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No. 1 May 1981

EEC-DG II Inflationary Expectations
Survey based inflationary expectations for EEC countries.

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EEC-DG II inflationary expectations; Survey based inflationary expectations for the EEC countries

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Internal paper

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ABSTRACT :

The Directorate General for Economic and Financial Affairs (DG II) of the Commission of the European Communities has carried out Consumer Surveys in all EEC countries since 1972. Information collected through these surveys were used to estimate quantitative expectations of consumer price inflation. In general, the quality of survey-based inflationary expectations depends on the amount and quality of information collected by the Survey itself. In this respect the Surveys used here fare well relative to other available surveys: large sample in each country; several countries surveyed consistently; semi-quantitative character of the survey. The method of quantification is discussed and the resulting time series are presented.

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I INTRODUCTION

One of the few economic variables which in the last decade has grown in importance at a pace similar to that of the price of oil are inflationary expectations.

In fact, the importance attached to inflationary expectations in academic and policy oriented circles has increased significantly over the last decade. In table 1 it can be seen that the term "inflationary expectations" was mentioned every 28 and 130 pages, respectively, in the 1970 annual reports of the BIS and of the IMF, and not at all in the report of the EEC Commission. In 1980 the frequency had grown to a mention every 9 pages for the first two institutions and one in every 43 for the third.

Taking the "American Economic Review" and the "Journal of Political Economy" as representative journals we can see that one article out of 99 for the former and one article out of 221 for the latter had the term inflationary expectations in the title in the biennium 1969-1970. The frequency has gone up to one article every 17 for AER and one every 69 for the JPE in the biennium 1979-1980.

The increased importance of inflationary expectations explain the growing attempts to measure them. These attempts can be divided into two main streams: 1) observing inflationary expectations through financial variables, two classical examples being Fama (1975) and Frenkel (1976, 1977, 1979); 2) observing inflationary expectations by means of surveys.

This paper falls into the second stream, deriving survey-based estimates of inflationary expectations for the EEC countries (excluding Ireland, Luxembourg and Greece) for the period 1973-1980[1].

[1]Updated estimates can be obtained on request from the Directorate General for Economic and Financial Affairs of the EEC Commission.

Table 1 - Frequency of use of the term "Inflationary expectations" in Reports of International Organizations and in Economic Journals

	Number of times mentioned in the text of the Report of the years		Relative frequency the term appears every - pages	
	1970	1980	1970	1980
Bank for Int. settlement	6	20	28	9
Int. Monetary Fund	1	9	130	9
Eur. Economic Commission	0	3	-	43

	Number of times mentioned in the title of the articles of the years		Relative frequency the term appears every - articles	
	'69-70	'79-80	'69-70	'79-80
American Economic Review	1	6	99	17
Journal of Political Economy	1	3	221	69

II SURVEY BASED INFLATIONARY EXPECTATIONS : A REVIEW

There exist a number of regular surveys on inflationary expectations, although those included in the EEC Consumer and Business Surveys are the only ones to be performed in a harmonized and consistent way [2] over a group of countries.

The Livingston series of inflationary expectations refer to a semi-annual survey performed in the US by T. Livingston since 1947 over a small (about 50) sample of business and academic economists, in which respondents are required to give point forecasts of the consumer price index (CPI). Some problems with computing the inflation rate from the given forecast of the CPI are underlined by Carlson (1977), and two versions exist of Livingston survey-based inflationary expectations:the original and that proposed by Carlson. Pesando (1975) expressed doubts on the representativity of the Livingston series, a criticism based, apparently, on the limited size of the sample from which it is derived.

A similar survey to Livingston's has been performed in the US by the American Statistical Association and the National Bureau of Economic Research since the end of 1968. These surveys have not been the subject of published research, to the knowledge of the author.

A quantitative survey is also made by the Italian Economic Journal "Mondo Economico" which,semi-annually since 1952,asks a panel of about a thousand economic operators to choose as between ranges (classes) of future price increases. The Mondo Economico survey has been thoroughly analyzed by I. Visco (1979). A similar survey has been performed quarterly since 1966 by the Survey Research Center (SRC) in the US on a representative

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[2] For an overall view of survey-based inflationary expectations data see : Chan Lee (1980) and P. Wachtel (1977).

[3] On the Livingston series see : J.A. Carlson (1977); J.A. Carlson (1975); W. Gibson (1972); K. Lahiri (1976); Mullineaux (1980); D.K. Pearce (1979); J.E. Pesando (1975); D.H. Pyle (1972); V. Tanzi (1980); S.T. Turnovsky (1970); S.T. Turnovsky and M.L. Wachter (1972); S. Figlewsky and P. Wachtel (1981); D. Resler (1981).

sample of the adult population. These expectations are fully analysed by De Menil and Bhalla (1975), Juster (1972-73) and Juster and Wachtel (1972 a and 1972 b).

The problem with "class surveys, such as those carried out by Mondo Economico and SRC, is that the chosen classes are arbitrary and while suitable in one period (or one country) may be unsuitable for others. For example the SRC survey has an upper interval relating to expected inflation rate "close to 10%", while the Mondo Economico survey had an upper class of "5% (on semi-annual basis) or more". Of course, such a formulation is absolutely inadequate in an era of double digit inflation. On the other hand it is a waste to have an interval for unlikely responses (say a 10% interval for a low inflation country) [4].

Class surveys are transformed into point estimates by giving the middle value to all the answers in any class and making ad hoc assumptions on the upper and lower open interval [5].

A third type of survey is of a more qualitative kind since only a question about the direction of the price movement is put. Respondents are asked to answer whether they forecast that prices will go up, stay the same or go down.

The monthly Business Surveys of the Directorate General for Economic and Financial Affairs of the European Commission (see "European Economy", Supplement Series B) are of this type and were used by Knobl (1974) and Carosio and Visco (1977) for estimating inflationary expectations in Germany and Italy respectively. Batchelor (1981) has used these surveys to quantify inflationary expectations in a group of EEC countries. The American SRC survey carried out between 1946 and 1966 and the Gallup Poll performed monthly in the United Kingdom since 1960 have the same, qualitative, character.

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[4] The Mondo Economico questionaire has recently been reshaped to deal with this problem, See V. Conti and I. Visco (1978).

[5] See Visco (1979) for a detailed discussion of the transformation of class surveys into point estimates.

III DESCRIPTION OF THE SURVEY USED IN THIS PAPER

The Directorate-General for Economic and Financial Affairs (DG II) performs consumer surveys in the first two weeks of the months of January, May and October of every year (starting with May 1972 for Italy, Netherlands and Belgium; [6] October 1972 for Germany and France; January 1974 for Denmark and May 1974 for the United Kingdom and Ireland).

The results are published some 9 to 10 weeks after actual performance in the "European Economy", Supplement Series C. The survey is carried out over a random sample of 2500 adults (mostly heads of households) in each country in January and May and of 5000 in October.

Questions are put, inter alia, on past and future price trends. For the evaluation of future inflation the question is :

"By comparison with what is happening now, do you consider that in the next twelve months -

- prices will increase more rapidly;
- prices will increase at the same rate;
- prices will increase more slowly;
- prices will remain stable;
- don't know".

The question is, therefore, explicitly put not on the expected inflation rate but rather on the expected change of the inflation rate.

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[6] However, the first surveys made in the original EEC members had a different question about price expectations. The survey has been in its present form since October 1973 for France, Germany, Italy, Netherlands and Belgium. Luxembourg is excluded from the survey.

IV THE METHOD OF QUANTIFICATION

Let us assume that we have a population of individuals ($i = 1, 2, \ldots n$) [7] each of whom has a point estimate of inflation [8]. These inflationary expectations have an element which is common to all individuals and which changes over time (p^e_t) and an individual component which also changes over time and varies as between individuals (u_{it}). We therefore have

$$(1) \quad p^e_{it} = p^e_t + u_{it} \qquad i = 1, 2, \ldots n$$

where p^e_{it} is the inflationary expectation of individual i at period t for the period maturing at t + 1.

The individual component is defined as that component which averages to zero when all individuals are considered, that is :

$$(2) \quad E_i(u_{it}) = 0$$

and therefore

$$(3) \quad E_i(p^e_{it}) = p^e_t$$

where E_i denotes the expected value operator over individuals.

The common element will depend on the information set used by consumers to forecast inflation, ϕ^c_t, that is

$$(4) \quad p^e_t = c_t(\phi^c_t).$$

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[7] No distinction is made between population values and sample values due to the large sample surveyed: Pickering, Greatorex and Laycock (1978) confirm that the sample is large enough to exclude any significant error in estimating the population mean value.

[8] It could also be assumed that any individual has a whole distribution of inflationary expectations. However, due to lack of information on this distribution, in estimation we should eventually summarize it into a measure of central tendency. Therefore it is simpler to start by considering just a point estimate.

Notice that no particular assumption is made on the content of the information set which conditions inflationary expectations, except that is common to all consumers. In particular it is not excluded that $\phi^c_t < \phi_t$, where ϕ_t is the set of all available information, which would be used if the expectations were rational a la Muth (1961). Thus formulation (4) can accommodate both rational and "non rational" expectations.

Let us also assume that individuals have a point estimate of the present rate of inflation (perceived rate of inflation), p_{it} . The mechanism underlying the formation of this estimate is similar to the one described above : there is a common element (p^*_t), but all individuals combine this element with an individual random component, z_{it}, which disappears when averaged over all individuals, that is :

$$(5) \quad \bar{p}_{it} = p^*_t + z_{it} \qquad i = 1, 2 \ldots n;$$

with $E_i\ (z_{it}) = 0$ and therefore $E_i\ (\bar{p}_{it}) = p^*_t$

where $\bar{p}_{it}$ is the individual perception of actual inflation. Notice that $\bar{p}_{it}$ is still a random variable at time t and, as yet, no assumption has been made concerning the perceived common element, p^*_t. In particular it is not assumed to be equal to the actual rate of inflation (p_t).

As explained above, the EEC surveys ask consumers questions about the expected change of the rate of inflation and respondents can choose one out of six answers. Let us assume, as in all papers about survey based inflationary expectations except Carlson and Parkin (1975), that the respondents who answer "don't know" have the same average expectation as those who give a definite answer and let us thus eliminate the 6th class by apportioning it, pro rata, to the first five.

Let us then attribute arbitrary numerical real values to each possible answer. Let us call these arbitrary values Y_k (with $K = 1, 2 \ldots 5$). That is we will have :

$Y_1 \leftrightarrow$ the rate of inflation expected for the next twelve months is higher than the present perceived one;

$Y_2 \leftrightarrow$ the rate of inflation expected for the next twelve months is equal to the present perceived one, i.e. $Y_2 \leftrightarrow p^e{}_{it} = \bar{p}_{it}$;

$Y_3 \leftrightarrow$ the rate of inflation expected for the next twelve months is lower than the present perceived one;

$Y_4 \leftrightarrow$ the rate of inflation expected for the next twelve months is zero, i.e. $Y_4 \leftrightarrow p^e{}_{it} = 0$

$Y_5 \leftrightarrow$ the rate of inflation expected for the next twelve months is negative.

In providing the survey information, the respondent is required to transform his inflationary expectation and his evaluation of the actual inflation rate into answers to the above question on inflationary expectations. To do so he will have a transformation function of the type :

$$(6)\quad Y_{it} = h_{it}\,(p^e{}_{it} - \bar{p}_{it}) = h_{it}\,(u_{it} + p^e{}_t - z_{it} - p^*_t) \qquad i = 1, 2 \ldots n$$

In (6) the respondents transform the difference between their expected and perceived rate of inflation into a survey answer (Y_{it}), choosing one of the five available options.

Of course, if we knew the h_{it} function for all individuals and for every period we could "transform backwards" Y_{it}, which we observe through the survey, into the expected change of the rate of inflation.

Since, evidently, we do not have the transformation functions we have to see whether by making some reasonable and not too restrictive assumptions, we can derive enough information to make the "backward transformation" of (6) and estimate the expected rate of inflation from the available survey data.

The first assumption needed is that :

$$(7)\ h_{it} = h_t$$

which means that the transformation function is, at any point in time, identical for all individuals, so that the differences in the answers given depend only on individual errors (u_{it} and z_{it}). The second, weak, assumption is that the transformation function, which is discrete at the individual level, is well approximated by a continuous function on average over all individuals. With those two assumptions and using, for notational simplicity, the same symbols for the average continuous function as for the individual discrete one, we have :

$$(8)\ E_i(Y_{it}) = h_t \left[E_i\ (p^e{}_{it}) - E_i(\bar{p}_{it}) \right] = h_t\ (p^e{}_t - p^*_t)$$

since we have by definition, see (2) and (5)

$$E_i(u_{it}) = E_i\ (z_{it}) = 0$$

Equation (8) implies that the average answer to the survey (the full sample result for the inflationary expectation question) is functionally related to the expected change in the inflation rate averaged over individuals.

The third assumption which we need concerns the weights Y_k, i.e. the arbitrary numerical values attributed to the answers to the survey. The most convenient hypothesis is that the weights Y_k are successive values of a linear function. This assumption is consistent with a situation whereby any respondent to the Survey divides the range of possible inflationary expectations into five intervals of equal size and chooses the interval, and therefore the answer to the survey, in which his point estimate of inflation falls.

Of course, although appealing, this assumption is not the only one conceivable. However, given that no satisfactory a priori or empirical criterion exists to choose among various alternative hypotheses about the weights, there are good reasons to choose the simplest one.
Formally, the linearity hypothesis means that we choose an arbitrary origin for the weights, say

$$(9) \quad Y_3 = X$$

and further assume that

$$(10) \quad Y_i = Y_{i+1} + C$$

that is, we assume that the difference between contiguous values of the Y_k is a constant. We obtain, as a result, a whole family of weights:

$$(11) \quad \begin{cases} Y_1 = x + 2C \\ Y_2 = x + C \\ Y_3 = x \\ Y_4 = x - C \\ Y_5 = x - 2C \end{cases}$$

We now have to make some assumptions about the shape of the h_t function. A first hypothesis is that h_t is a linear function. To obtain the parameters of the h_t function in the case that this is linear we can note that, given the weights as described in (11), we can write, remembering the formulation of the survey questions given on page 9,

$$(12)\quad \begin{cases} E_i(Y_{it}) = Y_2 \leftrightarrow p^e_t - p^*_t = 0 \\ E_i(Y_{it}) = Y_4 \leftrightarrow p^e_t - p^*_t = -p^*_t \end{cases}$$

that is, answer Y_2 will be chosen if the expected rate is equal to the perceived actual one and answer Y_4 will be chosen if the expected rate is zero.

Using the information given in (12) we can easily calculate the whole linear transformation function. Note that

$$(13)\quad E_i(Y_{it}) = \Sigma_i \; f_{it} \cdot Y_{it}$$

where f_{it} is the frequency of respondents choosing answer Y_i, and that, if the transformation function h_t is linear, (8) can be transformed into

$$(14)\quad E_i(Y_{it}) = \alpha_t + \beta_t\,(p^e_t - p^*_t)$$

Substituting (13) into (14) and using (12) to compute the parameters α_t and β_t we have

$$(15)\quad \hat{p}^e_t = p^*_t \cdot \left[1 + \frac{\Sigma_i f_{it} \cdot Y_{it} - Y_2}{Y_2 - Y_4} \right]$$

which is the formula to give the estimate of the expected rate of inflation, given p^*_t, the f_{it}'s, the Y_k and the linear shape of the transformation function.

Substituting the linear weights Y_k of (11) into (15) we have

$$(16)\quad p^e_t = f_2 p^*_t + \frac{p^*_t}{2}\,(3f_1 + f_3 - f_5)$$

where x and C have disappeared. That is, the values chosen for x and C are indifferent since, given that (10) holds, any value of x and C will give the same value for p^e_t. With this formulation the expected rate is a sort of weighted average of today's perceived rate (weighted by the frequency of those who expect no change in the inflation rate) and a

half of today's perceived rate (weighted by a transformation of the frequencies of the answers which imply a change).
It is interesting to note that the maximum value will be given when all respondents fall in the first category ($f_1 = 1$) and $p^e_t = \frac{3}{2} p^*_t$ while the minimum value will be when all respondents will fall in the last category ($f_5 = 1$) and $p^e_t = -\frac{p^*_t}{2}$

The very fact that the linear transformation can only accomodate, as a maximum, an inflationary expectation which is one and a half times the present rate, constitutes a potentially serious limitation of the method. This reflects the fact that in obtaining the linear transformation function we have overlooked that the E_i (Y_{it}) variable also has a theoretical maximum (Y_1) and a minimum (Y_5). We therefore have to find a function which not only respects the conditions of 12) but also has :

$$(17) \quad \begin{cases} \text{max. } E_i(Y_{it}) = Y_1 \\ \text{min. } E_i(Y_{it}) = Y_5 \end{cases}$$

A functional form which respects both the conditions of (12) and of (17) is the logistic transformation of the general form

$$(18) \qquad y = \frac{a}{1+be^{-cx}} - k$$

where y and x are symbols for the dependent and independent variables, respectively a, b and c are parameters and k is a constant. Using (12) and (17) and substituting $E_i(Y_{it})$ for y and ($p^e_t - p^*_t$) for x in (18), we can solve for p^e_t and derive an alternative estimate of the expected rate of inflation.

$$(19)\quad \hat{\hat{p}}^e{}_t = p_t^* \cdot \left(1 - \frac{1}{\ln\left(\frac{Y_1-Y_4}{Y_4-Y_5} \cdot \frac{Y_2-Y_5}{Y_1-Y_2}\right)} \cdot \ln\left(\left(\frac{Y_1-Y_5}{E(Y)-Y_5} - 1 \right) \cdot \frac{Y_2-Y_5}{Y_1-Y_2} \right) \right)$$

Assuming, as with the linear function, that the Y_k are equally spanned, (9) and (10), and substituting from (13) into (19) we have :

$$(20)\quad \hat{\hat{p}}^e{}_t = p_t^* \left(0.5-0.4552 \cdot \ln \frac{2-2f_1-f_2+f_4+2f_5}{2+2f_1+f_2-f_4-2f_5}\right)$$

Here again the expected rate of inflation does not depend on the arbitrarily chosen x and C since they are eliminated in the final formula. What counts is the (arbitrary but reasonable) assumption about the constant difference between contiguous values of the Y_k.
It is also interesting to note that the maximum of the expected rate of inflation is infinity, which occurs when all interviewees choose the Y_1 answer [9].

The linear and logistic functions provide ways to transform the qualitative answers to the survey into quantitative expectations. It is not possible, within the method proposed here, to compute the second moment of the distribution of average inflationary expectations over individuals. This is part of the price to be paid for disposing of a particular assumption about the distribution of individual inflationary expectations. All we know about the second moment is that the variance of the qualitative answers over individuals $\sigma_i^2\,(Y_{it})$ is a function

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[9] Things do not work so nicely in the case of deflation since the logistic transformation would give negative infinity if all interviewers choose the price decrease answer, while, unless the awkward idea of negative prices is introduced, the lowest conceivable rate of inflation is minus 100%. However, in periods of positive rates of inflation the behaviour of the function for negative values of $E_i(Y_{it})$ is not too important.

only of the individual components u_i and z_{it} ; if they were constant over individuals the response to the interview would be unanimous and its variance zero. That is :

$$(21) \quad \left. \begin{array}{l} u_{it} = u_t \\ z_{it} = z_t \end{array} \right\} \quad \forall^i \rightarrow \sigma_i^2(Y_{it}) = 0$$

In fact, from (6) and assuming the transformation function to be equal over individuals, as in (7), we have

$$(22) \quad \sigma^2_i(Y_{it}) = \sigma_i^2 \left\{ h_t \, (u_{it} + p^e_t - z_{it} - p_t^*) \right\}, \quad i = 1,2, \ldots n$$

but if (21) holds then the RHS of (22) is constant over i and its variance is zero. Since, of course, the variance can only be either positive or zero, and the latter case is covered when (21) holds, we can conclude that when the error term related to future and/or past inflation is not constant over individuals then the variance of the answers will be positive.

However, if one is willing to make somewhat more restrictive assumptions than those needed to estimate the average rate of inflation, one can also estimate the variance of inflationary expectations over individuals. This is shown in appendix A.

We have described, therefore, two methods (the "linear" of (16) and the "logistic" of (20) of converting survey observations into quantitative inflationary expectations, assuming that we know what, on average, respondents perceive to be the actual rate of inflation (p^*_t). This perceived rate of inflation, as can be seen readily from (11) and (20), is the scaling factor needed to transform survey results into inflationary expectations. The role played in Carlson and Parkin's method by the arbitrary scaling factor δ (which is assumed to be constant over time) is here performed by the perceived rate of inflation, which changes over time.

The simplest assumption about p^*_t is that individuals, on average, perceive correctly the actual rate of inflation, and therefore

$$(23) \quad p^*_t = p_t$$

However, this assumption, although appealing for its simplicity, is not entirely satisfactory.

Lucas (1973) builds his natural-rate-of-real output model precisely on the assumption that the actual rate of inflation is misperceived. Individuals which are scattered in different markets, although using available information rationally, are unable to understand exactly whether the changes in the prices of goods they observe (which are a subset of the representative basket of goods) reflect changes in the aggregate level or changes in relative prices.

Cukierman and Wachtel (1979) present a modified version of Lucas' model where the existence of the aggregate/relative confusion is justified by the delays in publishing aggregate price indices [10]. Some manipulations on Cukierman and Wachtel's model, shown in appendix B, permit the derivation of the perceived rate of inflation.

In fact it is shown in appendix B that

$$(24) \quad p^*_t = p_t - \theta \frac{\varepsilon_t}{1+\theta\gamma}$$

where : $\theta = \frac{\tau^2}{\sigma^2+\tau^2}$ and

[10] The same point is made, although in different terms, by Hess and Bicksler (1975) : "As is noted in the next section we approximate Z, with the Bureau of Labor Statistics estimate of the rate of inflation which is not published until several weeks after the end of each period. This introduces two complications: (1) the BLS estimate is subject to information that may not have been available at the end of period t-1, and (2) the BLS estimate may contain more information than what would be produced by a free market. This means that the BLS estimate may contain less noise than the best estimate available at the end of t-1, i.e. the BLS estimate may not have been known at the end of t-1". (p. 343).

τ^2 is the variance of relative prices around the aggregate average;

σ^2 is the variance, over the distribution of the aggregate random shock ε_t, of the aggregate price level;

γ is the elasticity of production with respect to relative prices, and

ε_t is an aggregate random demand shock hitting the economy at time t.

Equation (24) implies that the perceived rate of inflation is equal to the true rate of inflation plus an adjustment which is a function of the unexpected aggregate demand shock realised at t. The actual rate of inflation is equal to the perceived rate only when either the aggregate demand shock is zero or when relative price inflation (τ^2) is small relative to aggregate price inflation σ^2. It is shown in appendix B how it is possible to estimate the composite parameter, $\gamma\theta$, the aggregate demand shock, ε_t, and the perceived rate of inflation, p^*_t.

With a method for estimating the perceived rate of inflation, such as (24), equations 16 and 20 can be used to estimate the expected rate of inflation on the basis of survey data.

It may be useful to summarize the assumptions which have been required in order to estimate the expected price change (inflationary expectations) from the kind of data provided by the EEC-DG II survey.

- Respondents understand correctly that they are asked about expected changes in the inflation rate and not about expected rates of inflation;
- The method used by respondents to transform individual quantitative expectations about inflation rates into answers to the survey is everywhere identical;
- The transformation function is continuous, and not discrete, when averaged over all individuals;
- The arbitrary weights given to the various answers to the survey question (the Y_k) are linearly distributed ;

- The function respondents use to transform their quantitative expectation into an answer to the survey (the h_t function of equation 8) is linear (as in equation 14) or is logistic (as in equation 19).

It is interesting to compare the linear method of (16) with the method used to quantify the "class surveys" of the kind performed by Mondo Economico (Visco 1979) and the Survey Research Center (between 1966 and 1975 - De Menil and Bhalla 1975; Juster 1972-73 and Juster and Wachtel 1972 a and 1972 b). "Class" surveys are made by asking respondents to choose a class, out of a predetermined set, for their inflationary expectation. In general the extreme (upper and lower) classes are open, in the sense that the respondents are asked whether they expect the inflation rate to be higher, or lower, than an arbitrary value (10% is the upper limit for both surveys and 1% and - 5%, semi-annually, are the lower limits for the SRC and Mondo Economico surveys, respectively). Except for the more elaborate method used by Visco (1979) to close the upper open class, the method used to quantify "class surveys" consists of "closing" the upper and lower classes by assuming that they are of the same size as intermediate ones and then attributing the middle point of the interval to all respondents in a given class.

In symbols the expected rate of inflation will be given by :

$$(25) \quad p^c_t = \sum_{i=1}^{L} f^*_i Y^*_i$$

where p^c_t is the expected rate of inflation derived from the "class" survey, f^*_i is the share of respondents choosing class i, Y^*_i is the middle point of the class i and L is the number of classes among which respondents can choose. The similarity with (16) (repeated here) is striking

$$(26) \quad \hat{p}^e_t = p^*_t \sum_{i=1}^{5} f_i Y_i$$

In particular, if the classes are of equal size the difference between contiguous values of Y_k^* is constant, by analogy with what was assumed in equation (21). However, while the weights Y_k^* are arbitrarily fixed by the interviewer in the "class" surveys, they are proportional to the perceived rate of inflation in the surveys examined here (16). Thus, in summary, the EEC-DG II survey-based inflationary expectations considered in this paper are very similar, at least when "linear" version is applied, to "class" Surveys such as those carried out by the SRC in the US and Mondo Economico in Italy.

An overall comparison between the EEC-DG II survey-based inflationary expectations examined here and other survey-based approaches, or with expectations derived from financial variables, with a view to establish which are "better" and which are "worse" would probably be a futile exercise. It is however important to note three things:

- the quality of the survey based inflationary expectations depends on the amount of information collected by the surveys; in this respect the EEC-DG II surveys fare well with respect to other available surveys (large samples in each country, several countries surveyed, semi-quantitative character of the questions).

- even the more "quantitative" surveys (such as the Livingston series) have some drawbacks and limitations and require some arbitrary assumptions before they can be transformed into quantified inflationary expectations;

- deriving inflationary expectations from financial variables requires, in turn, some stringent assumptions about the relationship between the variables concerned and expected inflation (as the exchange between Fama and the critics of his 1975 article show).

As an addition to knowledge about inflationary expectations it is useful to have, in the EEC instrument, an alternative source of data which though by no means immune from limits and drawbacks requires for quantification purposes <u>different</u> assumptions than those required by other sources.

V EMPIRICAL RESULTS

In the preceding section two methods have been proposed to estimate quantitative inflationary expectations (the "linear" and "logistic" transformations) and two hypotheses were advanced to identify the "perceived" rate of inflation (either that it is equal to the true rate or different, because of the aggregate/relative price confusion).

A priori the most satisfactory quantification method seems to be that which uses the "logistic" transformation and in which the perceived rate of inflation is estimated using an extension of the Cukierman-Wachtel model (described in Appendix B). In effect, the logistic version fully exploits the information available (equations 12 and 17), so as to deduce the transformation function. As to the estimation of the perceived rate of inflation, the Cukierman-Wachtel hypothesis that the actual rate of inflation is not perfectly perceived is, for the reasons advanced above, more satisfactory then the alternative.

Nevertheless, it is interesting to see to what extent the estimates of inflationary expectations are robust with respect to the alternatives, that is to see what is the sensitivity of the estimates of inflationary expectations with respect to the alternative quantification methods considered.

In making these estimates, there are two minor choices to be made, for which no conclusive a priori guidance is available:

- should the rate of inflation be expressed in log or natural terms?
- how should the present inflation rate be measured: as a yearly rate or a six monthly one? (Although, having to forecast inflation one year ahead, it seems natural to start with the inflation rate realized over the last year).

These two problems were decided on empirical grounds, adopting as a criterion of choice the mean square error (MSE), that is to say, by selecting the method which gives a lower Mean Square Error. This, however, could bias the results towards attributing to the survey-based inflationary expectations a higher forecasting capacity than they really have. In theory, if the number of methods to transform the survey result into quantitative expectations was large enough, a method could always be found which would satisfy any chosen level of accuracy even if the real forecasting power of the surveys was zero. To avoid this danger, the empirical criterion has been used only in relation to the two minor choices mentioned. Moreover, the group of countries which constitute the overall sample has been divided, before starting the empirical work, in two subsamples: UK, France and Italy, on the one hand, and Germany, Netherlands, Belgium and Denmark, on the other. This partition was chosen because it was thought that a method should be robust over high and low inflation countries. A method was recognized as superior only if it had better forecasting power for both sub-samples.

Table 2 gives the MSE's of the various estimates of quantitative inflationary expectations, their correlation index with the estimate which was chosen, on a priori and empirical grounds, as "optimal" and the ratio of the MSE of any estimate with respect to the MSE of the "optimal" estimate. For comparison purposes also the MSE and correlation statistic of the estimate which uses as the actual rate of inflation the one derived from the most recent published figures (i.e. the ones realized

Table 2 - Mean Square Errors, correlation coefficients and Mean Square Error ratios of various methods of quantifying inflationary expectations

MSE 1st group	MSE 2nd group	Correlation index with "optimal estimate" 1st group	Correlation index with "optimal estimate" 2nd group	MSE ratio with "optimal estimate" 1st group	MSE ratio with "optimal estimate" 2nd group	Method of quantification: shape of transformation function	definition of inflation rate	span over which inflation rate measured	definition of perceived rate of inflation
33.43	8.69	0.999	0.998	0.982	1.087	linear(eq.16)	natural	one year	equal to the true one
33.28	8.65	0.999	0.998	0.978	1.081	"	logarithmic	"	"
39.56	9.45	0.978	0.976	1.162	1.183	"	"	"	equal to the true one but lagged one month
39.24	10.74	0.984	0.983	1.153	1.343	logistic(eq.20)	"	six months	equal to the true one
33.21	8.16	0.999	0.999	0.976	1.020	"	"	one year	"
39.56	9.45	0.979	0.978	1.156	1.109	"	"	"	equal to the true one but lagged one month
34.04	8.00	1.000	1.000	1.000	1.000	"	"	"	*estimated extending Cukierman's Wachtel's model (Appendix B)

1st group of countries : France, United Kingdom, Italy
2nd group of countries : Germany, Netherlands, Belgium, Denmark.

*"Optimal" (on empirical and a priori grounds) estimate.

in November, March and August for the Surveys realized respectively in January, May and October) is given.

The two main conclusions of table 2 are :

1) the sensitivity of the results to the quantification method chosen is fairly low;

2) the "logistic" method (described in equation 20) which uses the definition of the perceived rate of inflation given in appendix B (Cukierman-Wachtel's model) with the inflation rate measured in log-terms on a yearly basis (the lastline of table 2), is the "optimal" one.

More precisely,it can be seen, as far as the first point is concerned, that the correlation coefficients of the various estimates are very close indeed, which means that the estimates move very much together. The comparison of the Mean Square Error of the various estimates in relation to the "optimal" method is a more stringent test because it is sensitive also to an eventual constant difference between the series. Even according to this criterion the results show great similarity, with the possible exception of the method which uses the six monthly definition of the rate of inflation (which is not really defendable on a priori grounds in any case).

As far as the choice of the optimal method is concerned it can be seen that the method retained is not empirically the "best" one in terms of Mean Square Error. In fact the method listed in sixth place in table 2 is slightly superior in this respect. However, this "empirical" superiority is not consistent over the two groups of countries, is not really significant and, in any case, goes against "a priori" considerations. Consequently, the last method of table 2 has been retained to quantify the EEC-DG II inflationary expectations.

Annex C [10] gives the time series (for the period September 1973-December 1980) of : 1) the actual, twelve months consumer-price inflation [11];

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[10] The authors will greatfully receive any information about any use of the estimated series by other researchers.

[11] Notice that the rate of inflation, although estimated in log form, is retransformed and expressed in natural form in table 3. The source of the data for relative and aggregate consumer price inflation is the Statistical Office of the European Communities.

2) the currently perceived rate of inflation (as calculated in appendix B);
3) the EEC-DG II inflationary expectations, i.e. the survey based estimates of the rate of inflation expected at time t for the same month in a year's time.

The EEC-DG II inflationary expectations have already been subject to some preliminary analysis (Papadia 1981) which support the tentative conclusion that they possess substantial forecasting power and, in particular they seem to be rational in a weak sense, in that they outperform purely autoregressive estimates of inflation. Some further tests of rationality are in progress.

Ex-ante real rates of interest have also been computed using these inflationary expectations on the basis of national and Euro-currency interest rates. These are available on request from the authors.

APPENDIX A ESTIMATES OF THE VARIANCE OF INFLATIONARY EXPECTATIONS

If the transformation function h_{it} of (6) is linear and identical for all individuals at a given point in time, as in (7), equation (6) can be transformed into

(A1) $$Y_{it} = \alpha_t + \beta_t (p^e_{it} - \bar{p}_{it})$$

substituting from (11) and (12), we have

(A2) $$Y_{it} = x + c + 2c \left(\frac{p^e_{it}}{\bar{p}_{it}} - 1 \right)$$

Taking the variance and substituting from (1) and (5) we have

(A3) $$\frac{\sigma^2(Y_{it})}{(2c)^2} = \sigma^2 \left(\frac{p^e_t + u_{it}}{p^*_t + z_{it}} \right)$$

Thus, the variance of the answers to the EEC-DG II survey, scaled by the arbitrary factor $(2c)^2$, is equal to the variance of the ratio of individual inflationary expectations to individual perceived rates of inflation. It is not, therefore, possible to disentangle the effect on the survey variance of differential inflationary expectations from the effect of the differential perception of actual inflation. Only if the actual rate of inflation is perceived equally by all individuals, that is if $z_{it} = 0$, for all individuals, we have

(A4) $$\sigma^2 \frac{(Y_{it})}{(2c)^2} \cdot (p^*_t)^2 = \sigma^2 (u_{it})$$

and the variance of the survey answers can be used to estimate the variance of inflationary expectations over individuals. Of course, in practice equation (A4) will give an approximation of the variance of inflationary expectations if $\sigma^2(z_{it})$ is of trivial magnitude with respect to $\sigma^2(u_{it})$, i.e., if individual differences in perceiving the present rate of inflation are very small with respect to individual differences in estimating future inflation. Given that the actual yearly rate of inflation is a realized phenomenon and that, due to the monthly publication of aggregate price indices, it is widely known this might be an acceptable assumption.

Actual estimates of the variance of inflationary expectations over individuals based on (A4) are available on request from the authors.

APPENDIX B ESTIMATING THE PERCEIVED RATE OF INFLATION *

It has been remarked above (page 16) that, even if market operators use information rationally, they are likely to experience some confusion between movements in relative prices and movements in the aggregate price level. This is due to the fact that estimates of movements in the aggregate price level (price indices) are published only with delay.

Lucas' (1973) model, in which operators are scatterd in different markets, as modified by Cukierman and Wachtel (1979), is used to deal with this problem.

To save space, Cukierman-Wachtel's (CW) model is not reproduced here. However, their symbols are used and references are to the equations presented in their article [1].

According to CK's interpretation, the relative/aggregate confusion is due solely to delays in publishing aggregate price indices; this attributes a precise time dimension to their framework. Let us define the yearly inflation rate, π_w perceived in market w as the difference between the log of the optimal estimate of the actual aggregate price level and the log of the aggregate level of prices twelve months ago:

$$(B1) \quad \pi^*_{wt} = E\,[\bar{Q}_t \mid p_t(w),\ \bar{Q}_{t-}] - Q_{t-12}$$

where the optimal forecast is conditional on the information available to participants in market w : the actual price observed in market w, $p_t(w)$, and the optimal forecast ($\bar{Q}_t$) of the aggregate price level (Q_t), conditional on information available at t-1.

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* A. Cukierman and P. Indelli substantially contributed to this appendix.

[1] Notice that, as a result, the symbols in this appendix are not the same as those in the main text. Arab numerals refer to CK's article.

Substituting CK's (18), (16) and (14) into (B1), and averaging over markets, yields :

$$\text{(B2)} \qquad \pi_t^* = \pi_t - \theta \frac{\varepsilon_t}{1 + \theta\gamma}$$

where

π_t is the true rate of inflation realized at t;

$\theta = \frac{\tau^2}{\tau^2 + \sigma^2}$ and

τ^2 is the relative price variance ;

σ^2 is the aggregate price variance;

ε_t is the aggregate demand shock realized at t ;

γ is the elasticity of supply to changes of relative prices.

Equation (B2) implies that the rate of inflation perceived on average over markets is equal to the true rate of inflation plus a systematic error attributable to the unexpected aggregate demand shock which operators in the various markets were unable to distinguish from a market specific shock.

Of course since information on the aggregate price level is available with about one month's delay, the unexpected demand shock refers only to the month just elapsed. Therefore the difference between the perceived rate of inflation π_t and the true one is likely not to be very large since 11/12 of π_t are known while only 1/12 is unknown.

Equation (B2) implies, moreover, that in the presence of a positive shock the perceived inflation rate will underestimate the true one, and *vice versa*.

It will be convenient to express the unexpected demand shock (ε_t) in terms of observations on the price index (Q_t). To do this we can use CK's (14) (13) and (12) lagged one period to obtain :

$$\text{(B3)} \quad \frac{\varepsilon_t}{1+\theta\gamma} = Q_t - Q_{t-1} - \gamma\theta\frac{\varepsilon_{t-1}}{1+\gamma\theta} - \delta + \beta$$

where all the symbols have been already defined except δ which is the expected (average) change in aggregate demand and β which is the parameter of the trend component in the supply function.

Taking the expected value of (B3) over ε_t, we have, since

$E(\varepsilon_t) = E(\varepsilon_{t-1}) = 0$,

$$\text{(B4)} \quad E(Q_t - Q_{t-1}) = \delta - \beta$$

which indicates that the average monthly inflation rate is constant and equal to the average growth in demand minus the time dependent growth of supply. Substituting (B4) into (B3), putting $\theta\gamma = r$ and defining the monthly rate of inflation as

$$Q_t - Q_{t-1} = Y_t$$

we have

$$\text{(B5)} \quad \frac{\varepsilon_t}{1+r} = Y_t - E(Y_t) - r\frac{\varepsilon_{t-1}}{1+r}$$

Lagging (B5) <u>ad infinitum</u> and substituting

we have

$$\text{(B6)} \quad \frac{\varepsilon_t}{1+r} = \sum_{i=0}^{\infty} - r^i \left[Y_{t-i} - E(Y_t) \right]$$

where the conditions for the series to be convergent are : $|r| < 1$ and inflation rates are bounded.

Substitung (B6) into (B2) gives

$$(B7) \quad \pi_t^* = \pi_t - \theta \sum_{i=0}^{\infty} - r^i \, [\, Y_{t-i} - E(Y_t) \,]$$

If $r < 1$, a first, admittedly poor approximation of (B7) would be

$$(B8) \quad \pi_t^* = \pi_t - \theta \, [\, Y_t - E(Y_t) \,]$$

and the adjustment to be made to the true rate of inflation to get the perceived rate would be a function of the difference between the rate of inflation realised in the last month and the average monthly rate of inflation.

The unexpected demand shock $\frac{\varepsilon_t}{1+r}$ would be reflected in a higher than average inflation rate. In addition, (B7) permits the computation of the perceived rate of inflation to any required degree of approximation if an estimate of r is available and given the condition $r < 1$.

To arrive at such an estimate we note from CK's equations (13) and (14) [2]

$$(B9) \quad Q_t - x_{t-1} = (\delta + \alpha) - \beta t + \frac{\varepsilon_t}{1+r}$$

while by definition we have

$$(B10) \quad \Delta x_t = \delta + \varepsilon_t$$

Both $\frac{\varepsilon_t}{1+r}$ and ε_t can be estimated ,let us call these estimates

$\frac{\hat{\varepsilon}_t}{1+r}$ and $\hat{\varepsilon}_t$.

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[2] In the actual estimate, Q_t is no longer the consumer price index but rather the implicit deflator for consistency with the nominal income x_t.

$\frac{\hat{\varepsilon}_t}{1+r}$ will be the OLS residuals of the regression of the log of the price level minus the log of lagged nominal income on time, i.e. the residual of the estimate of equation (B9)[3] ; $\hat{\hat{\varepsilon}}_t$ can be estimated by first differencing the log of nominal income, computing the sample mean and its deviation.

We then compute the sample variances of $\hat{\varepsilon}_t/(1+r)$ i.e., $s^2\left(\frac{\hat{\varepsilon}_t}{1+r}\right)$, and $\hat{\hat{\varepsilon}}_t$, i.e., $s^2(\hat{\hat{\varepsilon}}_t)$

From these we can estimate r as

$$\text{(B11)} \quad \hat{r} = \frac{s(\hat{\hat{\varepsilon}}_t)}{s\left[\frac{\hat{\varepsilon}_t}{1+r}\right]} - 1$$

The estimated r can be used to establish whether the condition $r < 1$ holds and to estimate, using (B6), $\frac{\varepsilon_t}{1+r}$ to any desired degree of approximation.

In addition, $s^2\left(\frac{\hat{\varepsilon}_t}{1+r}\right)$ is an estimate of CK's σ^2 of their equation (15) i.e., an estimate of the variance σ^2 that enters into the definition of θ.

To calculate π_t, we only need now an estimate of τ^2, the variance of relative prices, which also enters into θ .

Following Vining and Elwertowski (1976) we can show that

$$\text{(B12)} \quad E_w \left[(p_t(w) - p_{t-1}(w)) - (Q_t - Q_{t-1}) \right]^2 = 2\tau^2$$

[3]The problem with this estimate, i.e. the reason why this cannot be used simply in (B2) to estimate ε_t is that it is, owing to the periodicity of national accounts statistics in the countries concerned, a quarterly or yearly estimate only while we need monthly data.

Thus, the variance of relative inflation is exactly twice the variance of relative prices around the aggregate price level. Equation (12) provides an estimate of τ^2 . We therefore have estimates for all the variables entering into (B2) and can thus compute the perceived rate of inflation π_t^*. Details about the estimation procedure and results are available on request from the authors.

ANNEX C

BELGIUM

ACTUAL, PERCEIVED AND EXPECTED RATE OF INFLATION

PERIOD T	RATE OF INFLATION ACTUAL AT T	PERCEIVED AT T	EXPECTED AT T FOR T+12
09-1973	5.79	5.83	8.43
12-1973	6.46	5.96	11.45
04-1974	10.33	9.71	10.05
09-1974	15.66	15.24	13.53
12-1974	15.67	15.72	13.21
04-1975	14.43	14.15	9.52
09-1975	10.84	10.76	8.38
12-1975	10.99	11.17	7.96
04-1976	9.75	9.66	7.86
09-1976	9.32	9.00	7.03
12-1976	7.60	7.76	6.48
04-1977	6.96	7.10	5.08
09-1977	6.49	6.56	5.20
12-1977	6.29	6.54	4.64
04-1978	5.28	5.65	3.59
09-1978	3.89	4.00	2.96
12-1978	3.91	3.98	2.94
04-1979	3.81	3.97	3.09
09-1979	4.56	4.75	4.41
12-1979	5.11	5.16	4.96
04-1980	6.50	6.67	5.65
09-1980	6.79	6.60	5.93
12-1980	7.57	7.76	6.81

ANNEX C ctd.

DENMARK
ACTUAL,PERCEIVED AND EXPECTED RATE OF INFLATION

PERIOD T	RATE OF INFLATION ACTUAL AT T	PERCEIVED AT T	EXPECTED AT T FOR T+12
12-1973	12.52	11.95	11.61
04-1974	14.30	13.35	13.70
09-1974	16.63	15.68	14.09
12-1974	15.55	15.68	9.79
04-1975	11.85	12.15	8.68
09-1975	8.73	8.69	5.29
12-1975	4.29	4.71	3.31
04-1976	8.91	9.25	6.77
09-1976	9.35	8.40	6.73
12-1976	13.03	13.42	10.84
04-1977	9.43	9.35	8.57
09-1977	10.10	9.97	7.88
12-1977	12.26	12.83	9.65
04-1978	11.51	11.82	9.02
09-1978	9.07	9.12	6.41
12-1978	7.08	7.51	5.16
04-1979	7.14	7.33	6.03
09-1979	12.76	12.51	9.67
12-1979	11.82	12.38	10.84
04-1980	14.16	14.23	12.70
09-1980	10.62	10.88	8.49
12-1980	10.89	11.25	7.86

ANNEX C ctd.

GERMANY
ACTUAL, PERCEIVED AND EXPECTED RATE OF INFLATION

PERIOD T	RATE OF INFLATION ACTUAL AT T	PERCEIVED AT T	EXPECTED AT T FOR T+12
09-1973	6.23	6.31	4.66
12-1973	7.81	7.76	8.29
04-1974	7.15	7.06	6.54
09-1974	7.29	7.23	6.51
12-1974	5.86	5.96	4.77
04-1975	6.12	6.05	4.38
09-1975	6.09	6.05	5.11
12-1975	5.38	5.42	4.16
04-1976	4.94	4.87	4.02
09-1976	3.75	3.89	3.24
12-1976	3.65	3.65	3.12
04-1977	3.50	3.50	3.01
09-1977	3.69	3.80	3.04
12-1977	3.45	3.47	2.93
04-1978	2.96	2.97	2.40
09-1978	2.33	2.37	1.84
12-1978	2.52	2.50	2.24
04-1979	3.35	3.26	3.04
09-1979	5.08	5.00	4.73
12-1979	5.31	5.29	5.84
04-1980	5.75	5.66	5.77
09-1980	5.06	5.14	4.79
12-1980	5.51	5.50	5.74

ANNEX C ctd.

FRANCE
ACTUAL,PERCEIVED AND EXPECTED RATE OF INFLATION

PERIOD T	*RATE OF INFLATION* ACTUAL AT T	PERCEIVED AT T	EXPECTED AT T FOR T+12
09-1973	7.77	7.48	7.38
12-1973	8.48	8.46	10.41
04-1974	13.23	12.40	10.39
09-1974	14.74	14.32	11.27
12-1974	15.16	15.07	10.31
04-1975	12.66	12.58	8.55
09-1975	10.71	10.66	8.38
12-1975	9.63	9.78	7.89
04-1976	9.57	9.55	8.28
09-1976	9.74	9.56	7.06
12-1976	9.86	10.26	7.29
04-1977	9.52	9.22	7.71
09-1977	9.69	9.71	7.17
12-1977	8.98	9.41	6.98
04-1978	8.97	8.80	9.56
09-1978	9.16	9.25	8.21
12-1978	9.71	9.89	9.00
04-1979	10.03	9.90	9.97
09-1979	11.04	11.00	10.46
12-1979	11.79	11.81	12.37
04-1980	13.94	13.64	13.74
09-1980	13.62	13.64	13.06
12-1980	13.64	13.64	12.80

ANNEX C ctd.

ITALY

ACTUAL, PERCEIVED AND EXPECTED RATE OF INFLATION

PERIOD T	*RATE OF INFLATION* ACTUAL AT T	*PERCEIVED AT T*	*EXPECTED AT T FOR T+12*
09-1973	11.40	11.42	9.27
12-1973	12.52	12.17	13.76
04-1974	16.25	16.37	17.00
09-1974	23.02	21.67	21.05
12-1974	24.50	25.00	21.18
04-1975	20.43	20.02	14.45
09-1975	13.00	13.08	11.85
12-1975	11.24	11.38	11.26
04-1976	15.36	14.60	13.03
09-1976	18.00	17.74	18.53
12-1976	21.99	22.06	21.29
04-1977	19.35	19.36	18.64
09-1977	18.18	18.18	17.07
12-1977	14.04	14.38	13.35
04-1978	12.28	12.44	11.17
09-1978	12.00	11.71	11.12
12-1978	11.63	11.95	11.81
04-1979	13.36	13.40	14.64
09-1979	15.80	15.16	17.53
12-1979	18.79	18.64	22.42
04-1980	21.00	20.79	23.66
09-1980	21.31	20.80	23.24
12-1980	21.32	21.66	24.46

ANNEX C ctd.

NETHERLANDS
ACTUAL, PERCEIVED AND EXPECTED RATE OF INFLATION

PERIOD T	*RATE OF INFLATION* ACTUAL AT T	PERCEIVED AT T	EXPECTED AT T FOR T+12
09-1973	8.42	8.07	6.30
12-1973	8.42	8.52	10.71
04-1974	9.39	8.91	9.23
09-1974	10.43	9.75	10.79
12-1974	10.84	11.15	11.58
04-1975	9.83	9.41	9.31
09-1975	10.16	9.69	10.80
12-1975	9.02	9.44	9.15
04-1976	9.82	8.68	8.74
09-1976	8.25	7.94	7.73
12-1976	8.40	9.02	8.24
04-1977	6.93	6.10	5.98
09-1977	6.31	6.37	5.54
12-1977	5.63	6.16	5.19
04-1978	4.32	4.08	3.27
09-1978	4.31	4.18	3.63
12-1978	3.89	4.30	3.79
04-1979	4.20	3.99	3.77
09-1979	4.56	4.19	4.66
12-1979	5.56	5.65	7.16
04-1980	7.29	6.56	7.03
09-1980	7.35	7.08	7.86
12-1980	6.97	7.23	7.47

ANNEX C ctd.

UNITED KINGDOM
ACTUAL,PERCEIVED AND EXPECTED RATE OF INFLATION

PERIOD T	RATE OF INFLATION ACTUAL AT T	PERCEIVED AT T	EXPECTED AT T FOR T+12
04-1974	15.16	13.03	10.94
09-1974	17.04	16.57	16.39
12-1974	19.15	18.84	19.13
04-1975	21.71	19.38	19.86
09-1975	26.61	26.78	22.01
12-1975	24.95	24.86	18.12
04-1976	18.97	18.20	13.44
09-1976	14.26	14.45	16.38
12-1976	14.96	14.90	14.89
04-1977	17.37	16.36	13.69
09-1977	15.66	16.16	8.74
12-1977	12.10	12.61	6.90
04-1978	7.91	7.62	6.21
09-1978	7.83	8.33	5.73
12-1978	8.47	8.65	7.43
04-1979	10.15	9.46	6.69
09-1979	16.54	16.08	14.05
12-1979	17.33	17.57	20.35
04-1980	21.81	19.48	19.45
09-1980	15.84	16.09	10.48
12-1980	15.15	15.56	10.96

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