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Diagnosis of the inflationary situation and monitoring of a direct inflation target: the Spanish case

I. INTRODUCTION

Price stability, the fundamental objective of monetary policy, is not synonymous with the firmness of each and every price in an economy, but is rather a concept related to the rate of average price variation (or rate of inflation) and consistent with the adjustments in relative prices necessary for proper resource allocation. Of course, both the concept of price stability and the method of measuring it must be validated in practice, but, be that as it may, the monitoring of prices and the analysis of their determinants are essential components of the information that the monetary authorities must collect in order to make decisions.

In Spain, moreover, the current monetary policy strategy is based on the attainment of a direct inflation objective. In this

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context -wherein the ultimate objective of price stability is identified with a numeric inflation rate value-analysis of the inflationary phenomenon is important; not only must its trend be monitored, but the degree of attainment of the direct objective must also be continually assessed. The change in monetary policy strategy has not substantially altered the Banco de España's approach to the analysis of aggregate price developments, which is centred essentially on estimating trend or underlying movements in inflation and explaining these movements by studying their determinants. Nevertheless, there has been a shift in emphasis, so that forecasting price movements in the relevant target period has become important in making monetary policy decisions (in the short and, most importantly, the medium term). Moreover, special attention is also given to the indicators of inflationary expectations, which provide information about the price movements expected by economic agents and which are, therefore, one of the keys to their future trend.

This article details the information and tools available for monitoring inflation in Spain and for obtaining an ex ante view of the inflationary situation, upon which to base monetary policy decisions. Thus, no attempt is made to analyze the effects of the measures adopted, through the channels of monetary policy transmission, or the information necessary for doing so, although, obviously, both types of analysis have points in common. The Banco de España's concern with observing and interpreting price movements has been constant, and, as a result, it has developed an array of analytical techniques based on the statistical treatment of the price series and on studying the determinants of inflation within the framework of the National Accounts. However, with the change in monetary policy strategy, a number of efforts have been undertaken to improve inflation monitoring and forecasting in the short and medium terms. Consequently, in the following sections, in addition to the traditional analytical techniques, mention will be made of research in progress and tentative conclusions concerning the use of certain indicators.

Before embarking upon a detailed description of the information available for analysing prices in Spain -the aim of section III, where some general considerations are made, and of section IV, where the Spanish case is addressed- section II first summarises the course of events that has led to the current framework for monetary policy conduct in Spain being set in place. Section V contains the final comments.
II. THE CHANGE IN THE MONETARY POLICY FRAMEWORK IN SPAIN: THE DIRECT MONITORING OF AN INFLATION TARGET

Before describing and assessing the information available for diagnosing the inflationary situation in sections III and IV, it would be desirable briefly to discuss the events leading to the formulation of a direct inflation target for monetary policy in Spain from 1995. This change in strategy has made inflation monitoring the centrepiece of the monetary authority’s decision-making process.

The Banco de España’s monetary control strategy has been through various stages over the past twenty-five years. As explained in detail in Ayuso and Escrivá (1996), in the wake of the rupture of the fixed exchange-rate system established at Bretton Woods the Banco de España set in train a two-stage monetary control strategy with a money stock variable as an intermediate target (namely $M_3$, a broad monetary aggregate) and with the banking system’s bank reserves as an instrumental variable. Against the then prevailing background of floating exchange rates and capital controls, which conferred considerable autonomy on monetary policy, the framework worked adequately. In the early eighties, however, financial innovation and the growing importance of the exchange rate as the Spanish economy progressively began to open up meant certain modifications had to be made to the initial framework.

Thus, in 1984, $M_3$ was replaced by $ALP$, a broader aggregate less affected by financial innovation processes. The greater breadth of the new intermediate variable meant that control thereof had to be exerted more gradually and flexibly. Further, control of the instrumental variable -bank reserves- was progressively eased to allow for more orderly movements in interest rates. Lastly, the nominal effective exchange rate gained weight in the reaction function of the Banco de España.

In the second half of the eighties, and despite the foregoing changes, monetary policy was enormously hampered by the heightening of the phenomena that had given rise to such changes. The Spanish economy continued to be beset by high inflation rates, against a backdrop of strong growth in demand, propelled by an expansive fiscal policy stance. It was therefore necessary to pursue a restrictive monetary policy, keeping interest rates high. The latter, in turn, lured foreign capital, the effect of which was the appreciation of the peseta, in addition to driving the money stock upwards. This reinforced the need for tight monetary policy and high interest rates, creating a vicious circle.
Hence, in a setting of greater economic integration and capital mobility than in the seventies, the scope for monetary policy autonomy was substantially reduced.

The way out of this situation was via a change in monetary policy strategy, which was now to be underpinned by a commitment to exchange rate stability with a country or group of countries clearly committed to price stability. The concrete expression of this was the entry of the peseta into the Exchange Rate Mechanism (ERM) in June 1989. The move meant an easing of the constraints on monetary policy to control the economy's internal liquidity.\(^1\) In fact, the exchange rate commitment was expected to have a doubly beneficial effect: on one hand it would reinforce monetary discipline, since the pursuance of expansive policies, differing substantially from those implemented by the anchor country, would prompt an appreciation of the real exchange rate, with the subsequent loss of competitiveness; and on the other, it would raise the credibility of monetary policy, since the ERM commitment would enable part of the anchor country's credibility to be imported.

However, ERM membership alone could not ensure these beneficial effects would be harnessed; they would only come about if the exchange rate commitment was sufficiently credible as to ensure it would be maintained.\(^2\) In the Spanish case, such credibility was called into question, to some extent, even during the period of greatest ERM stability. This was no doubt due to the absence of any correction of the macroeconomic disequilibria that had built up in the Spanish economy during those years and, in particular, to Spain's continuing wide inflation gap with the ERM core countries and to the persistence of sizable budget deficits.

Accordingly, the peseta was one of the currencies most affected when, in the summer of 1992 and for reasons we will not delve into here, the ERM crisis broke, entailing successive devaluations for the Spanish currency. The exchange rate commitment was thus seen to be an insufficient anchor to ensure the nominal stability of the Spanish economy. In any event, from the outset of ERM membership the Banco de España continued setting domestic quantities-based objectives. These were pursued very flexibly but meant interest rates had to be kept high, whereby the peseta

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\(^1\) However, the strong growth of domestic demand prevailing at that time made it necessary to introduce temporary credit curbs and exchange controls, which were lifted at the beginning of 1991.

tended to be in the area close to its appreciation ceiling in the period prior to the 1992 crisis. Movements in ALP during this period evidenced serious deviations from the targets indicated by the Banco de España, due in part to the continuous flow of financial innovations. Indeed, since the late eighties a fresh break has been witnessed in the relationship between the ALP aggregate and nominal expenditure.

In short, following the ERM crisis, which culminated in the widening of the fluctuation bands around the central parity to ±15% in the summer of 1993, it became necessary to revise once more the monetary policy strategy in Spain. One of the key factors behind this revision was the fact that the model used until then was spent, marked by the instability of the relationship between ALP and nominal expenditure and by the insufficient nominal anchorage provided by ERM membership. The other key factor was the modification of the institutional framework within which the Banco de España operates, further to the approval of legislation on its autonomy in June 1994. The resulting Law of Autonomy enshrines price stability as the primary aim of monetary policy in Spain and gives the Banco de España full independence in the achievement of this goal. It was thought in these circumstances that the setting of a direct inflation target would commendably establish an explicit and quantified link with the main aim of price stability, enhancing the credibility and effectiveness of the disinflationary process in the Spanish economy.

Admittedly, the adoption of a direct inflation target has its drawbacks, among which are the fact that the central bank has only a limited capacity to control prices and that the relationship between prices and monetary policy action is imprecise and susceptible to significant delays. But the advantages appear to have become weightier in recent years. Further, as regards the difficulties referred to, it should be pointed out that recently greater speed has been observed in the transmission of monetary policy impulses to market and credit system interest rates, although it is true that the lags incurred before the latter ultimately affect expenditure are still sizable. Research continues into inflation diagnosis, and the application of new techniques in this connection have notably improved the reliability with which progress in disinflation and the degree of compliance with the price objective may be assessed. The following deal with this subject.

\(^8\) See Gutiérrez (1996).
III. INFLATION AND VARIABLES PROVIDING INFORMATION ON THE TREND OF PRICES. THE EXPERIENCE OF OTHER COUNTRIES

Both the concept of inflation and that of price stability are generic and must be specifically defined in order to be of any use. In practice, the trend of prices is measured by a variety of indices, and a determination must be made as to which one or which ones are considered the most appropriate for representing all of the prices in an economy. This very variety implies that there is no one measure of inflation—defined as the rate of general price growth—but as many as there are price indices accepted as representative. The consumer price index and the GDP and aggregate expenditure deflators are price indicators widely used to monitor prices and overall inflation. Normally, they refer to the prices of final goods and services in the economy. The specific characteristics of indices that measure prices are such that the concept of stability is frequently associated with slightly positive inflation rates, although it is not the purpose of this chapter to enter into that discussion.

In countries where the monetary policy is aimed at attaining a direct inflation objective, and, therefore, where the concept of price stability is associated with a specific numeric value, a decision must be made as to which price index will be used to define the objective. Most countries with this type of strategy use the corresponding general consumer price index (or the equivalent price index) or some of its components to define their monetary policy objectives. Once this decision has been made, all of the information necessary to properly monitor attainment of the objec-

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4 The annual rates of variation in the price index selected, i.e., rates of change in one period (month, quarter) relative to the same period of the preceding year, are normally used to measure inflation. For example, for a monthly index, which is what consumer price indices usually are, it is common practice to use monthly year-on-year rates (one month relative to the same month of the preceding year) and the annual average rates (average for the twelve months of a year, relative to the preceding year's average). This does not preclude the use of other rates, such as month-on-month rates (one month relative to the preceding month), which are also widely used. A detailed discussion of rates of variation and their application to economic phenomena can be found in Espasa and Cancelo (1998), chapter V.

5 Price indices are vulnerable to a number of measuring biases, which depend on their characteristics and which can result in a certain overestimation of inflation. See Viñals (1996), in this volume.
tive must be identified. Given that the instrumental variables used by central banks (normally, the intervention interest rates) can affect prices after a considerable lapse of time (the lags are usually estimated at about two years), analysing the contemporaneous pressures on prices is insufficient. Available information must be collected on the future behaviour of prices and the channels through which potential inflationary pressures may develop. This means that it is necessary not only to monitor the price index used to define the objective, but also a potentially wide range of indicators that can provide clues as to the possible course of prices in the short and medium terms. In any case, monitoring and extracting information from a broad spectrum of indicators is not an exclusive characteristic of central banks that pursue direct inflation objectives. In countries where two-stage strategies are pursued, and although logically the intermediate variable (generally, the exchange rate or a monetary aggregate) is a determining factor in the decisions of the monetary authority, it is increasingly common for other indicators to be carefully monitored, especially those that signal possible inflationary pressures, to supplement the information provided by the intermediate variable.

Owing to the variety of indicators that contain information about an economy's inflationary situation and the numerous methods of extracting this information, price monitoring assumes different characteristics in each central bank. Nevertheless, it is worth trying to give a general (although probably incomplete) description of this series of indicators and methods. Regarding the type of indicators that can provide valuable information for the analysis of inflation, mention should first be made of the price series themselves, not only consumer prices or the index taken as the main point of reference, but also deflators, producer prices, etc. Secondly, there is another set of variables that provides information on price determinants. The most important are costs (wages, import prices and exchange rate, and fiscal variables such as contributions and indirect taxes) and the pressure of demand (output gap, capacity utilization, public expenditure). Variables that provide information on the trend of nominal expenditure, such as monetary aggregates, can also be included. A third set of relevant variables consists of indicators of inflationary expectations. Some of the variables mentioned, such as the exchange rate and inflationary expectations, not only provide clues about the probable course of prices, but are also channels for the transmission of monetary policy, so that monitoring them enables the
monetary authorities to check the possible effects of the measures adopted.

Various methods can be used to analyze the indicators selected and to extract information from them concerning present and future price trends. These methods include the univariate modelling of the series as well as the estimation of structural models, the preparation of composite indicators, and the use of accounting figures to estimate macroeconomic aggregates. Obviously, a given indicator can be used in different ways; thus, wage indicators can be used to construct various types of models, develop composite indicators, or estimate macroeconomic aggregates.

The information obtained using various methods to analyze the indicators will relate to the actual or projected trend of prices in different target periods. For example, some of the information will be indicative of contemporaneous inflationary pressures: thus, the univariate modelling of the price series, forecasts of which essentially incorporate the past trend of the series and therefore presuppose future behaviour similar to that of the recent past, will facilitate a useful characterization of current inflation through the calculation of centred rates, in addition to providing accurate short-term forecasts that can be improved via transfer functions. Multivariate models (such as VARS) and structural models, to the extent that they incorporate variables representative of inflationary pressures in the coming months or quarters (for example, wage increases approved for the period, trend of import prices and of the exchange rate) will provide more precise information on inflationary pressures within the time frame of a few quarters. The forecasts from these models will be conditional upon keeping policies within hitherto known parameters and upon the course imposed for the exogenous variables. The models will also be appropriate for simulating the results of alternative hypotheses about economic policy variables.

Moreover, the estimation and forecasting of macroeconomic aggregates with the simple requirement that they be consistent from an accounting standpoint, but also confirmed by the analyst's economic knowledge, are an alternative method of introducing known information on inflationary pressures in the near future and of making the forecasts conditional upon a given trend in the exogenous variables and in economic policies. The main difference between the projections obtained using structural econometric models and the forecasts arrived at with the simple requirement of accounting consistency is that in the latter, the
relationships between variables are not predetermined by econometric estimates, but depend instead on the analyst's opinion, which is influenced by data of a very different sort, including the estimated elasticities in the econometric models themselves. The summary inflation indicators constitute another method of extracting information on the future trend of prices, which is increasingly used in many central banks, but without discarding other kinds of tools.

Diagram 1 summarizes the ideas expressed in the preceding paragraphs. The basic information on prices comes in the form of indicators. These are processed, individually or collectively, using various methodologies and, when necessary, adding assumptions about exogenous variables and alternative policies to obtain information on inflationary pressures in various periods and on inflationary expectations. Of course, the methodology used in each case is not dissociated from the information sought nor from the available indicators. Moreover, given the broad spectrum of usable indicators and methodologies, the information obtained in each case must be prioritized in order to arrive at a single diagnosis of the inflationary situation. In the following section, this general outline is applied to the Spanish case.

IV. INFLATION MONITORING AND ANALYSIS IN SPAIN

1. Characteristics of the information available for the analysis of inflation

In Spain, the preferred price index for measuring inflation and defining monetary objectives is the consumer price index (CPI), owing to its wide dissemination and its use in the pricing of all types of contracts. Moreover, the fact that it is prepared outside the Banco de España and is not subject to change by the Bank itself promotes the transparency of monetary policy. The Banco de España defines its objectives in terms of the year-on-year rate of the CPI (the rate of variation between a given month and the same month of the preceding year). Therefore, a significant part of the effort to monitor inflation is focused on the analysis of this index and its immediate determinants. However, the Banco de España also monitors a large number of indicators to formulate its opinion on the inflationary pressures developing in the Spanish economy and on the inflationary expectations of economic agents. The Banco de España's focus is rather eclectic,
Diagram 1: Analysis of Inflation Through the Various Available Indicators

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Methods of extracting information</th>
<th>Information on inflationary pressures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prices</td>
<td>• Composite indicators</td>
<td>• Current inflationary situation</td>
</tr>
<tr>
<td>Costs</td>
<td>• Univariate and single-equation models</td>
<td>• Future inflationary pressures (no change in policy)</td>
</tr>
<tr>
<td>Demand pressure</td>
<td>• VAR and BVAR models</td>
<td>• Simulations (with assumption concerning alternative policies)</td>
</tr>
<tr>
<td>Monetary variables</td>
<td>• Structural models</td>
<td>• Inflationary expectations</td>
</tr>
<tr>
<td>Opinion surveys</td>
<td>• Macroeconomic forecasts based on accounting models</td>
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<tr>
<td>Yield curve</td>
<td>• Other analytical treatments (yield curve ...)</td>
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<td></td>
<td>+ Formulation of assumptions concerning exogenous variables and alternative policies</td>
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</table>
without relying explicitly on the predictions of a structural model to prepare a quantified diagnosis of inflation.

As indicated in the diagram in the preceding section, the first group of indicators available for the analysis of inflation consists of the various price indices prepared for the Spanish economy. These indices can be used to approximate the contemporaneous growth of prices in various stages of the price formation process, through the estimation of trends, and to assess to what extent accelerations and decelerations are temporary or incorporate more permanent elements.

A second group of extremely varied indicators provides information on the determinants of prices and the price formation process. It has already been pointed out that in the Banco de España, this information is analyzed from a number of perspectives, ranging from the individual analysis of indicators to their collective use in models, composite indicators, and macroeconomic estimates. Although a quarterly model - small in size and structural in nature - is being prepared, it is not used at present as the basic starting point for medium-term inflation forecasts, but mostly in simulation exercises for alternative monetary policy measures, as explained in Andrés et al. (1996). A BVAR multivariate model is also used, which relates the CPI to several of its basic determinants and the activity in question. Moreover, the preparation of quarterly macroeconomic estimates and forecasts in the National Accounts context makes it possible to check the consistency of price forecasts (measured with deflators) with the expected movements in their determinants, on both the demand and cost sides, making these forecasts conditional upon a given macroeconomic policy action and a given external context and exchange rate.

In order to explore all possible methods of forecasting the future course of prices, a composite leading indicator of prices has also been constructed, which is now in the testing phase. Variables representative of prices, income, and the real sector have been incorporated into this indicator, as well as monetary variables. The latter are also used in other ways (through expert analysis, the estimation of demand for money equations, or the construction of weighted monetary aggregates) to extract the information they contain on the future course of prices.

Lastly, a third group of indicators monitored by the Banco de España are those related to inflationary expectations. The most important of these are interest rates and their relationships
through the yield curve, as well as the information gleaned from opinion surveys.

The diversity of the information that can be used to analyze inflation underscores, on the one hand, the importance of the quantitative and econometric techniques used to extract, as efficiently as possible, the information contained in the various indicators and sets of variables; and, on the other, the necessity of prioritizing this information, which, on occasion, can give contradictory signals. This is the basic task of the analyst, who must arrive at the most accurate diagnosis possible of the situation and of the trend of inflation, using a wide variety of information.

The following sections contain a more thorough discussion of the aforementioned major tools used in the Banco de España to evaluate the behaviour of prices in the short and medium terms.

2. **Direct price indicators**

There are a variety of indicators which directly reflect price observations and which normally take the form of an index number. As mentioned above, the most important of these is the CPI, the purpose of which is "to measure temporary movements in the level of prices of consumer goods and services acquired or purchased by households". This index has been adopted as a reference for defining the price objectives of monetary policy.

The CPI is a monthly Laspeyres index, i.e., it is calculated on the basis of a fixed basket of goods in the base year, which remains constant throughout the life of the index. The breakdown that is currently used for CPI analysis in the Banco de España groups the CPI items into five components (unprocessed food, processed food, non-energy industrial goods, energy and services), the processed food, non-energy industrial goods and services components reappear in the index of prices of services and non-energy manufactured goods (Índice de precios de servicios y bienes elaborados no energéticos, IPSEBENE). The construction of a subaggregate of consumer prices excluding the prices of energy and unprocessed foods, which are considered especially volatile, is a widespread international practice.

Because it is a Laspeyres index, the CPI is subject to the so-called "substitution bias", owing to the fixed nature of the basket of goods and the weights, which makes it necessary to re-base the index every so many years. The expenditure and added value deflators, on the other hand, are Paasche indices and are therefore subject to another type of bias, although not the substitution
bias, since a contemporaneous basket is used for their weights. The deflators are estimated in the context of the National Accounts and are annual and quarterly. Although the GDP deflator and the private consumption deflator could, in principle, serve as more appropriate measurements of aggregate inflation than the CPI itself, as they are quarterly rather than monthly, the more imprecise nature of their estimates (being implicit deflators), the successive revisions to which they are subject and the longer delay in the availability of their data make the CPI a better choice. In any case, the deflators provide an additional measurement of price variations and are particularly useful for analysing inflation from the standpoint of its determinants, as they are consistently estimated using other National Accounts variables.

In addition to the CPI and the deflators, which capture the trend of final prices in the economy, there are other indices that show the behaviour of the producer prices of certain productive activities: the industrial price index (IPRI) and the prices-received-by-farmers index. Mention should also be made of the foreign trade unit value indices (UVI).

Of course, the first problem to be solved in analysing inflation is that of obtaining an accurate measurement of the subject of analysis. Price indices in general, and the CPI in particular, reflect changes in relative prices as well as changes in the general level of prices, i.e., the inflation rate. The latter can also be associated with more permanent or persistent movements of price indices, as changes in relative prices give rise to transitory movements. Moreover, regardless of whether they reflect changes in relative prices, price index movements can be erratic and therefore difficult to interpret. There are various means of obtaining a permanent signal of the trend of prices with a view to eliminating general index movements resulting from readjustments in relative prices and not reflective of changes in the overall level of prices, and, in general, to obtain a stable signal of the inflation rate trend. One of the most common methods of doing this is to eliminate those components of the CPI which, owing to the type of goods they include, are considered more likely to reflect erratic or relative price movements, and to approximate inflation by means of the rate of variation in the components that make up the so-called "inflationary core." The components excluded from the measurement of this core (which coincides with the IPSEBENE) are the prices of unprocessed foods and consumer energy prod-

\[\text{See Álvarez and Matea (1996).}\]
ucts. Nevertheless, there is a good deal of disagreement over whether the exclusion of these prices is justified, it being argued that they are more likely to be affected by supply shocks.

One method of avoiding the a priori exclusion of certain prices while attempting to eliminate price movements not indicative of changes in the general level of prices is to use limited influence estimators —such as the truncated mean and the weighted median—, the calculation of which excludes extreme price variations, on the assumption that the effects of changes in relative prices are concentrated in the tails of the distribution.

Another method of obtaining a streamlined measurement of inflation is by estimating a trend price signal: the trend, free of seasonal and irregular elements, can be used to define the more stable and permanent elements of price movements, and, therefore, provides a more suitable basis for calculating the economy's inflation rate. Underlying inflation is defined precisely as the rate of duly centred, year-on-year variation, calculated on the basis of the price trend. It can be shown that the centred, year-on-year rate of the original series' three-month moving average provides a reliable approximation of underlying inflation in the case of the CPI. It should be noted that the estimation of this rate for the most recent period requires the use of predictions.

The concept of underlying inflation, as defined above (the centred, year-on-year rate of the price trend), applies to price indices other than the CPI, for which it is also possible to find approximations of underlying inflation in terms of centred rates, calculated on the basis of moving averages (more or less long-run, depending on the case) of the original series.

Lastly, another method of using price indices to obtain trend measurements of the inflation rate is based on the use of VAR-type autoregressive models, which differs from the above methods in that information from outside the price index itself is used (multivariate measurements of inflation). In the Banco de España, two measurements of this type have been estimated —permanent inflation and latent inflation— using a VAR model with two variables (CPI and GDP), in which the condition of a vertical, long-run Phillips curve is satisfied.7 The first of these measurements captures the influence of those disturbances which affect the long-term inflation rate, while latent inflation captures the impact on prices of those disturbances which do not affect long-term production. In practice, the two are very similar to each other and to the ob-

7 See Álvarez and Sebastián (1995).
served rate of inflation, which indicates the predominance of nominal-type, permanent disturbances in determining inflation in Spain.

Price predictions are necessary for more reasons than calculating a trend signal. The availability of predictions is useful in and of itself as a quantitative expression of the prospective trend of prices implicit in the information series used to obtain these predictions; they therefore facilitate a more accurate appraisal of the new price data that appear. There are numerous methods of predicting prices, whether on a conditional or nonconditional basis, ranging from univariate models to multivariate models and including structural econometric models. A balance must therefore be struck between simplicity and economy of means, on the one hand, and volume of information and the analytical capacity of the resulting predictions, on the other, which must be resolved in accordance with the purposes of the analysis. In this chapter, which focuses on the means available for evaluating the inflation-

**FIGURE 1. UNDERLYING INFLATION IN THE CONSUMER PRICE INDEX, 1993-1996**

![Graph showing underlying inflation in the consumer price index from 1993 to 1996.](image_url)

**SOURCES:** Instituto Nacional de Estadística and Banco de España.
ary situation in the short and medium terms-and not so much on assessments of the interaction of macroeconomic variables-, the formulation of monthly or quarterly forecasts is of special interest. For the CPI, single equation models (described briefly below) and the BVAR model (summarized in a subsequent section) are available.

The use of single equation models (ARIMA and transfer functions) for short-term price predictions is particularly useful because these models very efficiently capture the monthly dynamics of these series and are a very powerful tool for evaluating new data. ARIMA models can be used to extrapolate a series using its own past as the sole source of information, whereas transfer function models include information from other variables that anticipate the behaviour of the series analyzed, in order to improve the results of the projection. Matea (1993) provides a detailed analysis of the problems associated with predicting prices using models of this type. In any case, because the predictions they yield are highly inertial, they are inappropriate for medium, and long-term predictions. They can be used in the short term, however, to appraise the processes of price acceleration or deceleration, based on the systematic deviations of the new data from predictions thereof. Chart I illustrates this point in the case of the CPI: each new datum contributes new information, which is incorporated in the forecasts for the following months, and, therefore, modifies the estimate of underlying (trend) inflation in the preceding months, demonstrating the effects of the information contained in the new datum on the trend of prices.

In the case of the CPI, modelling and prediction are via models estimated for its basic components (except the energy component), since both its dynamics and its determinants—and, therefore, its potential indicators—are different. The indicators used in these transfer functions do not feature producer prices. Matea and Regil (1996), in fact, explore the possibilities of improving the analysis and short-term prediction of the CPI and the IPSE-BENE using other variables from the real sector (prices, demand, activity) and the monetary sector that could anticipate their behaviour.

3. The price formation process: costs

From a macroeconomic standpoint, analysis of the price formation process is essential for explaining the past and present behaviour of inflation and for making short, and medium-term
conditional forecasts. With this analysis, it is possible to determine the contribution of the various cost components, as well as that of decisions concerning margins -i.e., supply factors-, to the trend of prices.

The price formation process can be analyzed by means of direct cost and price indicators (using wage, output, employment, and price statistics), which are also useful for properly monitoring cost pressures disaggregated by productive activity. The National Accounts also provide precise information for studying the formation of prices, in a context where the various cost and margin measurements acquire internal consistency, although the disaggregated analysis is complicated in this case by the delay in publishing the information and the revisions made to it. In any case, at the aggregate level, National Accounts data provide an overall view of price formation in the economy and are the most appropriate framework for making conditional forecasts of medium-term cost pressures.

The price formation process, at the aggregate level and in the context of the National Accounts, is approximated by breaking down the final demand deflator. The annex to this chapter shows how the expression of the final demand deflator as a function of costs can be arrived at, based on National Accounts figures and the relationships established between the various account aggregates. The expression obtained for the deflator is:

\[ \Delta P_{df} = \omega_y [\Delta P_y + \Delta \lambda_y] + \omega_m [\Delta P_m + \Delta \lambda_m] \]

where

\[ \Delta P_y = \omega_r ACLU + \omega_r \Delta \left( \frac{EB^*}{y} \right) + \omega_i \Delta \left( \frac{TN}{y} \right) \]

\( P_{df}, P_y, \) and \( P_m \) being the deflators for final demand, GDP and imports, respectively; \( \lambda_y \) and \( \lambda_m \) the share of GDP and imports to final demand, in real terms, respectively; and \( \omega_i \) the weights of the various components of final demand and GDP, as defined in the annex. In expression (2), \( CLU \) are labour costs, \( EB^* \) is the ad-

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8 This is one of the lines of research currently being pursued in the Banco de España. It should be pointed out, in any case, that to ensure consistency, analyses performed with indicators must be based on the structure of the input/output tables.

justed gross operating surplus, as explained in the annex, and \( TN \) indirect taxes net of subsidies, all at current prices; lastly "\( y \)" is GDP in real terms.

Expressions (1) and (2) summarize the price formation process at the aggregate level by making explicit the contribution of domestic costs (labour) and external costs (imports), as well as the impact of net indirect taxes and the behaviour of unit margins. As these expressions demonstrate, the contribution of the domestic factors -summarized in the GDP deflator-, and of the cost of imports to the variation of the deflator depends not only on the movement of the corresponding GDP and import deflators, but also on how their "market shares" have evolved, i.e., the extent to which final demand, in real terms, is satisfied with domestic production or with imported goods and services. Despite this being merely an accounting breakdown, the two expressions together have a high interpretative content if analyzed in light of a mark-up pricing model, wherein the component \( \left(EB^*/y\right) \) reflects the extent to which entrepreneurs do or do not pass on to prices the full impact of costs and indirect taxes.

As for the factors behind the external component of final prices, the trend of import prices will be explained by the behaviour of international prices and the exchange rate. Of course, this is not the only way that movements in these variables can affect the process of inflation in an economy (although it is the most direct and quantifiable). The prices of domestic goods that compete with imported goods will also have to move in line with import prices, expressed in pesetas. Furthermore, the movements of external prices and the exchange rate take a certain amount of time to show up in import prices and in domestic prices, so that monitoring the corresponding indicators is very important for evaluating the inflationary situation, for, as mentioned below, they may serve as leading indicators of inflation. In short, there is more to analysing the external sources of inflation than studying the import deflator and its direct contribution to the formation of final prices in the economy.

The domestic price components in the expression for the GDP deflator; equation (2), summarize the principal means by which inflationary pressures are generated on the supply side of the economy. Thus, unit labour costs reflect the pressure from wages and other labour costs, and the effect of public sector decisions (through taxes and contributions) on these costs. Likewise, through productivity, they reflect the technological and cyclical circumstances of the economy. The impact of indirect taxation on
the price formation process also stems from public sector decisions. Lastly, unit margins are the result of a variety of factors, ranging from the degree of competition in product markets to the level of demand pressure, which is not a supply issue, as prices are not the result of supply factors but rather of the confluence of the latter with demand. Any information concerning the probable behaviour of the components of short, and medium-term costs will be useful for pinpointing potential cost pressures in said terms.

By way of illustration, chart II shows the growth rates and contributions of the various cost and margin components to the growth of the GDP and final demand deflators for the period 1987-95. As for the contributions of domestic and import costs to the growth of the final demand deflator, what stands out most throughout the period is that the share of imports has systematically expanded in the Spanish market, except in 1993. Until that year, import prices posted substantially lower rates of variation than those of GDP, spurred by the appreciation of the peseta during the period, so that their growing weight in final demand was a moderating factor in final prices. In more recent years, however, import prices have accelerated markedly, reflecting the depreciation of the peseta since the summer of 1992.

Unlike import prices, the GDP deflator slowed in 1993, owing to the appreciable moderation of labour costs. One of the components of the GDP deflator that stands out is the strong growth of the surplus per unit of output throughout the period, which signals a sustained process of expanding margins in the economy as a whole. The lack of competition in a significant segment of the goods and services markets and, in general, the existence of rigidities in the functioning of the markets are reflected quantitatively and in summary fashion by the continued growth of the unit surplus. The moderation of unit labour costs in the most recent period and the persistent pressure of business margins are clearly illustrated in the contributions chart.

4. The pressure of demand on capacity and prices

In addition to the various measurements of cost pressure analyzed above, the other important group of indicators and variables that must be taken into account in studying the determinants of short, and medium-term prices comprises those which approximate the pressure of demand. In some cases, the purpose of these indicators is to measure the existing gap between real ex-
FIGURE II. COMPOSITION OF THE FINAL DEMAND DEFLATOR, 1987-95

Contributions to the growth of the final demand deflator

Contributions to the growth of the GDP

Sources: Instituto Nacional de Estadística, and Banco de España.
expenditure and a measurement of trend or potential output, either directly, such as the output gap, or indirectly, such as capacity utilization (CU). In other cases, they represent approximations of nominal expenditure, either of a particular sector (public or private sector, for example) or of the economy as a whole (such as certain monetary aggregates, which are analyzed in the following section). Some measurements of the pressure of expenditure rely on conditional estimates and forecasts made in the context of the National Accounts, such as the output gap, although there are exceptions, such as CU or the monetary aggregates.

The pressure of demand on capacity is an important factor in explaining possible price accelerations (surges in inflation) in a mark-up type pricing model. The indicators available for these purposes range from measurements such as the output gap, which attempts to measure the cyclical component of GDP, to others such as the non-accelerating-inflation rate of unemployment (NAIRU) or CU, both of which provide information on the degree of input utilization.

There are several methods of measuring the output gap \(-i. e.,\) the gap between trend or potential output and that actually observed, which depend on how trend or potential output is calculated. In general terms, two types of calculation methods can be distinguished: those that are based on statistical procedures and those that take a more analytical approach, attempting to apply the concepts of economic theory. The statistical methods employ the observed values of the GDP series to obtain the trend component of this variable. Initially, linear trends were used, which could vary from one cycle to another. Later, Hodrick and Prescott proposed smoothing the GDP series with a linear filter, which allows the user to select the desired degree of smoothing. The latter method is the one most widely used, at least among those with a statistical focus, given its ease of use, although it does have some disadvantages, including the fact that it is not based on the criteria of economic theory and estimating the trend at the extreme ends of the sample period is sensitive to the receipt of new information and varies with it.

Among the methods with an analytical focus, that most widely used is based on the estimation of an output function that permits the approximation of potential output using existing quantities of inputs. This is the approach taken in the OECD (see Giorno et al., 1995), where potential output is calculated subject to the requirement that it should not lead to price accelerations \((i. e.,\) potential employment is measured in terms of the NAWRU, or non-
accelerating-wages rate of unemployment). One of the advantages of these methods is that they have a clear economic interpretation, although they are more difficult to use than the purely statistical procedures and the results depend on the structural assumptions that must necessarily be made. Moreover, the VAR model estimated by Álvarez and Sebastián (1995) for the CPI and GDP, in addition to providing estimates of latent and permanent inflation, can also be used to measure trend output. Given that there is no general criterion accepted as superior, the ideal method would be to obtain various measurements of the output gap, if possible, in order to compare them. In the Banco de España, the output gap is generally estimated using the Hodrick-Prescott filter and the above-mentioned VAR model, although attention is also paid to the statistical measurements published by other institutions.

For indicators that attempt to approximate the pressure of demand through the degree of input utilization, quarterly information on the degree of capacity utilization in the industrial sector can be obtained from the opinion surveys of entrepreneurs in that sector. Urtasun (1994) has assessed the goodness of fit of this indicator for signalling inflationary pressures in the 1972-93 period, and it has been shown that there is a level of utilization beyond which prices are driven up; for the period under consideration, it is estimated that this level is situated slightly above 80 percent. The estimate was obtained using various measurements of inflation in the industrial sector (IPRI, industrial VA deflator), as well as more general measurements (CPI). The use of this estimate is similar to that of the NAIRU.

On the subject of the pressure of demand, one of the most relevant aspects to be analyzed is to what extent general government activity may be curbing or encouraging the excessive growth of nominal demand. It should be noted, first, that not all general government activity related to the determination of prices at the macroeconomic level is reflected in its impact on aggregate demand. Some of this activity has a direct impact on costs and prices (indirect taxes, operating subsidies, contributions) and is captured by the fiscal variables included in the above-described equation for breaking down the final demand deflator.

The simplest method of assessing the contribution of public spending to the growth of demand is to compare the rates of

10 These variables represent the economy as a whole and therefore include general government and EU taxes and subsidies.
nominal variation of both variables. Taking a somewhat more sophisticated approach, Martí and Argimón (1996) propose monitoring two quarterly indicators, designed specifically to approximate the impact of general government activity on prices, through aggregate demand. The first captures the trend of general government final demand (government consumption plus public investment). An indicator of direct demand can also be defined that excludes civil service wages from government consumption, i.e., which includes only general government purchases of goods and services and public investment. In any case, the series are deflated to obtain an indicator of real demand. The purpose of the second indicator is to measure the indirect effect of fiscal policy on demand, transmitted through household disposable income and, therefore, through private consumption. In any case, these indicators are of recent construction and will have to be enhanced as and when they are used.

One very prevalent method of analysing general government activity is to construct fiscal impulse indicators (see Gómez Jiménez (1993) and Gómez and Roldán (1995)). Indicators of this type, widely used by international organizations, attempt to assess in summary fashion the expansive or contractive nature of the fiscal policy implemented from a macroeconomic perspective, whereby the cyclical movements of the deficit must be eliminated. These indicators are not, therefore, designed to measure public sector pressure on demand, although they do provide valuable information about the relationship between fiscal policy and inflation, since, insofar as the impulse is countercyclical, it will help moderate inflation movements throughout the cycle. It should be remembered that their construction involves estimating a cyclical component of the general government balance, which is derived from the automatic stabilisers incorporated into public revenue and expenditure, and a structural component of the deficit, associated with the discretionary action of the fiscal authorities. The fiscal impulse indicators should be interpreted with caution, because their synthesizing function poses problems, stemming from the difficulties of making an accurate temporal allocation of the discretionary fiscal measures and the assessment of the cyclical component itself. In some cases, the expansive or contractive nature of this discretionary action is related to comparison with a base year (as in the IMF indicator, for example), which qualifies any conclusions derived therefrom. Generally, these indicators do not aim to provide precise information on the level of the various components of the public deficit (as a percentage of GDP), but
rather on the change in that level, so as thus to assess whether a given year's fiscal policy stance is expansive or contractive.

Fiscal policy stance indicators distinguishing between cyclical and structural components are open to criticism because, by calculating one of the components as a residual, they incorporate into it, along with genuinely structural or cyclical (according to the case) elements, transitory effects. An alternative approach for extracting the various components of the fiscal balance is to make a distinction between a trend component that would capture the more permanent elements of the deficit, a cyclical component correlated with the fluctuations in output, and a third residual component that would capture the impact of discretionary measures and noncyclical factors, with transitory effects, all measured in terms of budgetary variables expressed as a percentage of GDP. This approach has two advantages: separation of the transitory elements from the definition of structural deficit, and the direct estimation of the stabilising effects of fiscal policy on variables as a percentage of GDP, which is a way of deflating the variables so that the results can be interpreted in real terms. This line of research is currently being pursued in the Banco de España.

5. Monetary variables and nominal expenditure

The monetary aggregates are, in principle, leading indicators of nominal expenditure; thus, they can anticipate inflationary pressures stemming from an excessive increase in demand. In fact, this relationship between monetary aggregates and nominal expenditure is the basis of two-stage monetary policy strategies that take one of these aggregates as an intermediate objective. In Spain, the switch from a two-stage strategy based on the use of the ALP aggregate as an intermediate objective to the direct monitoring of a price objective was largely prompted by stability problems in the relationship between ALP and expenditure. Despite this, interest in analysing monetary aggregates remains strong, and they are still considered privileged indicators for monetary policy decision-making.

As demonstrated in a recent series of studies re-examining the short-term relationship between aggregates, nominal expenditure and prices, the informational content of the various aggregates is high. Various methodologies can be used to extract this information on prices and nominal expenditure, and they are described in Cabrero et al. (1996). One means of harnessing information from monetary and credit variables is centred on the capacity of
these variables to anticipate the turning points of inflation. In the study referred to, it was chosen to use the rate of variation of inflation, adjusted for deterministic effects, as a reference variable. The results indicate asymmetries among the various indicators in capturing the turning points. Moreover, the peaks -indicative of the start of a period of slower inflationary growth- are captured with less dispersion than the troughs. Using various criteria for the goodness of fit of the lead, the most consistent aggregate and the one that best satisfies said criteria is domestic credit to households and firms, broadly defined.

The second line of research described in the above-mentioned study is the construction of weighted monetary aggregates, in which the weights of each asset included in the definition reflect its distinct degree of liquidity (as not all assets are perfect substitutes from this standpoint). To calculate the weights, and, given the difficulties of doing so using interest rate differentials in respect of an alternative, illiquid asset, a procedure was used consisting of estimating, by means of a leading indicator model, those weights which, when applied to the various components of a given aggregate, yield a liquidity growth that anticipates the trend of nominal expenditure in a more stable manner. The weight structure obtained allows for analysis of both the relative liquidity of the various assets or asset groups making up the aggregate and their trend over time.

On the whole, the conclusion may be drawn that the monetary and credit aggregates provide relevant information for the analysis of short-term inflation, as they tend to anticipate movements in the target monetary policy variable. Nevertheless, there is no one aggregate, weighted or unweighted, which is clearly superior to the others in this anticipatory function, so that the best strategy would be to combine all of the information they provide.

6. Composite inflation indicators

As pointed out above, inflation is a phenomenon characterized by a general rise in prices and costs, but, obviously, not all prices or their determinants vary simultaneously. This points to a possible method of predicting inflation -and, specifically, the rate of CPI variation-, as the chronological order of cyclical variations in a set of indicators potentially related to final prices can serve as the basis for anticipating the critical points at which the trend of the

11 Juan Carlos Delrieu assisted in the preparation of this section.
phenomenon being monitored -i.e., inflation- will change direction. The information contained in this set of leading indicators of inflation can be combined in a composite index, the purpose of which is to qualitatively anticipate the points marking the transition from one phase to another, rather than quantitatively predicting variables.

The methodology of composite leading indicators is rooted in tasks related to the preparation of composite indices to anticipate the turning points in the general index of economic activity, which mark the changes between the expansive and recessive phases of the economy. Conceptually, a composite leading indicator is a time series that summarizes the information contained in a set of partial indicators representative of an economic phenomenon, for purposes of anticipating as precisely as possible the cyclical consistencies of that phenomenon. Insofar as the inflation rate exhibits cyclical behaviour, the methodology based on the determination of turning points can play a clear role in the analysis of inflation, by exploiting the predictive capacity of those indicators that anticipate the turning points on the inflationary path.

The preparation of composite indicators capable of anticipating movements in the rate of inflation is complicated in Spain by the shortness of the macroeconomic series which, together with the large trend component of inflation, results in few turning points in the price variation series. Nevertheless, some studies have attempted to construct leading indicators of inflation, e.g. Fernández and Virto (1994). Another more recent study employing a similar methodology is that of Cabrero and Delrieu (1996). What sets this study apart is, first, the use of inflation rate variation (measured by the CPI) as a reference indicator, corrected for deterministic phenomena, instead of the trend component of the IPSEBENE; and, second, the effort to adapt the composite index to the dynamic trend of inflation, in order not only to anticipate the turning points, but also to predict the trend component of medium-term inflation.

In this study, after establishing the reference chronology with the aforementioned indicator, an analysis is performed of a large sample of real, monetary and financial indicators that approximate the pressure of demand on the factor, commodity, and

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12 See, for example, the seminal study of Burns and Mitchel (1946) and, more recently, Lahiri and Moore (1991).
13 See, inter alia, the studies of Klein (1986) and Quinn and Mawdsley (1996).
capital markets, to determine their lead capacity vis-à-vis the reference chronology. Part of the analysis (i.e., the part related to monetary and credit indicators) was mentioned in the preceding section, in the discussion of these aggregates as indicators of nominal expenditure. The analysis as a whole indicates, as a general concept, that the peaks of the reference indicator are anticipated with greater precision than the troughs.

Based on the individual analyses performed with each indicator, the authors select those that best anticipate the turning points of the reference indicator. These criteria are complemented with the application of certain causality tests, to check for the possible existence of a dynamic relationship over time between the variables previously selected and the CPI. The synthesis between the set of indicators with a capacity to anticipate turning points in the reference series and those with significant predictive power allows a total of ten indicators to be selected to form the composite index. The composite indicator ultimately obtained detects the critical

**Figure III. Year-on-Year Growth of the Composite Index and the CPI, 1982-95**

![Graph showing year-on-year growth of the composite index and the CPI, 1982-95.](image)

*Sources: Instituto Nacional de Estadística, and Banco de España.*
points of the reference indicator with a relatively stable lead, which, on average, can be quantified at around nine months (see chart III). The goodness of fit of this indicator is reaffirmed by its ability to predict the trend of prices in a continuous and nondiscrete environment, which can be verified by estimating and testing a statistical prediction model. Undoubtedly, the results obtained so far in this line of research are encouraging, although they will have to be tested by actually using the indicator and confirming that it provides information additional to that obtained with other prediction models.

7. Indicators of inflationary expectations

A very important channel for the transmission of monetary policy in the current system, which is based on a direct price objective, is the influence of economic agents on inflationary expectations. The importance of this transmission channel is determined by how swiftly and pervasively monetary policy can produce effects through it, and by the weight of the expectations in determining the basic price trend variables. This section contains a few comments on the most representative indicators of expectations.

The financial markets are among those most affected by the trend of inflationary expectations. The swiftness and efficiency of operations in these markets are such that changes in expectations promptly affect equilibrium prices. In certain circumstances, the term structure of interest rates -i.e., the relationship between interest rates and maturities- can provide information on the expectations of economic agents concerning the future trend of inflation and interest rates themselves. Ayuso and Núñez (1996) analyze the conditions in which information concerning expectations can be extracted from the term structure of interest rates.

To obtain this information, the first task is to estimate the term structure of interest rates and of the corresponding implicit forward rates. This structure is not directly observable, as the rates observed, which are not available for all terms, contain credit and liquidity risk premia, the effects of taxation, etc. Public debt interest rates, which are not affected by credit risk and which are usually sufficiently liquid, are used for the estimate, which is made under the assumption that the forward rates converge toward a given level and at a certain velocity, which will have to be estimated.

Once the yield curve has been estimated -and, therefore, the
structure of implicit forward rates-, and given the theoretical relationship between forward rates and the interest rates expected by economic agents, the latter can be derived from the former, provided an estimate of risk premia by term is available. Although this latter condition is not easily satisfied, it appears that these premia are very small in Spain. There is also a theoretical relationship between forward rates and the expected inflation rate, although deriving the latter from the former requires knowledge not only of the premia by term, but also of the inflation premia and the real interest rates expected by economic agents. Again, these latter elements of the forward rates are difficult to disentangle, but there are indications that in our case they are relatively stable; therefore, given the smallness of the premia by term, shifts in the forward rates curve will be indicative of changes in inflationary expectations.

In summary, given the not unrealistic assumption that ex ante real interest rates as well as premia by term and inflation premia remain relatively stable, the forward rates curve can be used as a monetary policy indicator, since shifts in it can be associated with changes in two key variables, such as interest rates and expected inflation rates. Thus, shifts in the forward rates curve for the medium term (1 year, for example) can be associated with changes in inflationary expectations, while shifts in the forward rates curve for shorter periods (1 month, for example) can be more easily interpreted as changes in nominal interest rates expected by economic agents in that term, which, in so short a period, will be associated with the expected changes in Banco de España intervention rates.

Apart from the yield curve, there are other indicators of inflationary expectations which are related to nonfinancial markets. Prominent among these are opinion surveys, which provide information on the price expectations of various economic agents, these expectations being, in turn, of a different nature. Thus, the Monthly Business Survey (Encuesta de Coyuntura Industrial, ECI) provides information on the trend of industrial prices projected by entrepreneurs themselves, who are the ones who will ultimately set these prices. Consumer opinion surveys, on the other hand, also include information on consumer price rises expected by these agents, wherein the variable with the most immediate effect is wages.

The relationship between opinions on the projected price trend (ppt), as captured in the business survey (ECI), and the inflation rate measured by the industrial price index (IPRI) has been
discussed in various Banco de España studies. Specifically, Matea (1994) estimated a transfer function using the ppt as an explanatory variable of IPRI variations, arriving at the conclusion that the former actually led the latter. Urtasun (1995) analyzes this relationship by estimating a structural equation derived from an augmented Phillips curve including expectations, whose explanatory variables also include orders on hand and the expected trend in orders on hand as approximations of output gap pressure. The results, still highly provisional, also show the potential of the ppt as a leading indicator of inflation in the industrial sector.

8. Multi-equation forecasting models

As already pointed out, the analysis of more or less varied information on the inflationary situation should lead to the estimation of a projected path of price movements, together with a measurement, if possible, of the uncertainty associated with this forecast. One method of achieving this synthesis of information may be to prepare macroeconomic forecasts, with the sole requirement of accounting consistency. In this case, the expert is entirely free to incorporate his own opinions into the forecast, although the procedure has the disadvantage of not being particularly transparent, and a quantified measurement of the uncertainty associated with the forecasts is not easily obtained. The construction of structural macroeconomic models is another method of synthesizing information on the economy as a whole to obtain forecasts of the principal macroeconomic variables, including prices. Although, in the past, models of this type assumed considerable proportions, they have since tended to shrink, so that the amount of information they contain is, in principle, insufficient for the expert’s purposes. However, they are more transparent since the relationships between the variables are explicit and make it possible to quantify the uncertainty surrounding the forecasts. In the case of both expert forecasts and those generated by a structural model, the forecasts will generally be conditional, as they will be subject to the assumptions made concerning the behaviour of the exogenous and economic policy variables throughout the forecasting period.

A third method of synthesizing the information is to use a multivariate forecasting model, which, unlike structural methods, uses only the statistical properties of the series selected to estimate the interrelationships between the several variables and obtain
forecasts, whether nonconditional, i.e., based solely on the past values of these series, or conditional. In the Banco de España, Álvarez et al. (1996) have estimated such a model. It is a small macroeconometric model, estimated according to the methodology of Bayesian vectors of autoregression (BVAR). Briefly, the BVAR methodology involves estimating the interrelationships within the vector of variables selected on the basis of information provided by the past values of the series and certain a priori information on the probability distribution of the model's parameters. The distinguishing characteristic of BVAR models is that the a priori information does not consist of exclusion conditions imposed on the parameters of the model by economic theory, but is rather of a purely instrumental character and has an empirical origin divorced from theory. The resulting predictions in turn incorporate as basic information the past values of the variables selected and the estimated interrelationships between them.

The BVAR model of the Spanish economy is quarterly and includes nine variables, representative of the four sectors into which the economy has been divided for purposes of the model: the external sector (exchange rate, representative of the competitiveness of the economy and the channel for the transmission of monetary policy, and level of world economic activity); the monetary sector, which includes the monetary authority and the financial institutions (interest rate, channel for the transmission of monetary policy through its effect on spending decisions, and money stock); the public sector (net government financing); and the domestic sector, which includes the domestic economic agents who make decisions concerning production, investment, labour supply and demand, and consumption (prices, approximated by the CPI, wages, employment, and GDP).

The a priori information introduced in the model assumes that all of the variables are endogenous, except world economic activity, which is exogenous. Likewise, it is assumed that the interest rate follows an autoregressive process, exogenous to the rest of the variables in the system. Moreover, tests of the predictive capacity of the model -generally, and in relation to inflation- have been satisfactory, especially in medium-term target periods, so that consideration of the interrelationships between variables in forecasting the future behaviour of inflation is useful. In short, the BVAR model is a useful, complementary tool for predicting inflation in Spain, the main advantages of which are its transparency and the possibility of supplementing the forecasts with a quantitative measurement of their probability of fulfilment.
V. FINAL CONSIDERATIONS

The Banco de España's current monetary policy strategy, which is characterized by the lack of an intermediate variable and the direct monitoring of a price objective, is based essentially on analysis of the inflationary situation and the diagnosis of price trends. This necessitates the processing and analysis of a wide variety of information, to ensure that the diagnosis is as accurate as possible. As this article has endeavoured to make clear, the Banco de España takes an eclectic approach to the use of information, as there is not enough confidence in any one technique to make it stand out from the others. This also reduces the likelihood of making major errors. In this context, the Bank's efforts are focused on developing powerful analytical tools, although the analyst's opinion is essential in formulating a diagnosis on inflation.

To ensure the credibility of actions taken by the Banco de España on the basis of this information, it is essential that the information be analyzed with sufficient transparency, hence the importance of the various reports published by the Bank analysing the inflationary situation, particularly the semi-annual Inflation Report. Moreover, the method of analysing inflation and processing the related data is constantly evolving. The use of increasingly efficient techniques and the incorporation of new information capable of providing a greater understanding of price behaviour indicate that the analytical process is constantly being developed and perfected.

Annex

BREAKDOWN OF THE GDP AND FINAL DEMAND DEFLATORS

In the context of the National Accounts, one direct method of arriving at an expression of final prices as a function of costs, based on the relationships established between the various account aggregates, is to consider the balance between uses and resources described in the goods and services account:

\[ Q + M = CI + DF \]

where \( Q \) is total output, \( M \) imports, \( CI \) intermediate consumption and \( DF \) final demand, and the use of capital letters indicates that the variables are valued at the current prices of year \( t \) (omitting
the $t$ subscript for purposes of simplicity). Given that gross domestic product ($Y$) equals total output less intermediate consumption in the productive process, it is holds that:

$$Y + M = DF$$

*i. e.*, final demand is satisfied with domestic output or imports. As the deflators are implicit variables, resulting from the division of variables at current prices and at base year prices, the following expression can be derived from the preceding identity:

$$P_{df} = \frac{DF}{df} = \lambda_y P_y + \lambda_m P_m$$

where the use of small letters indicates that the variables are valued at constant base year prices, $\lambda_y = \frac{y}{df}, \lambda_m = \frac{m}{df}$ and $P_x$ is generally the deflator of variable $X$.

The final demand deflator represents the index of aggregate prices of all goods and services in the economy to be used for final consumption and investment purposes, and the preceding expression can be interpreted as the summarized form of the supply curve of these goods and services. However, more than the expression of the final demand deflator in levels, the interesting aspect here is the change in the level. Taking the preceding expression (and disregarding the second order terms), the following is obtained:

(1) \[ \Delta P_{df} = \omega_y \left[ \Delta P_y + \Delta \lambda_y \right] + \omega_m \left[ \Delta P_m + \Delta \lambda_m \right] \]

where:

$$\Delta X = \frac{X - X_{-1}}{X_{-1}}, \omega_y = \frac{Y_{-1}}{DF_{-1}} \text{ and } \omega_m = \frac{M_{-1}}{DF_{-1}}$$

Expression (1) summarizes the contribution of internal and external factors to the growth of the final demand deflator, from the viewpoint of supply, *i. e.*, of resources available to satisfy that demand. As for inflation of domestic origin, the economy's operating account can be used to perform a more detailed analysis. According to this account:

$$Y = RA + EB + TN$$
where $RA$ is the compensation of wage earners, $EB$ is the gross operating surplus, and $TN$ indirect taxes net of subsidies, including VAT and net import taxes. The GDP deflator can therefore be expressed as:

$$P = \frac{RA}{y} + \frac{EB}{y} + \frac{TN}{y}$$

so that the variation of this deflator will be:

$$\Delta P = \omega_r \Delta \left( \frac{RA}{y} \right) + \omega_e \Delta \left( \frac{EB}{y} \right) + \omega_t \Delta \left( \frac{TN}{y} \right)$$

where:

$$\omega_r = \frac{RA}{y-1}, \omega_e = \frac{EB}{y-1} \text{ and } \omega_t = \frac{TN}{y-1}$$

The components:

$$\frac{EB}{y} \text{ and } \frac{TN}{y}$$

capture the surplus and indirect taxes net of subsidies per unit of real output. As there is no deflator for any of these variables, their contribution to the change in the GDP deflator is obtained directly by multiplying their nominal variation per unit of GDP by the corresponding weight.

Moreover, the expression:

$$\frac{RA}{y}$$

is equivalent to the unit labour cost, since dividing by the number of wage earners ($A$) would yield:

$$\frac{RA}{A} = \frac{\text{compensation per wage earner}}{\text{productivity per wage earner}}$$

However, productivity is usually measured in terms of total employment (including non-wage earners), since this facilitates comparisons between time periods (productivity per employee is more stable than per wage earner), between sectors, and between countries (to mitigate the effects of different hiring rates). Moreover, the cost of labour would also have to take into account the
compensation of non-wage earners. As no information is available concerning the latter, it is assumed that compensation per non-wage earner is equal to compensation per wage earner. Labelling the compensation of employees \( RE \):

\[
RE = \frac{RA}{A} E = RA + \frac{RA}{A} (E - A)
\]

where \( E \) is the total number employed, yields the usual expression of unit labour cost, or cost of labour per unit of output, \( CLU \):

\[
CLU = \frac{RE}{y} = \frac{RE/E}{y/E} = \frac{\text{compensation per employee}}{\text{productivity per employee}}
\]

The insertion of this variable into the expression of the GDP deflator necessitates redefining the gross surplus to exclude the part allocated to the compensation of employees under the heading of compensation of non-wage earners:

\[
EB^* = EB - \frac{RA}{A} (E - A)
\]

So that the variation of the GDP deflator can be reformulated as:

\[
(2) \quad \Delta P_y = \omega_r \Delta CLU + \omega_e \Delta E B^* \frac{BA}{\Delta y} + \omega_l \Delta TN \frac{BA}{\Delta y}
\]

where \( \omega_r \) has also been redefined as:

\[
\omega_r = \frac{RE-1}{y-1}
\]

and \( \omega_e \) as:

\[
\omega_e = \frac{EB^*-1}{y-1}
\]

Substituting the expression of the GDP deflator in the expression of the final demand deflator yields:

\[
\Delta P_{df} = \omega_p \left( \omega_r \Delta CLU + \omega_e \Delta \left( \frac{E B^*}{y} \right) + \omega_l \Delta \left( \frac{TN}{y} \right) + \Delta \lambda_y \right) + \omega_m (\Delta P_m + \Delta \lambda_m)
\]

This expression is a breakdown of the final demand deflator that synthesizes the process of final price formation in the economy, as it captures the contributions of the various cost com-
ments (labour, imported goods) to the growth of prices, the impact of net indirect taxes and the behaviour of unit margins.

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