast, the TT data is probably better for predicting wholesale, producer or export price inflation.

Although the HS data seems to offer us the best modelling possibilities, it is not very useful as a single exogenous variable in explaining realized rates of inflation. The small number of observations alone limits the use of advanced econometric methods and several exogenous variables. With the accumulation of more observations over time, however, we will be able to expand the model and the use of alternative data. For particular, the TK data seems quite promising.

Tiivistelmä

Selvityksessä esitellään lyhyesti suomalaisten inflaatio-odotuksia säännöllisesti mittaavat kyselyaineistot ja tarkastellaan niiden käyttömahdollisuuksia kuluttajahintainflaation ennustamisessa.

Suomessa julkaistaan säännöllisesti kolme kyselyä, joissa kysytään vastaajien käsitystä toteutuneesta ja/tai toteutuvasta hintatason tai inflaatiiovauhdin muutoksesta. Kyselyjä tekevät Tilastokeskus (TK), Teollisuuden ja työnantajain keskusliitto (TT) ja Helsingin Sanomat (HS).

Tilastokeskuksen mittaamat odotukset ennakoivat toteutuvat inflaatiiovauhdin muutokset melko hyvin, mutta aineisto on kovin lyhyt. Teollisuuden ja työnantajain aineisto on riittävän pitkä, mutta odotukset eivät näytä heijastavan toteutuvaa kuluttajahintainflaatiota. Helsingin Sanomien mittaamat odotukset tavoittavat toteutuvan inflaation varsin hyvin ja aikasarja kattaa yhtä suhdannekiertoa pitemmän ajan.

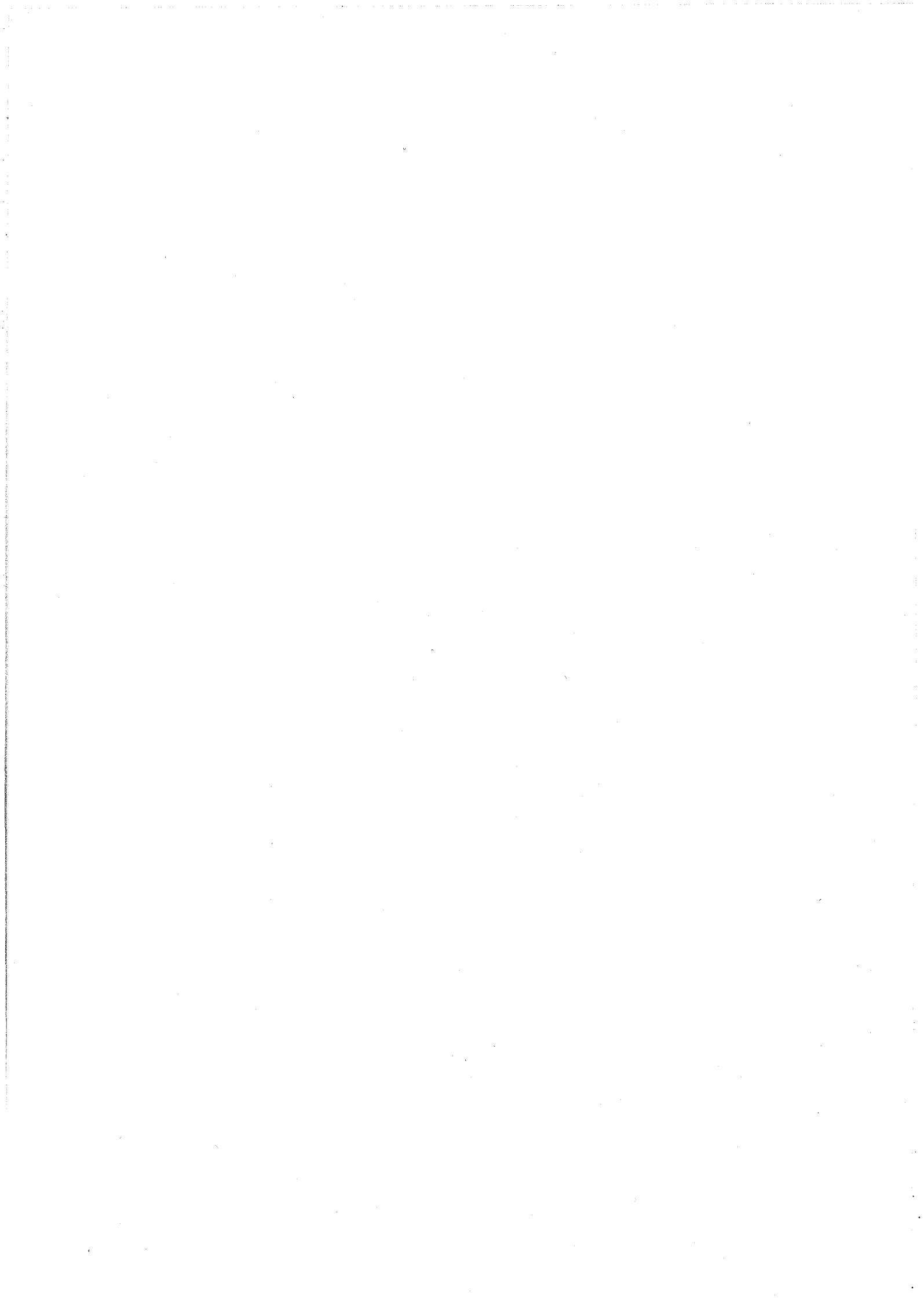
Korrelaatioanalyysin perusteella TK:n ja HS:n aineistot näyttävät käyttökelpoisilta ennustettaessa kuluttajahintainflaatiota. Sen sijaan TT:n aineisto ennakoinee pikemminkin tukku-, tuottaja- tai vientihintainflaatiota.

Vaikka HS:n mittaamat odotukset näyttävät tarjoavan parhaat mahdollisuudet ekonometriseen työhön, ne eivät yksinään ole kovin käyttökelpoinen inflaation selittäjä. Havaintojen vähäinen määrä rajoittaa vaativampien ekonometristen menetelmien ja useampien selittävien muuttujien käyttöä. Ajan myötä havaintoja kertyy kuitenkin lisää, jolloin mallia ja vaihtoehtoisten aineistojen käyttöä voidaan laajentaa. Erityisesti TK:n aineisto näyttää lupaavalta.



Contents

	page
Abstract	3
1 Introduction	7
2 Using Survey Data — Some General Discussion	7
3 The Finnish Survey Data	9
4 Qualitative Analysis	13
5 Quantitative Analysis	17
6 Concluding comments	23
Appendix	24
References	29



1 Introduction

In economic theory the question of how expectations are formed has long been seen as crucial for understanding how the economy works. The inflationary experience of many countries over the past decade has also underlined the importance of expectations. As a result, inflation analysis has increasingly focused on the role of expectations in inflation dynamics as well as on the methods of testing the formulation of these expectations.

Low and stable inflation is widely considered to increase the credibility of monetary policy and to promote favourable developments in the real economy. A floating markka and an explicit inflation target have emphasized the importance of inflation analysis in Finland. For this reason, much attention has been paid to policy implications and transmission mechanisms in connection with inflation expectations. This paper continues these efforts.

We do not explicitly test the formation of economic agents' expectations, that is, whether they are rational or adaptive. That would be the next step. Instead, we give a short overview of how inflation expectations are measured in Finland and we look at whether there are any possibilities of using that information to predict actual inflation.

In section 2 we run through some of the general pros and cons of using survey data in analysing inflation expectations. In section 3 we introduce the survey data used in this study. Section 4 includes some qualitative analysis, and section 5 reports on some simple modelling exercises in quantitative analysis of expectations in the inflation process. Section 6 includes concluding comments and some proposals for further research.

2 Using Survey Data — Some General Discussion

In principle there are two methods of testing expectations hypotheses. In the indirect method we choose an economic model including expectations as variables and make certain assumptions about how these expectations are formed. The expectations hypothesis and a specific economic theory underlying the model are then tested together empirically. The problem, however, is that if the test tells us to reject e.g. the rational expectations hypothesis, we cannot tell whether we should reject rational expectations as such or only in the context of the assumed model.

In the direct method we use observed expectations. The different expectations hypotheses impose different restrictions on the observed expectations. Those restrictions are tested to see if they are valid for the particular set of expectations data. We do not need to specify an underlying model.

In most of the studies the data are taken from an opinion survey. The respondent (e.g. firm, consumer, household, expert) is asked about his expectations concerning, for example, the price level in a future period.

Opinion surveys can be divided into three:

- 1) Those providing categorical observations, e.g. "prices go up/prices go down/prices remain unchanged/don't know.
- 2) Those providing quantitative interval estimates, e.g. prices go up 4–6 per cent.
- 3) Those providing point estimates, e.g. prices go up 5.6 per cent.

Our data belong to the first and second categories.

The use of survey data in studying the inflation expectations of firms, households/consumers or experts has been widely questioned. A serious objection to the use of direct observations of expectations in empirical studies is the risk of errors in variables.

One related factor is the possibility of misunderstanding the question. The respondents being asked the direction of the change in the price level may answer whether they expect the rate of inflation to increase, decrease or remain unchanged. Another factor is whether the answers represent those expectations the economic agents actually act upon. We cannot know for certain whether the respondent gives us those expectations he actually has in mind when making his everyday economic decisions. The true expectations are revealed only in economic transactions. The third factor concerns especially firms' expectations. When interpreting the results it is important to realize that reported anticipations may not concern true expectations but rather plans (Svendsen 1993). For example, price setters tend to make plans while price takers form expectations. Price setters know to some extent what is going to happen while price takers can only expect what the price setters are going to decide and what is going to happen as a result of these decisions. The point is that these plans necessarily satisfy the properties of rationality whereas expectations may not.

Using categorical data or interval estimates raise particular problems if one wants to transform the qualitative data into point estimates before the modelling or the tests are carried out. The most frequently used methods of transforming categorical observations into point estimates (Carlson and Parkin 1975, Pesaran 1984, 1987) require heavy aggregation. It is by no means obvious that conclusions drawn from aggregate-level tests hold on the disaggregate household/consumer level. This problem can be avoided by using cross-sectional data (König and Nerlove and Oudiz 1981). Unfortunately, the rational expectations hypothesis cannot be thoroughly tested with cross-sectional data (for details see Svendsen 1993).

Finally, the so-called "peso problem" may cause some complications when ex ante inflation expectations data are used in modelling and hypothesis testing (Jonung and Laidler 1988). The "peso problem" arises when over a sequence of periods there is a positive probability of the occurrence of an event which, if it occurred, would significantly affect the course of the variable to be predicted. This probability will certainly influence respondents' ex ante expectations and could cause the expectations to differ systematically from the realized ex post observations as long as the prescribed event failed to occur. As a result the error terms are serially correlated and the model or test can be neither accepted nor rejected.

3 The Finnish Survey Data

In Finland, there are three regularly published surveys¹, which include questions on ex post perceptions and/or ex ante expectations of the direction of change in the general price level or in the inflation rate. They are conducted by Statistics Finland (Tilastokeskus, TK), the Confederation of Finnish Industry and Employers (Teollisuuden ja Työnantajain Keskusliitto, TT) and the newspaper Helsingin Sanomat (HS). In all of these surveys the respondent, a firm or a household/consumer, is asked about his perception or expectation concerning the direction of the change in the phenomenon under consideration for some past or future period of time. Statistics Finland has also asked respondents to give quantitative interval estimates.

Consumer barometer of Statistics Finland

The questionnaire used by Statistics Finland in monitoring inflation perceptions and expectations can be seen in table 1. The questions have been constructed to be as general as possible — for use irrespective of whether the price level increases or decreases. Furthermore, information on the actual movements of the price level is not given in order to avoid any guidance of respondents or scaling of their answers.

Table 1

Statistics Finland Questionnaire

Q1: How do you think prices of goods and services in Finland have developed over the last 12 months?

Do you think prices are higher, as high or lower than a year ago?

a lot higher	1
a little higher	2
about the same	3 → Q3
a little lower	4
a lot lower	5
don't know	6 → Q3

Q2: How many per cent higher/lower than a year ago:

1-2 %	1
3-4 %	2
5-6 %	3
7-8 %	4
9-10 %	5
11 % or more	6
don't know	9

¹ One of our commercial banks, Kansallis-Osake-Pankki, has been conducting a survey since 1990, irregularly once or twice a year. In this survey, approximately 400 financial controllers are asked about their point estimate for the rate of inflation over the next 12-months.

Q3: How do you expect prices of goods and services in Finland to change over the next 12 months?

Do you think prices will be higher, as high or lower than now?

a lot higher	1
a little higher	2
about the same	3 → Q5
a little lower	4
a lot lower	5
don't know	6 → Q5

Q4: How many per cent higher/lower than now:

1-2 %	1
3-4 %	2
5-6 %	3
7-8 %	4
9-10 %	5
11 % or more	6
don't know	9

Source: Statistics Finland

The questionnaire consists of four questions. First, a respondent is asked qualitatively whether the level of consumer prices now, compared to 12 months earlier, is much higher, somewhat higher, much lower, somewhat lower or the same. Second, he is asked to be more specific, that is, he is given a limited number of intervals in percentage points and is asked to choose the interval which includes, in his opinion, the actual rate of inflation (or deflation) for the past 12 months. Questions 3 and 4 are constructed in the same way as questions 1 and 2 except that the respondent is now asked to look at consumer price development over the coming 12 months. If the respondent thinks that the price level has not changed (question 1) or will not change (question 3) he is not asked for further specification (in questions 2 and 4).²

After the proportions of respondents in each category (much or somewhat higher, no change, much or somewhat lower, don't know) in questions 1 and 3 are known, a weighted balance is calculated. The categories much higher and much lower are respectively weighted +1 and -1, the categories somewhat higher and somewhat lower $+\frac{1}{2}$ and $-\frac{1}{2}$, and the categories no change and don't know are both weighted zero. This balance figure describing the perceived or expected changes in the level of consumer prices is available to the public. The intervals data from questions 2 and 4 have never been published because of the lack of a commonly acceptable and watertight method of transforming qualitative estimates into quantitative point estimate.

² A "no change" -answer does not necessarily mean an exact zero rate of inflation. Normally, those respondents who have answered "no change" give, when asked to specify, an inflation rate estimate between ± 1 per cent. If asked, these individual estimates would affect the aggregated overall estimate quite noticeably, especially at times when the actual rate of inflation is low and the share of "no change" answers is large.

The respondents are asked to estimate the direction of change in consumer prices. Although the index is not explained precisely it would seem rational to assume that the given estimates refer to the development of the consumer price index (CPI) calculated and published by Statistics Finland.

This raises the question whether respondents really think of the official CPI when they give an estimate of perceptions or expectations. Clearly, the structure of a respondent's consumption may differ dramatically from that of the official CPI. On average, the expected value of the difference (or the error) between the individual and official consumption structure is assumed to be zero. However, if the base year of the CPI has not been changed recently it is possible that the average consumption structure of the population differs ultimately from that of the CPI and that systematic estimation errors occur. In this situation the respondent acts according to the actual rate of inflation which is not measured correctly by the official CPI.

The first survey was carried out in November 1987. Up to May 1991 the surveys were conducted semiannually, in May and November. Since August 1991 the surveys have been conducted quarterly, in February, May, August and November. In May 1994 the questionnaire was experimentally changed. One-half of the respondents had exactly the same questions as before. The other half were asked for a point estimate of perceived and expected 12-month percentage change in the rate of inflation, instead of having to choose between different inflation intervals. Because Statistics Finland has decided to do at least one more test survey using a somewhat different questionnaire and because we would only have two observations at hand in any case, we will concentrate on the data received according to the original questionnaire, November 1987 – May 1994.

Business cycle barometer of the Confederation of Finnish Industry and Employers

The questionnaire of the Confederation of Finnish Industry and Employers has two questions concerning future price developments. First, a respondent in a manufacturing firm is asked qualitatively whether he expects the rise in the general price level (inflation) to speed up, remain unchanged or slow down in the next quarter (Q+1) compared to the current quarter (Q). Second, he is asked the same question concerning the following quarter (Q+2) compared to quarter Q+1. To clarify, the respondent is asked whether he expects the change in the inflation rate to be positive, zero or negative from quarter Q to Q+1 and from Q+1 to Q+2. The "don't know" response is not allowed.

After the shares of the respondents in each category (speed up, no change, slow down) are known, a weighted balance is calculated. The speed up, no change and slow down categories get the respective weights of +1, 0 and -1. This balance figure describing the expected changes in the rate of inflation is publicly available.

This method of monitoring inflation expectations has two major drawbacks which may cause misunderstandings and severely reduce the reliability and usefulness of the data.

First, as the underlying price index is not explicitly defined we cannot know what the respondent's reference price index is. Although the questioner has the official consumer price index in mind in forming the questions, it is not at all

obvious that the respondent has the same index in mind when answering the questions. The respondent fills out the questionnaire as a part of his job and is presumably acting as a planner or a business-man, not as a consumer. He might think only of prices that are important in his sector. In the case of a manufacturing firm this might mean producer prices, wholesale prices or export prices and the respective indices (tthi, thi, vhi).

Second, the questions do not tell the respondent what the underlying period is to which the rate of inflation is referring. This means that the respondent can choose the period, e.g. quarter-on-quarter or year-on-year inflation. As a consequence, the interpretations of the questions and, hence, the chosen periods will most certainly differ among the individual respondents. Because the questions are open to various interpretations we cannot draw any firm conclusions whatsoever concerning the change in the overall rate of inflation.

The obscurity of the reference period and reference index discussed above make the use of this business survey data questionable. Despite the words of warning by the questioner the results of these questions are reported and referred to quite carelessly.

The first business survey to include questions on inflation expectations was carried out in September 1984. These surveys have been conducted quarterly in March, June, September and December. The sample includes approximately 530 respondents representing the main manufacturing and construction industries. Nearly 140 similar surveys are conducted in over 50 countries. In the area of the European Union the questionnaires have been harmonized and summarized results are published regularly.

In May 1994 the questionnaire was changed. The respondent was asked whether he expects the rise in the rate of inflation measured by the consumer prices to be higher, the same or lower in the next quarter (Q+1) compared to the present quarter (Q) and in the corresponding quarter of the following year (Q+4) compared to the present quarter (Q). Information on the actual year-on-year rate of inflation in the present period was also delivered to the respondent. As can be seen, the first part of the new question is unchanged (see above) and for that part there is no break in the time series. The new question emphasizes the desired reference index (consumer prices) and the reference period for the inflation rate (year-on-year) reducing the problems attached to the previous question discussed above. However, because we would only have one observation at hand in any case, we concentrate on the data received with the original questionnaire between September 1984 and December 1993.

Helsingin Sanomat consumer index

The questionnaire of the newspaper Helsingin Sanomat has one question on future price developments. The respondent is asked, in qualitative terms, whether he expects prices to increase, remain the same or decrease during the coming 6 months. "Don't know" responses are also allowed. No balance figures are publicly reported but the shares of the respondents answering increase, no change, decrease or don't know are provided on request.

The problem of reference price index is obvious but not as serious as in the case of business surveys because respondents are consumers with a structure of

consumption on average similar to the official consumer price index (see discussion above). The problem of transforming the qualitative answers into quantitative point estimates however remains.

The first such survey was conducted in May 1980. Since January 1981 they have been conducted about once in each half-year. The interval between successive surveys has not always been exactly six months³. The time series can however be considered semiannual.

4 Qualitative Analysis

Before we discuss the results of the descriptive qualitative analysis and econometric modelling, a few words of warning concerning the quality of the available data seem appropriate.

If we want to make reliable qualitative interpretations based on the use of survey data we ought to have a time series long enough to include at least one complete business cycle. The HS time series (semiannual 1980–1994) meets this criterion. The TT time series (quarterly 1984–1994) is long enough but has many deficiencies which may cause fuzzy interpretations (see above). The TK time series (semiannual 1987–1991, quarterly 1991–1994) is too short and the change of the questioning period reduces the usefulness of the data further.

For econometric analysis the situation is even worse. The TK time series has 14 semiannual or 13 quarterly observations, the HS time series 29 semiannual observations and the TT time series 38 quarterly observations. Furthermore, analysing realized expectations and shifting the time series forward accordingly results in the loss of one or three observations from the HS and TK time series, respectively. Therefore, drawing strong conclusions would seem very courageous. All in all the available data do not allow us to draw very effective methods.

Synchronizing the time periods

In order to see how good the respondents are at forecasting future rates of inflation, we have synchronized the realized and expected time series data. The expected rate of inflation (or the percentage balance figure) for a certain time period should be compared with the realized inflation rate for the same period. This means that the expectations time series have to be moved forward to match the realized time series. The comparison and forward shift have to be done according to the expectations period (6 or 12 months) determined in the particular question.

For example, if a respondent is asked how many per cent consumer prices are going to change during the coming 12 months, we have to compare his answer with the realized year-on-year rate of inflation 12 months later. In the TK data the expected year-on-year rate of inflation (actually the up/down balance) for May

³ HS consumer index surveys have been carried out 29 times as follows: May 1980; January, June 1981–1984; January, June, December 1985; June 1986; January, June, December 1987; May, November 1988–1993; May 1994.

1993 is asked in May 1992. The realized year-on-year inflation rate is calculated for the same 12-month period, i.e. from May 1992 to May 1993. In the HS data the expected 6-month inflation rate (actually the up/down balance) for December 1983 is asked in June 1983. The realized 6-month inflation rate is calculated for the same 6-month period, i.e. from June 1983 to December 1983.

Levels, rates or point estimates?

We are naturally interested in the difference between expected and realized figures, i.e. the expectations errors. The surveys ask respondents about the perceived or expected development in the price level, not in the rate of inflation (see above). If we look at the realized 6- or 12-month changes in the price level, we can see that these changes have been neither negative nor near to zero in any month (except December 1967) between mid-1961 and end-1993. Therefore, when a respondent is asked whether he expects consumer prices (the general price level) to increase, decrease or remain unchanged during the coming 6 or 12 months he should always expect prices to increase.⁴ Every other answer seems either illogical or very daring because the respondent has not seen negative or zero 6- or 12-month changes in consumer prices in any month during the last 30 years or so.

The share of respondents expecting consumer prices to fall or remain unchanged during the coming 12 months varies from 11 to 67 per cent in the TK data. The corresponding share of respondents expecting prices to fall or remain unchanged during the next 6 months varies from 21 to 70 per cent in the HS data. Furthermore, it can be seen that the larger the share of respondents expecting consumer prices to fall or remain unchanged the smaller the realized rate of inflation (not deflation!) It seems obvious that some of the respondents have misunderstood the question. They have responded on the basis of whether they expect the rate of inflation to speed up, remain the same or slow down during the coming 6 or 12 months instead of relating their expectations for the coming changes in the level of consumer prices.

We do not, however, have to believe that the respondents have misunderstood the questions. We can always focus on the share of answers expecting the price level to increase. These are the respondents who have actually formed their expectations rationally given the data on realized price changes and other relevant information for the last 30 years.

It seems rational to expect that the share depends on how much higher the price level is expected to be on average, i.e. the larger the expected increase in price level the larger the number of respondents expecting higher and the smaller the number of respondents expecting a lower price level in the future. If the increase in the price level is expected to be larger than before, some of the respondents who have previously expected prices to decrease now expect them to remain unchanged, and some of respondents who have previously expected prices

⁴ Of course, in addition to the information on previous perceived changes in price level or the rate of inflation there are other factors which affect respondents when they form their expectations (information on economic events, education, attitudes, age, sex,...see Mankinen 1989). These factors, however, have favoured inflation rather than deflation during the past 30 years.

to remain unchanged now expect them to increase. And of course, if the increase in the price level is expected to be smaller than before, some of the respondents who have previously expected prices to increase now expect them to remain unchanged, and some of respondents who have previously expected prices to remain unchanged now expect them to decrease. Therefore, the number of respondents in each of these three categories depends on the relative size of the increase in price level, i.e. on the rate of inflation, and each share is connected with a certain rate of inflation.

The problem, however, is how to transform the qualitative shares into quantitative point estimates of the inflation rate. Carlson & Parkin (1975) and Pesaran (1984, 1987) have developed sophisticated methods for doing this. They are somewhat complicated and are not described here.

There are also more straightforward methods. The best possible fit between expected balance figures and realized inflation figures can be searched by matching the means and ranges of the particular time series. The long run average mean and amplitude of a time series (survey data) is altered according to the reference time series (6- or 12-month inflation rate), so that the differences (errors) are minimized over time (see charts below). In the case of the TK data we can also form a simple point estimate from the expected inflation rate intervals. Choosing the average inflation rate for each interval and the inclusion or exclusion of "don't know" responses is, however, somewhat arbitrary. In charts 2 and 4 in the appendix we have excluded all "don't know" responses and formed a point estimate by weighting together the mean points of intervals according to the relative share of respondents in each interval. A list of the symbols used can be found in the appendix.

A descriptive analysis

Let us look at the Statistics Finland TK data first. Charts 1,2,3 and 4 give the perceived and expected observations, the perceived and expected point estimates and the respective realized rates of inflation. As can be seen in charts 1 and 2 respondents' perceptions followed the trend in the realized rate of inflation quite closely from the start of the survey to mid-1992. After mid-1992 a large portion of the respondents has considered the consumer price level unchanged or decreasing even though the CPI increased on average 2.9 per cent in 1992 and 2.2 per cent in 1993. At the beginning of 1994 the 12-month percentage increase in CPI was at its lowest in 30 years. At the same time the number of respondents who felt that consumer prices were at a higher level than 12-months before has increased.

One possible explanation is the value added tax, which was introduced in June 1994. It seems that it was as late as in May 1994 as the respondents realized the VAT is going to increase the price level in the near future. Some of the respondents obviously mixed up the dates and thought that the VAT had already affected consumer prices. Studies in Finland and in other countries show that the respondents are normally quite well aware of recent economic events that have had or might have an effect on consumer prices. Hence, the low balance figures after mid-1992 seem unreasonable. The markka's depreciation since its devaluation in November 1991 and floating in September 1992 clearly affected consumer

prices and should have also affected respondents' perceptions concerning the rate of inflation during the past 12 months.

The effects of the VAT and markka devaluation can also be seen in the charts 3 and 4 showing the expectations. The VAT should have affected expectations already in August 1993 and not in May 1994 as seems to have been the case. The respondents have not been able to deal rationally with the possible effects of the VAT beforehand. After realizing the existence and magnitude of these effects they have, however, revised both their perceptions and their expectations.

The effect of the devaluation in November 1991 is interesting. The November 1991 survey was conducted just after the devaluation on the 15th of November. The possible effects of devaluation were the major issue in all the newspapers throughout the two-week questioning period. According to previous experience and the experts' forecasts, the respondents revised their expectations sharply from the previous survey. If we interpret charts 1 and 3 somewhat daringly, we can detect that the respondents expected the 12-month rate of inflation to speed up from the prevailing level of 3.5 per cent in November 1991 to the level of 5.5 per cent in November 1992. As they realized that the price development was going to be much more moderate they revised their expectations downward to the original level of the February 1992 survey. The floating of the markka did not have any special effect on respondents' expectations. All in all, the balance figures seem to follow the trend quite closely.

Charts 2 and 4 give the perceived and expected point estimates formed by excluding all "don't know" responses and weighting together the mean points of the inflation intervals according to the relative share of respondents in each interval. This method does not seem very promising. The perceived rates of inflation are always below the realized rates. The expected rates of inflation seem to be more stable than the realized rates. The high rates of the late 1980s are underestimated and the low rates of recent years are overestimated.

It is also interesting to look at the perceptions and expectations errors. It would seem that perception errors should be smaller than expectations errors as we normally have more information on the developments than on future developments. Looking at the balance and point estimate figures in charts 1 to 4, we see that expectations have caught the realized rates more effectively than have perceptions, especially during the past few years. Furthermore, we can see that the matched balances move more closely than the point estimates with the realized rates. Matching the means and ranges of the balance figures would seem to be a more effective way of making use of this kind of qualitative data. Forming a point estimate out of the intervals of expected inflation rates requires too much ad hoc discretion to be acceptable.

Charts 5 to 8 give the Confederation of Finnish Industry and Employers expectations data matched with realized rates of inflation. The problems regarding the TT data have already been discussed above. As the underlying reference price index has not been explicitly defined, we assume it to be the consumer price index, for the time being. Furthermore, as the underlying reference period to which the rate of inflation refers was not mentioned at all in the questionnaire, we use both quarter-on-quarter and year-on-year rates of inflation (khi1, khi4). The balance figures reflect expectations for the next versus the current quarter (tt1q1) and the quarter after next versus the next quarter (tt1q2). The list of symbols used can be found in the appendix.

The TT data does not seem very promising. Although the fluctuations in the balance figure series match the seasonal variations in the quarter-on-quarter realized rates of inflation to some extent, the match weakens considerably as we move further into the quarter following the next quarter. The expectations errors increase markedly between the next quarter and the following quarter. The same is also true when we match year-on-year realized rates of inflation with expectations. For the 1990s the match is especially poor. The responding firms have expected inflation to burst out at any moment. They have had great difficulty in adapting themselves to diminishing rates of inflation.

One reason might be the depreciation of markka, which disturbed the TK data balance figures above. Furthermore, if we look at the TT data, firms seem to have consistently stronger inflationary expectations than consumers in the TK data. On the other hand, respondents in firms might not think of consumer prices but rather wholesale, producer or export prices when filling in the questionnaire. If we consider the various deficiencies and the limited forecasting power of the TT data balance figures, the usefulness of the data seems questionable.

In the charts 9 and 10 we have matched the balance of the 6-month expectations (hsind1) and the share of upward 6-month expectations (hsind2) of the newspaper Helsingin Sanomat together with the realized 6-month percentage change in consumer price index (6khi). As we see, the HS data catches the stochastic trends and the turning points quite well. There are two major expectation errors, the first in January 1982 and the second in November 1991. The reason for the January 1982 expectation error being realized in July 1982 is unclear. The second error is due to the devaluation of the markka in November 1991. As in the case of Statistics Finland TK data, the respondents quickly revised their expectations after realizing that inflation was actually not speeding up.

If we consider the available survey data, the HS data seems most useful. In the TK data expectations match with realized rates of inflation quite well but the time series is too short. In the TT data the time series is long enough but the match between expectations and realized rates is poor. In HS data the match is quite good and the time series covers more than one business cycle. A descriptive analysis alone does not, however, allow us to accept or reject any data. For that we need some quantitative analysis.

5 Quantitative Analysis

Correlation analysis

The correlation coefficients between the variables used are shown in table 2. From them we can see whether there is any connection between the balance figures and the rates of inflation, i.e. whether high balance figures are associated with high rates of inflation or vice versa. We have also tested whether the correlations are statistically significant. Our null hypothesis is that the correlation coefficients are zero, i.e. the size of the balance figure has nothing to do with the rate of inflation.

Table 2

Correlations between variables used $H_0: \text{corr}(x,y) = 0$ $H_1: \text{corr}(x,y) > 0$ **Statistics Finland TK data:**

perceived rate of inflation (n=20)

	12khia	t-test
tkia1	0.8729	7.5905***
tkia2	0.8451	6.7067***
tkia3	0.8866	8.1324***

	12khia	t-test
tkib1	0.7775	5.2453***
tkib2	0.7793	5.2761***
tkib3	0.7947	5.5546***

	tkia1	tkia2	tkia3	t-test
tkib1	0.9211			10.0376***
tkib2		0.9278		10.5509***
tkib3			0.9363	11.3109***

expected rate of inflation (n=17)

	12khib	t-test
tkib1	0.8944	7.7448***
tkib2	0.9033	8.1548***
tkib3	0.9088	8.4360***

The Confederation of Finnish Industry and Employers TT data:

expected rate of inflation (n=38)

	khi1	thi1	tthi1	vhi1
tt1q1	0.3831	0.5158	0.5020	0.4792
t-test	2.4885**	3.6124***	3.4826***	3.2758**
tt1q2	0.0527	0.1388	0.2855	0.1273
t-test	0.3166	0.8409	1.7874*	0.7701
tt1q1	0.1391	0.3854	0.4538	0.4986
t-test	0.8428	2.5060**	3.0555**	3.4512***
tt1q2	-0.0251	0.4215	0.4589	0.4576
t-test	-0.1506	2.7888**	3.0990**	3.0879**

The newspaper Helsingin Sanomat HS data:

expected rate of inflation (n=28)

	6khi	t-testi
hsind1	0.5376	3.2510**
hsind2	0.5602	3.4484***

As can be seen the correlation coefficients between various TK and HS balance figures and the respective rates of inflation are quite high and statistically very significant. In case of TT data the situation is unclear.

Let us look at the TK and HS data more closely. We have calculated the correlation coefficients for the weighted and unweighted balances and for the share of upward perceptions and expectations. First, we notice that the correlation coefficients are somewhat higher in the case of the share of pure upward answers (tkia3, tkib3, hsind2) than in the case of weighted or unweighted balances (tkia1, tkia2, tkib1, tkib2, hsind1). In other words, excluding "wrong answers" from the data gives us better perceptions and expectations. Although the difference is very small and hardly significant statistically, the share of pure upward answers as an explanatory variable did explain the rate of inflation better than the weighted or unweighted balance figures.

Second, the correlation coefficients between the balance figures for expectations (tkib1-2-3) and both the balance figures for perceptions (tkia1-2-3) and the realized rate of inflation for perceptions (12khia) are significant. This means that perhaps the most important factor behind a respondent's inflation expectation is his perception concerning the realized rate of inflation in the near past. This result is not surprising, as it has been confirmed in many studies (see e.g. Mankinen 1989, Jonung 1990, Svendsen 1993).

The results from TT data are not as promising. According to the correlations between balance figures and realized inflation rates for various price indices, the responding firms do not seem to form an expectation for consumer prices but rather for wholesale, producer or export prices. Only between the quarter-on-quarter consumer price inflation (khi1) and next quarter expectations (tt1q1) is there any statistically significant correlation. Other correlations between balance figures and realized consumer price inflation are actually nonexistent.

According to the correlation analysis the TK data of Statistics Finland and the HS data of the newspaper Helsingin Sanomat seem to be usable in forming some kind of estimate of the future rate of consumer price inflation. The TT data of the Confederation of Finnish Industry and Employers might be usable if we were interested in forming an estimate of wholesale, producer or export price inflation.

Coin beats the survey data

Next we look at the forecasting ability of the available survey data. The objective of the following test is to find out how good the respondents are at predicting the direction of the change in the inflation rate. We have assumed that high balance figures are connected with high inflation rates. Therefore, if the balance figure increases, the respondents expect that the inflation rate is also going to increase. Of course, they might predict right or wrong. We can test statistically whether the respondents ability to predict right is significantly different from pure chance. To get a standard measure, the probability of the right direction of change can be compared with the probability of getting a right direction by simply tossing a coin. The results are shown in table 3.

Table 3

The probability of predicting the direction of change (up/down) in the inflation rate as compared with tossing a coin

$$H_0: p(\text{right}) = 0.5$$

$$H_1: p(\text{right}) > 0.5$$

Statistics Finland TK data:

perceived rate of inflation (n = 19)

	12khia	z-test
tkia1	0.63	1.1471
tkia2	0.63	1.1471
tkia3	0.68	1.6059

expected rate of inflation (n = 16)

	12khib	z-test
tkib1	0.56	0.5000
tkib2	0.56	0.5000
tkib3	0.63	1.0000

The Confederation of Finnish Industry and Employers TT data:

expected rate of inflation (n = 38)

	khi1	thi1	tthi1	vhi1
tt1q1	0.55	0.58	0.58	0.45
z-test	0.6489	0.9733	0.9733	-0.6489
tt1q2	0.47	0.47	0.50	0.45
z-test	-0.3244	-0.3244	0.0000	-0.6489
	khi4	thi4	tthi4	vhi4
tt1q1	0.61	0.74	0.66	0.58
z-test	1.2978	2.9200**	1.9467*	0.9733
tt1q2	0.47	0.61	0.53	0.42
z-test	-0.3244	1.2978	0.3244	-0.9733

The newspaper Helsingin Sanomat HS data:

expected rate of inflation (n = 27)

	6khi	z-test
hsind1	0.56	0.5774
hsind2	0.63	1.3472

All in all, the coin beats the respondents' predictions. Only in the case of the TT data of the Confederation of Finnish Industry and Employers did the respondents manage to beat the coin in forecasting the direction of change in wholesale and producer prices in the next quarter. If we look at the probabilities more closely we can see that the pure share of upward answers hit the nail on the head more often than the various balance figures. This is not surprising as we know that shares of upward answers correlate better with inflation rates than balance figures.

The model

Next we try to form a very simple model by regressing the 6-month percentage change in the consumer price index (6khi) on the share of upward answers in the HS data (hsind2). As a result of the preceding analysis the HS data seems to offer us the best modelling possibilities. The series are long enough and the correlation between the share of upward answers and rates of inflation is quite strong. Our goal is to explain how inflation expectations affect actual inflation. We expect a priori that if the exogenous variable rises, then the endogenous also rises. In other words, we expect a positive parameter value for expectations.

The data include 28 observations. The time period is 1980(2) to 1994(1) where the number in the parenthesis tells us the half year in question. The endogenous and exogenous variables are presented in chart 10.

First, we used a simple model, regressing inflation on the constant and the expected inflation. The results are shown in table 4.

Table 4 **Dependent variable: 6khi**

Variable	Coefficient	Std. Error
const.	-0.30137	0.95319
hsind2	0.06052	0.01986 *

$R^2 = 0.263$ $RSS = 35.442$ (for 2 variables and 28 observations)
 $DW = 0.583$ $F(1,26) = 9.2835$ [0.0055]

As we see the model is poor. The tests and graphical diagnostics (not shown) show that the residual is far from white noise. As a check, we recognize that the parameter value of expectations is positive.

Next, we seasonally adjusted the inflation series and ran the same model as above. The results were as poor as before.

From the chart 10 we see that after devaluation of the markka in November 1991 inflation expectations clearly rose. In the next regression we included the devaluation dummy variable and the deterministic dummy variable which captures seasonal variations. The results are shown in table 5.

Table 5 **Dependent variable: 6khi**

Variable	Coefficient	Std. Error
const.	3.2008	1.0080*
hsind2	0.1121	0.0216*
d	-4.6033	1.2970*
seas	1.2994	0.4161*

$R^2 = 0.625$ $RSS = 27.784$ (for 4 variables and 28 observations)
 $DW = 1.01$ $F(3,24) = 13.371$ [0.0000]

From table 5 we can see that all exogenous variables are statistically significant at the 5 per cent level and the signs of the parameters are as expected. R^2 is 0.63. Again the diagnostics look bad (both tests and graphics). There is serial correlation in the residuals and the fit is tolerable at best.

One might wonder why we did not include lagged dependent variables in the regression function. That leads inevitably to the better model if we look at the tests and fit of the model. The problem is that we are interested in how the expectations affect inflation. If we were to include lagged dependent variables in the model they would dominate very substantially and the other exogenous variables would become irrelevant. We decided to emphasize the role of expectations in the regression function. That decision is subject to criticism if one looks at the problem only from the statistical point of view.

One possible reason why the model does not work is the following. Let us view the problem in the two-dimensional space where inflation is measured on the vertical axis and expectations in percentage shares of upward answers is on the horizontal axis. Inflation is not a limited variable but expectations is. Expectations (as we have measured them) can vary from 0 to 100. The scatter plot between inflation and expectations tells us that as expectations approach the limit value of 100, the inflation rises sharply. So there is the possibility of nonlinearity between these variables.

In the next step we have transformed the dependent variable using the BOXCOX-transformation (for details, see Hamilton 1994). In other words, we calculated a likelihood function which tells us the optimal transformation parameter. The likelihood function is shown in chart 11 in the appendix. The result with the transformation was 0.5. This means that we should take the square root of the dependent variable. Technically speaking, it will linearize the relationship between these two variables. The problem now is how to interpret the model. In our understanding there is no straightforward economic interpretation, so one should not put too much weight on this technical exercise.

Estimation results from the transformed model are shown in table 6. The fit of the model can be seen in chart 12.

Table 6 **Dependent variable: $(6khi)^{0.5}$**

Variable	Coefficient	Std. Error
const.	-0.5667	0.3294
hsind2	0.0405	0.0070*
d	-1.5317	0.4239*
seas	0.4400	0.1360*

$R^2 = 0.663$ RSS = 2.9689 (for 4 variables and 28 observations)
 DW = 1.13 F(3, 24) = 15.706 [0.0000]

From table 6 we see that transformation of the dependent variable has only a minor effect on the explanatory power of the model. Adjusted R^2 is 0.663. All parameters other than the constant are statistically significant and they have the expected signs. Regression diagnostics also reject this model.

We have also tried to estimate models where we take differences in the variables, but the results were not very encouraging. We would like to underline that this exercise is just an introduction to this problem and is in no way the final step.

6 Concluding comments

As a result of the above analyses, we have come to the conclusion that none of the available survey data is very useful as a single exogenous variable in explaining realized rates of inflation. The small number of observations alone limits the use of advanced econometric methods and the number of exogenous variables. With time, we will hopefully acquire more observations and will be able to expand the model. Especially the TK data seems quite promising. Together with the balance figures, other macroeconomic variables can be included in the right hand side of the model. This will be the next step.

The relationship between survey balance figures and various price and earnings indices could be easily studied with the same kinds of methods. For example, when revealing the expectations of firms, the TT data together with the index of wage and salary earnings might give us some insight into the wage formation process. In this paper our objective, however, was limited to the study of the relationship between balance figures and consumer price inflation. We did look at the development of the underlying rate of inflation together with available survey data, but the results were not very encouraging.

Finally, we would like to give some practical advice to the survey planners. Because of their potential usefulness in monitoring expectations, surveys should be designed with care, paying attention to their ultimate use in economic research. Cukierman (1986) has listed some recommendations based on experience gained in using survey data in econometric work (see also Visco 1984).

- 1) The survey question should make it clear what is the precise measure of each economic phenomenon that is sought. Otherwise respondents may misunderstand the question and report individually different measures of that phenomenon.
- 2) A quantitative answer with no a priori suggestion should be sought to avoid the need for using some arbitrary interpolating assumptions. If, for some practical or other reason, answer intervals are suggested they should be reasonably detailed and the upper interval should not be open-ended.
- 3) To get symmetric information, questionnaires that are returned after new information on general price indices might have become available should be discarded.
- 4) Respondents could be asked directly about the information set they used in reaching their forecasts. This information could be used as a guide to studies on the formation of expectations.

Appendix

List of variables used:

- 12khia = consumer price index (1990=100), percentage change from the corresponding month of previous year, realized rate for perceptions
- 12khib = consumer price index (1990=100), percentage change from the corresponding month of previous year, realized rate for expectations
- tkia1 = weighted balance (upward-downward) for 12-month perceptions, TK data
- tkia2 = unweighted balance (upward-downward) for 12-month perceptions, TK data
- tkia3 = share of upward 12-month perceptions, TK data
- tkib1 = weighted balance (upward-downward) for 12-month expectations, TK data
- tkib2 = unweighted balance (upward-downward) for 12-month expectations, TK data
- tkib3 = share of upward 12-month expectations, TK data
- khi1 = consumer price index (1990=100), percentage change from previous quarter
- thi1 = wholesale price index (1990=100), percentage change from previous quarter
- tthi1 = producer price index for manufactured products (1990=100), percentage change from previous quarter
- vhi1 = export price index (1990=100), percentage change from previous quarter
- khi4 = consumer price index (1990=100), percentage change from corresponding quarter of previous year
- thi4 = wholesale price index (1990=100), percentage change from corresponding quarter of previous year
- tthi4 = producer price index for manufactured products (1990=100), percentage change from corresponding quarter of previous year
- vhi4 = export price index (1990=100), percentage change from corresponding quarter of previous year
- tt1q1 = balance (upward-downward) for quarter-on-quarter or year-on-year expectations q+1 vs q, TT data
- tt1q2 = balance (upward-downward) for quarter-on-quarter or year-on-year expectations q+2 vs q+1, TT data
- 6khi = consumer price index (1990=100), 6-month percentage change
- hsind1 = balance (upward-downward) 6-month expectations, HS data
- hsind2 = share of upward 6-month expectations, HS data

CHART 1 PERCEIVED vs REALIZED INFLATION
12-month percentage change

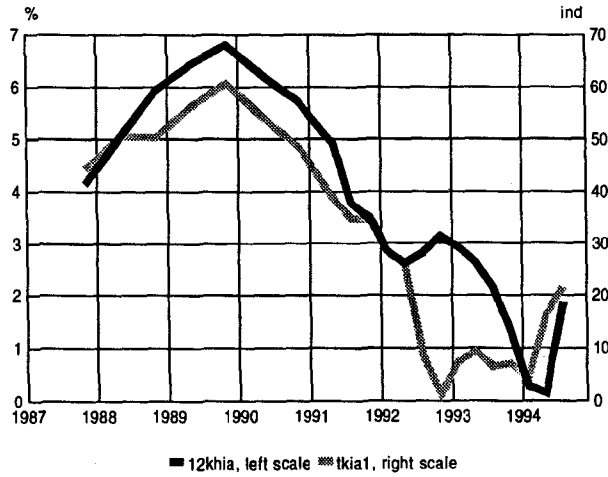


CHART 3 EXPECTED vs REALIZED INFLATION
12-month percentage change

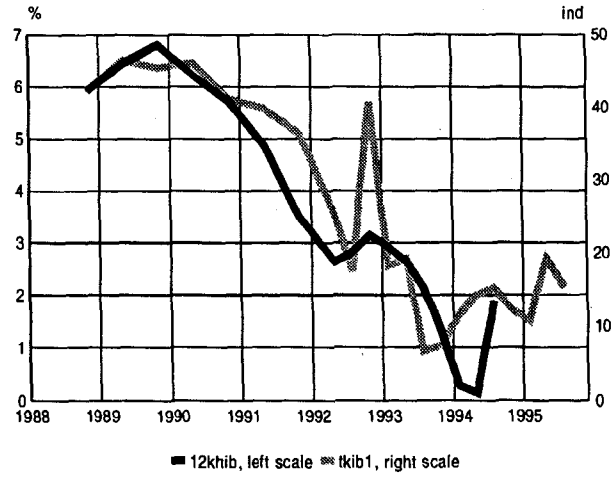


CHART 2 PERCEIVED vs REALIZED INFLATION
12-month percentage change

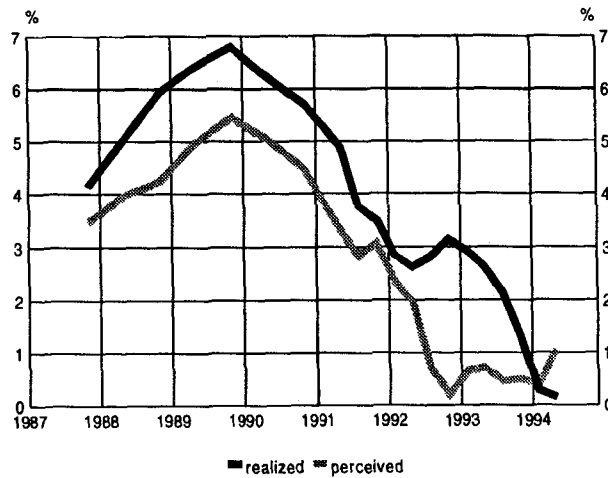


CHART 4 EXPECTED vs REALIZED INFLATION
12-month percentage change

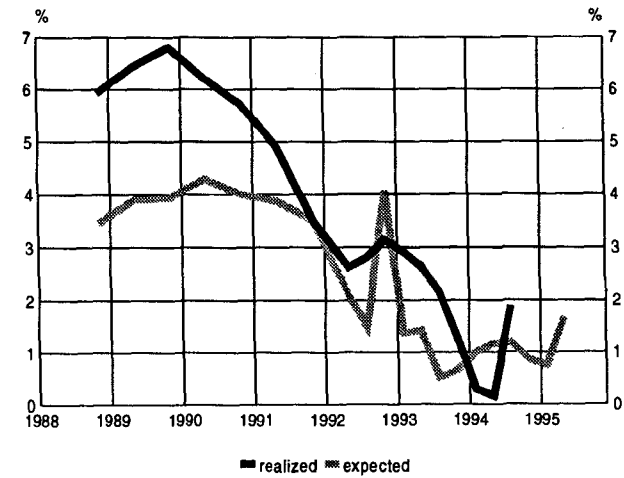


CHART 5 EXPECTED vs REALIZED INFLATION
Quarter-on-quarter percentage change

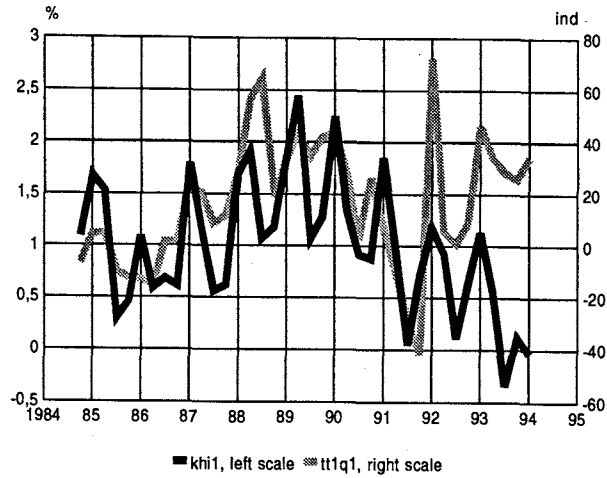


CHART 7 EXPECTED vs REALIZED INFLATION
Year-on-year percentage change

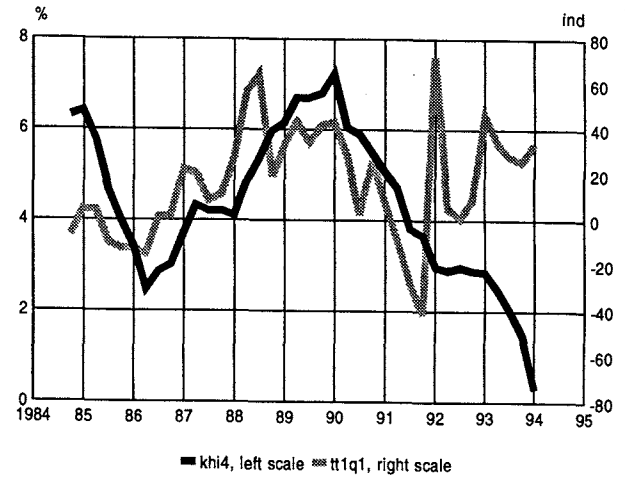


CHART 6 EXPECTED vs REALIZED INFLATION
Quarter-on-quarter percentage change

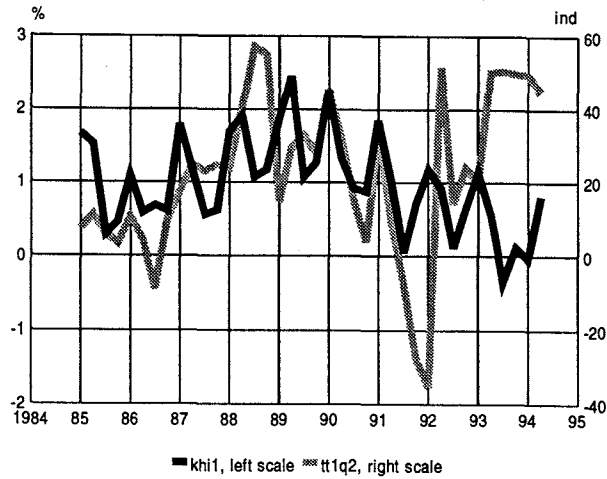


CHART 8 EXPECTED vs REALIZED INFLATION
Year-on-year percentage change

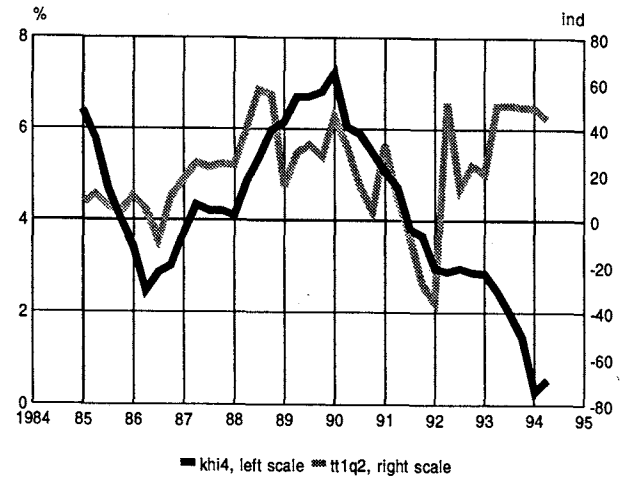


CHART 9 EXPECTED vs REALIZED INFLATION
6-month percentage change

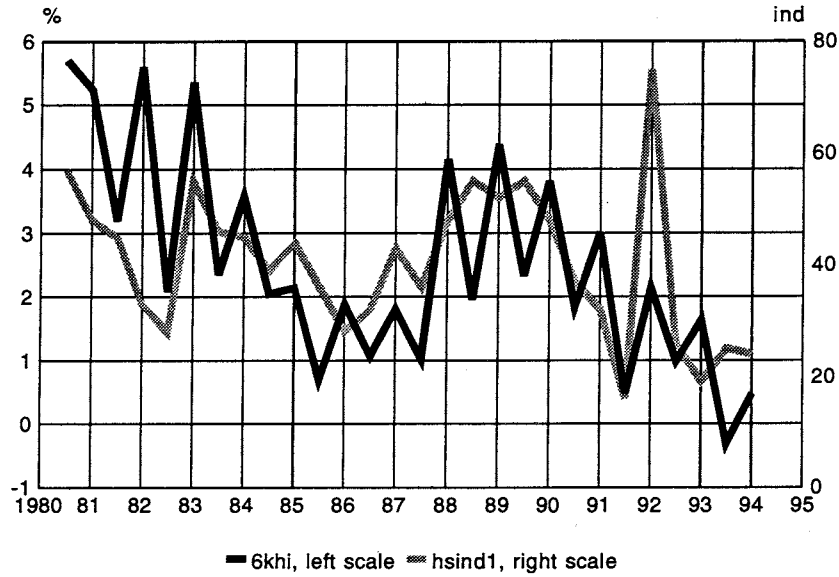


CHART 10 EXPECTED vs REALIZED INFLATION
6-month percentage change

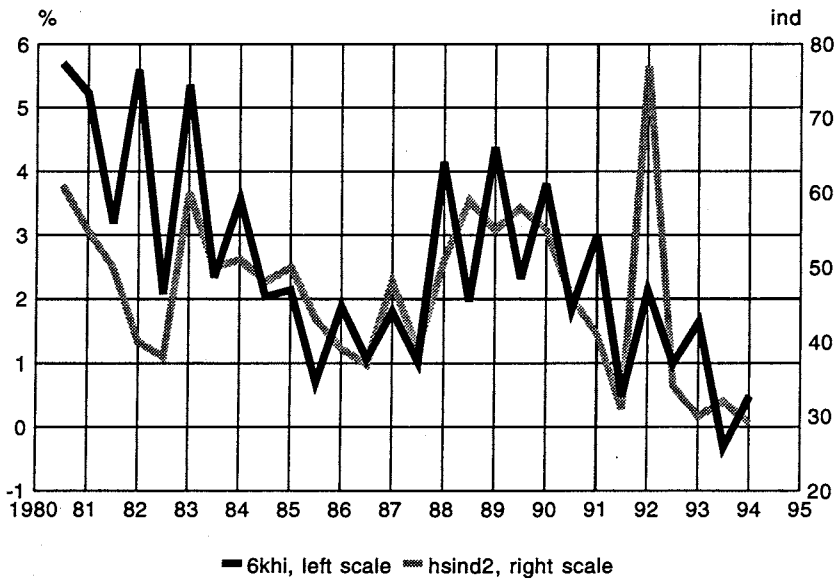


CHART 11 BOX-COX TRANSFORMATION FOR INFLATION

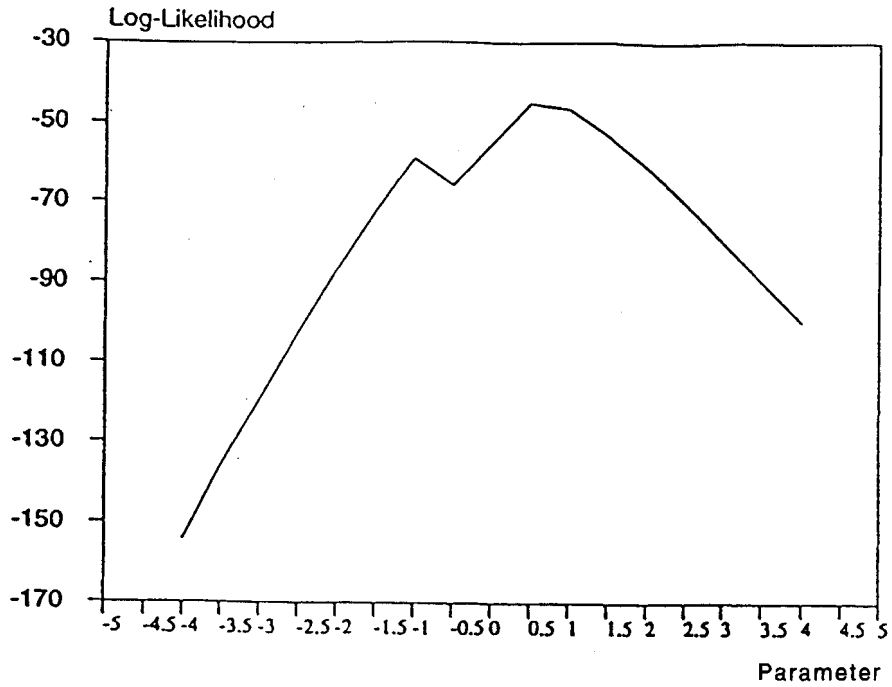
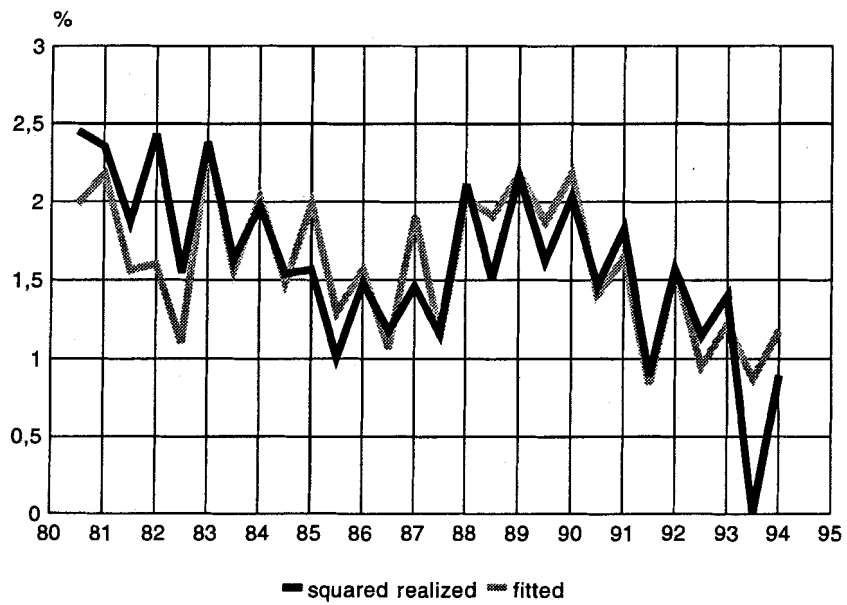


CHART 12 SQUARED REALIZED vs FITTED INFLATION



References

- Carlson, J.A and Parkin, M. (1975) **Inflation Expectations**. *Economica* 42, pp. 123–138.
- Cukierman, A. (1986) **Measuring Inflationary Expectations — A review Essay**. *Journal of Monetary Economics* 17, pp. 315–324.
- Hamilton, J.D. (1994) **Time Series Analysis**. Princeton University Press. Princeton, New Jersey.
- Jonung, L. (1990) **Inflationsförväntningarna i Sverige**. Skandinaviska Enskilda Banken Kvartalsskrift 1/1990.
- Jonung, L. and Laidler, D. (1988) **Are Perceptions on Inflation Rational? Some Evidence for Sweden**. *The American Economic Review*, December 1988, vol.78, no.5, pp 1080–1087.
- König, H., Nerlove, M. and Oudiz, G. (1981) **On the Formation of Price Expectations: An Analysis of Business Test Data by Log-Linear Probability Models**. *European Economic Review* 16, pp. 103–138.
- Mankinen, R. (1989) **Study of Finnish Inflation Expectations and their Formation**. The Research Institute of the Finnish Economy, B 60.
- Pesaran, H. (1984) Malgrange and Muet (eds.): **Contemporary Macroeconomic Modelling**. Basil Blackwell.
- Pesaran, H. (1987) **The Limits of Rational Expectations**. Basil Blackwell.
- Svendsen, I. (1993) **Empirical Tests of the Formation of Expectations — A Survey of Methods and Results**. Social and Economic Studies, Statistics Norway.
- Visco, I. (1984) **Price Expectations in Rising Inflation**. North-Holland, Amsterdam.

BANK OF FINLAND DISCUSSION PAPERS

ISSN 0785-3572

- 1/94 Juha Tarkka **Implicit Interest as Price Discrimination in the Bank Deposit Market.** 1994. 28 p. ISBN 951-686-385-X. (TU)
- 2/94 Airi Heikkilä **Selvitys suorista sijoituksista Suomeen** (Foreign Direct Investment in Finland). 1994. 59 p. ISBN 951-686-386-8. (TU)
- 3/94 Erkki Koskela – Jouko Vilmunen **Tax Progression is Good for Employment in Popular Models of Trade Union Behaviour.** 1994. 22 p. ISBN 951-686-387-6. (TU)
- 4/94 Anne Brunila **Investment and Financing Considerations: Evidence from Finnish Panel Data.** 1994. 28 p. ISBN 951-686-398-1. (KT)
- 5/94 Jarmo Kontulainen – Jouko Vilmunen **Viewpoints on "Three Assessments of Finland's Economic Crisis and Economic Policy".** 1994. 19 p. ISBN 951-686-401-5. (RP)
- 6/94 Pia Ahlqvist **Käteisrahan kysyntä Suomessa 1992** (The Demand for Cash in Finland in 1992). 1994. 52 p. ISBN 951-686-402-3. (TU)
- 7/94 Peter Nyberg – Vesa Vihriälä **The Finnish Banking Crisis and Its Handling (an update of developments through 1993).** 1994 49 p. ISBN 951-686-404-X. (RM)
- 8/94 Martin Dufwenberg – Heikki Koskenkylä – Jan Södersten **Manufacturing Investment and Taxation in the Nordic Countries.** 1994. 24 p. ISBN 951-686-405-8. (TU)
- 9/94 Paavo Peisa **Työn tuottavuuden kasvu toimialojen kokemusten valossa** (A Sectoral Analysis of the Rise in Labour Productivity). 1994. 27 p. ISBN 951-686-406-6. (KT)
- 10/94 Lauri Kajanoja **Spekulatiivisten hyökkäysten teoria ja paineet Suomen markan kurssia kohtaan 1985–1992** (The Theory of Speculative Attacks and Pressures against the Markka's Exchange Rate in 1985–1992). 1994. 87 p. ISBN 951-686-407-4. (KT)
- 11/94 Kari Takala – Matti Virén **Chaos and Nonlinear Dynamics: Evidence from Finland.** 1994. 50 p. ISBN 951-686-408-2. (TU)
- 12/94 Aija Salomaa **Suorien sijoitusten uudelleen sijoitettujen voittojen seuranta ja ennustaminen** (Monitoring and Forecasting Reinvested Earnings from Direct Investment). 1994. 22 p. ISBN 951-686-409-0. (TP)
- 13/94 Risto Murto **Nonlinear Dynamics of Speculative Attacks on the Finnish Markka, 1987–1992.** 1994. 27 p. ISBN 951-686-410-4. (TU)
- 14/94 Ilmo Pyyhtiä **Investment Plans, Innovations and Credit Market Deregulation. Empirical results with the Finnish data.** 1994. 20 p. ISBN 951-686-411-2. (KT)
- 15/94 Taru Lehto **The Level of a Central Bank's International Reserves: Theory and Cross-Country Analysis.** 1994. 80 p. ISBN 951-686-412-0. (TU)
- 16/94 Heikki Koskenkylä – Jukka Vesala **Finnish Deposit Banks 1980–1993: Years of Rapid Growth and Crisis.** 1994. 33 p. ISBN 951-686-414-7. (TU)
- 17/94 Erkki Koskela – Jouko Vilmunen **Monopoly Unions, Corporatism and Optimal Structure of Labour Taxation.** 1994. 23 p. ISBN 951-686-415-5. (TU)

- 18/94 Juha Tarkka **Risk Sharing in the Pricing of Payment Services by Banks**. 1994. 26 p. ISBN 951-686-418-X. (TU)
- 19/94 Pekka Hietala — Esa Jokivuolle — Yrjö Koskinen **Short-Selling Restrictions, Strategic Stock Holdings and Index Futures Markets in Finland**. 1994. 36 p. ISBN 951-686-419-8. (TU)
- 20/94 Heikki Koskenkylä **Pohjoismaiden pankkien tilanne vuonna 1994** (The Financial Condition of the Nordic Banks in 1994). 1994. 52 p. ISBN 951-686-431-7. (RM)
- 21/94 Mika Kuismanen — Mikko Spolander **Measuring Inflation Expectations in Finland — A Survey Data Approach**. 1994. 29 p. ISBN 951-686-433-3. (KT)