

Summary of Prof. Espasa's contributions to the field of economic forecasting

24th February 2017.

I Monetary forecasting

Espasa and Pérez (1979), which was not published because as that was the policy of the Bank of Spain policy at the time, developed a series of quantitative models useful for the implementation of monetary policy for the first time in Spain. These models were systematically used by the Bank of Spain until the institution changed its control strategy. Espasa and Salaverría (1988) performed an in-depth review of the initial econometric models.

Espasa (1980) represented the first study of the demand for cash in the Spanish economy and Escrivá and Espasa (1988) developed and estimated a model concerning the determination of reserves in the banking system.

Espasa and Cancelo (1987) estimated a model to predict daily fiduciary currency circulation demand.

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II Inflation

A study evaluating salary inflation models up to 1977 can be found in Espasa (1977).

Espasa, Matea, Manzano and Catasús (1987) develop and generalise the approach proposed by Espasa, Molina and Ortega (1984), considering the need to analyse inflation for forecasting and diagnostic purposes, by means of a disaggregated econometric system. The paper was conclusive in a series of results that established the framework that many subsequent analysts have followed to forecast inflation in Spain. In this context, Espasa and Matea (1991) define the methodology for the calculation and forecasting of core inflation.

Espasa and Lorenzo (1995) progress in the disaggregate approach for forecasting inflation and in the introduction of leading indicators in specific price indices. These models are used in Espasa, Lorenzo and Escribano (1995) to defend the use of forecasts as a basis for diagnosing inflation, and, in Espasa and Lorenzo (1995) to analyse the convergence of Spanish inflation with Europe.

Espasa, Senra and Albacete (2002) approach inflation analysis and forecasting in the euro area, showing that models based on sectoral or geographic disaggregation generate more accurate forecasts than aggregate models. The paper also analyses the interest of constructing vector models for each type of disaggregation, including the long-term constraints affecting the different components.

In the analysis of euro area inflation, Espasa and Albacete (2007) show that it is important to apply disaggregation by sectors in each country. A minimal sectoral and geographic disaggregation is analysed, so that it can be implemented with the available sample sizes while including the main common trend factors among CPI components. This leads to a vector of ten components, two sectors in five geographical areas, constructing a VEqCM model with a block diagonality constraint. The paper shows that this model forecasts euro area inflation more precisely than any of the other aggregate or disaggregate alternatives considered.

Albacete and Espasa (2005) approach the problem of forecasting euro area inflation as precisely as possible while explaining the factors that determine inflation forecasts. The paper shows that the most precise forecasts are obtained with monthly models of vector time series with an equilibrium correction mechanism, as proposed in Espasa and Albacete (2007). These models do not provide an explanation of inflation in terms of its causal variables. This is possible in Albacete and Espasa (2005) by means of quarterly vector econometric models with a mechanism to correct the equilibrium among the vector's different economic variables. This paper proposed a way of combining the results of both types of models –monthly time series models and quarterly econometric models- to obtain precise forecasts with a causal explanation.

Espasa and Albacete (2005) summarized the experience and procedures in macroeconomic forecasting developed since 1994 in the monthly publication Bulletin of EU & US Inflation and Macroeconomic Analysis.

Espasa and Mayo-Burgos (2013) focus on providing consistent forecasts for an aggregate economic indicator, such as a consumer price index, and all its components. The procedure developed is a disaggregated approach based on single-equation models for the components, which take into account the stable features as common trend and common serial correlation that some components share. The procedure starts by classifying a large number of components based on restrictions from common features. The result of this classification is a disaggregation map, which may also be useful in applying dynamic factors, defining intermediate aggregates or formulating models with unobserved components. The authors apply the procedure to forecast inflation in the Euro Area, the UK and the US. These forecasts are significantly more accurate than a direct forecast of the aggregate and other indirect forecasts.

Tena, Espasa and Pino (2010) approach the ambitious goal of forecasting the Spanish CPI, together with all its individual indices, with reference to all consumption sectors in each autonomous region. This and a subsequent paper -Pino, Tena y Espasa (2013)- provide a framework for a thorough analysis of a region's inflation and prices relative to the euro area, Spain and other similar economic regions. In turn, these relative prices are the basis for competition studies.

Carlomagno and Espasa (2014) extend the pairwise approach in Espasa and Mayo-Burgos (2013) by analyzing analytically and by simulation experiments the statistical properties of the procedure and modifying it according with those results; by studying the implications in model simplicity of different normalizations of the cointegration relationships due to the corresponding different formulations of the α matrix of adjusting coefficients; by comparing it with the alternative of using DFM and showing that it dominates DFM in many empirically relevant situations; by showing that the procedure performs very well when the common trends are not pervasive; by analyzing the properties of the procedure in the presence of outliers and proposing a strategy to deal with them, particularly in cointegration tests.

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III Macroeconomic forecasting

Espasa (1989) develops a procedure for estimating the trend of the Spanish gross domestic product, contemplating the existence of structural changes in mean growth, and Martinez and Espasa (1998) use that methodology to contemplate that the economic cycle is asymmetrical

and requires modelling by non-linear structures. Espasa (1993a-b, 1994a-d and 1995a-d) includes A. Espasa's contributions to "Economic Forecasts" about Spanish economy forecasting, and Espasa (1996) summarises his contribution, as the Macroeconomic Forecasting representative, to the group of Economic Forecasting experts created by the Ministry of Economy.

Minguez and Espasa (2006) analyse forecasting the euro area gross domestic product by different types of model, time series and econometric, with different disaggregations, showing that the best forecasting results are obtained by combining the GDP forecasts derived from disaggregation in terms of demand components with those derived from disaggregation in terms of supply components, using leading indicators whenever possible.

Cuevas, Quilis and Espasa, 2015, propose a method to forecast quarterly the GDP's of the 17 Spanish regions disaggregated in the different official production sectors. The main characteristics of the procedure are as follows.

- 1) It interpolates the official annual regional Spanish data at quarterly level incorporating leading indicators of the specific regions.
- 2) It builds econometric dynamic models to forecast all the production components of all GDPs of the Spanish regions. These models include leading indicators as explanatory variables.
- 3) Aggregating the results in (2) for a specific region, a forecast of the corresponding GDP is obtained.
- 4) The forecasts of the GDPs of all the regions are submitted to triple jointly-consistency criteria.

4.a) For each region a temporal consistency criterion provides that the aggregation of the quarterly GDPs figures for four natural quarters aggregate to the corresponding annual official figures.

4.b) For each quarter a cross-section consistency criterion provides that the aggregation of all regional GDPs provides the corresponding official figure for Spain or the corresponding forecast for Spain. The latter is obtained by an independent model constructed at the level of Spain with quite large information set on the Spanish economy.

4.c) Since the macro data are linked Laspeyres indexes, a non-linear consistency approach is developed.

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IV Macroeconomic forecasting methodology

The outstanding contribution of the book by Espasa and Cancelo (eds) (1993) consists of its in-depth presentation of all the available statistical-econometric methods and the creation of a methodology for its application to analysing economic outlook. The previous papers that influenced this book included, among others, Espasa (1977a- c, 1978, 1980a, 1980b, 1982a and b and 1983). In the book's prologue, E. Fuentes-Quintana expresses an opinion that the subjects contemplated in the book should be subject to examination at the end of B.Sc. courses in economics. A subsequent contribution concerning forecasting and macroeconomic analysis methods can be found in Espasa (2002), Espasa and Albacete (2004). Espasa and Peña (1995) present a procedure for breaking down the forecasting function of an ARIMA model into one permanent and one temporary term, comparing it with other methods presented in the literature and applying it to actual series. The paper generalises the concept of integration with the $I(d,m)$ notation for distinguishing the stochastic and deterministic factors in the permanent component of an economic variable.

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V Forecasting weekly, daily and hourly series of economic activity, for business logistics and planning, for the implementation of business intelligence and for the construction of real-time quantitative macroeconomic indicators

The first study by A Espasa in the topic of forecasting a daily series of economic activity is in Espasa 1979, which evaluates the effects of the February banking sector strikes on the computable liability figures provided to the Bank of Spain. It was thus possible to estimate banks' real computable liabilities and apply monetary policy accordingly, and not based on the declared

liabilities that did not consider the enormous number of account movements that were not accounted for because of the strike. This subsequently gave rise to a thorough study on the modelling of monetary variables, which Espasa and Cancelo (1987) applied to the daily fiduciary currency circulation forecasting that the Bank of Spain needed to plan its cash transfers to banks.

Experience in the field of daily monetary series enabled an approach to daily electricity consumption forecasting in a 1988 project for Red Eléctrica de España. The model structure designed in this project is still used in REE and has forecast the historic peaks observed in past years. In his Ph D thesis J R Revuelta shows that these forecasting procedures based on econometric models with complex structures in order to consider calendar, holiday, seasonal and weather-related effects, generate much more accurate forecasts than those obtained from methods based on neuronal networks.

Cancelo and Espasa (1995) formulate the theoretical context of the econometric models used in the 1988 project in which the meteorological variables are allowed to have non-linear and dynamic effects which change with the type of day and season of the year. Cancelo et al. (2008) present the models for hourly electricity consumption forecasting and design a strategy for combining the results of a daily model and 24 hourly models for forecasting consumption in the 168 hours of the next seven days.

Taylor and Espasa (2008) provide a general description of the quantity and price forecasting problems currently affecting the electric sector, including those associated to renewable energy, the production of which cannot be controlled.

Espasa et al. (1996) and Cancelo and Espasa (1996) generalise the models developed for daily monetary and electricity consumption series for many other series. Cancelo and Espasa (2001) study high-frequency (daily, hourly, etc.) time series containing valuable information for business forecasting and logistics. The paper proposes and illustrates the use of time series techniques for that purpose, developing a general framework capable of reflecting the principal properties of these time series. These techniques are being widely used by major international corporations in sectors such as energy, transport and communications in order to forecast different variables that are of importance for their respective businesses. A field in which such forecasting is very useful is in the strategy to satisfying the demand of major clients that need to be supplied on a weekly or daily basis. Indeed, based on the historic figures relative to their customers, suppliers are able to forecast their weekly or daily needs, ensuring sufficient supply.

In line with the above, Cancelo and Espasa (2009) develop three basic ideas for the implementation of Business Intelligence techniques, showing how to develop a forecasting system that converts a firm's raw data in useful knowledge for market operations.

Jointly with J R Cancelo, A Espasa has developed projects of daily econometric models in other economic sectors as petrol. In it several questions show to be relevant. Between others the specification and estimation of long run relationship between the domestic petrol prices and the international price of crude oil and the comparison between different countries. The results on this question are important for the national authorities controlling the competitiveness in the sector. Other topics of interest to these authorities are, for instance, if the several changes in the weekly seasonality of prices induced by the distribution companies are merely cyclical changes or if also affect the trend. Another one refers to the rockets-and-feathers behaviour which can be found on those prices. A proper specification and estimation of this type of behaviour is important to quantify if it generates additional profits for the distribution companies. All this questions need to be studied with daily data.

The possibility of having real-time daily information about economic activity variables such as electricity consumption, consumption of other sources of energy, communications, transport, transactions, sales, etc., means that it is possible to construct hard macroeconomic indicators that quantify the magnitude in question in real time. These indicators are very important, as they can be obtained as soon as soft indicators that merely synthesise a majority opinion concerning their evolution. The construction of this hard data, however, is much more complex than merely compiling daily observations, as the magnitudes to which they refer are highly affected by weather and the calendar, and these effects are not macroeconomic indicators. It is therefore essential to correct daily observations for such effects and construct indicators from the corrected data. Cancelo and Espasa (2009) present a method based on daily and monthly models enabling the construction and

forecasting of such hard data. The method also enables advancing the indicator for the month in question much before it ends.

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SUMMARY

Fellow of the European Economic Association.
Rey Jaime I Prize for Economics, 1991.
Date of birth: 1945. Married. Spanish nationality.

Antoni Espasa, B. Sc. in Econ., Ll. B. (Deusto University) and M.Sc. in Econ. (Distinction) and Ph.D. in Econ. (LSE), was a senior economist at the Research Department of the Banco de España since 1975 and since 1985 chief-economist in charge of the Unit of Quantitative Methods.

In October 1991 he was awarded by an international jury the first edition of the national "Rey Jaime I" Prize for Economics.

At present, he has a chair on Econometrics at the "Universidad Carlos III de Madrid" and is the director of the Flores de Lemus Institute at this university. This institute is responsible for the monthly publication, *Bulletin of EU and US Inflation and Macroeconomic Analysis*.

Antoni Espasa has published the book *The Spectral Maximum Likelihood Estimation of Econometric Models with Stationary Errors*, Vandenhoeck and Ruprecht, Gottingen, 1977, and articles on econometrics, applied macroeconomics and statistics in the Journal of the American Statistical Association, International Economic Review, Journal of Forecasting, International Journal of Forecasting, International Regional Science Review, Econometric Theory, The European Journal of Finance, etc., in different books with anonymous evaluations and in different Spanish journals.