

**A SURVEY OF RECENT APPLIED MACROECONOMIC AND
MODELLING RESEARCH ON THE SPANISH ECONOMY***

by

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Abstract

This survey reviews some recent empirical research on different relationships referred to the macroeconomic side of the Spanish economy. It also reviews recent attempts to model the Spanish economy with the help of macroeconometric models, mostly used for policy analysis. The selection of the abundant recent Spanish literature on the field covered by our work has not been exhaustive, leaving aside many valuable contributions not directly related with the research project in which the authors are now engaged. This survey is indeed the result of preparatory work carried out in cooperation with research centres at Lisbon, Dublin and Athens in order to construct a small and simple-to-use macroeconometric model of the Spanish economy for the study of the macroeconomic effects of the E.C. structural funds for the peripheral Member States. The criteria stemming from this purpose have thus guided the selection here presented.

An important exception, for the time being, is the Public Sector. Only indirectly, work related to the behaviour of the Spanish Public Sector has been included despite the abundant applied work done in this area. All in all, what our short review reveals is an important amount of research relatively inter-related in which many Spanish economists have been recently involved.

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1. INTRODUCTION

This survey reviews some recent empirical research on different relationships referred to the macroeconomic side of the Spanish economy. It also reviews recent attempts to model the Spanish economy with the help of macroeconometric models, mostly used for policy analysis. The selection of the abundant recent Spanish literature on the field covered by our work has not been exhaustive, leaving aside many valuable contributions not directly related with the research project in which the authors are now engaged. This survey is indeed the result of preparatory work carried out in cooperation with research centres at Lisbon, Dublin and Athens in order to construct a small and simple-to-use macroeconometric model of the Spanish economy for the study of the macroeconomic effects of the E.C. structural funds for the peripheral Member States. The criteria stemming from this purpose have thus guided the selection here presented.

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2. SUPPLY-SIDE EMPIRICAL RESEARCH

2.1 Labour Market

The amount of applied research on this topic has been very important since the early 1970s in Spain (see Bentolila and Toharia (1991) for a very comprehensive collection of recent contributions).

Within the supply-side of an economy, the performance of the labour market determines whether any shock affecting a given country will be absorbed mainly by price movements, mainly by quantities adjustments, or by a balanced combination of both types of movements. Of course, price formation practices are very important and generally away from the perfect competition paradigm, as it will be discussed in section 4.1.

Demand for labour and its wage elasticity must be known since they are at the basis of the employment creation process. Unemployment in Spain has been, and continues to be, dramatically high, so that a common concern of the empirical research in this field has been to establish its determinants among a long list of causing factors: taxes and Social Security contributions, technical progress, unions power, demand and capital shortages, labour costs and other structural factors (see Dolado, 1991). Computing the non accelerating inflation rate of unemployment (NAIRU), both in a closed and open economy, has been carried out, in illustrative ways, to show the very reduced margin that exists in order to implement expansionary policies without, at the same time, provoking inflation and/or current account deterioration.

It is more and more apparent, however, that the macroeconomic approach to employment and unemployment must be complemented with the microeconomic approach. Indeed, at the root of the majority of unemployment stories lie a large variety of microeconomic factors having related to workers behaviour, firm or sector specific conditions, technology, training, obstacles to mobility, etc... The interested reader should see among others, recent work done by Jimeno and Toharia (1993), Draper (1993), Bentolila (1992), and Gil and Jimeno (1993).

Raymond et al. (1986), starting from a CES production function, estimate a reduced version of the model proposed by Layard and Nickell (1986a), where the demand for labour is a function of output, real wages and a time trend proxying technological progress. This specification allows them to obtain a wages/employment total elasticity (i. e., output effect and substitution effect). Alternatively, given the characteristics of the CES function, the authors consider also a specification that substitutes the stock of capital for output, which allows the computation of the elasticity of the substitution effect (capital for labour), once the relative cost of labour is introduced.

In the short-run equation, the real prices of intermediate goods and energy are also included as additional explicative variables. The estimation offers a low short-run elasticity of labour with respect to wages, both total and substitution, being this result independent of whether the data refers to the whole economy, or to the services or manufacturing sectors. The long-run elasticities are found to be greater than the short-run ones.

Carrasco and Lorente (1988) reconsider the results obtained by Raymond et al. (1986), by assuming a different procedure to compute the capital stock that enters the equation substituting output. The results suggest that the elasticity of employment with respect to real wages is very sensitive to changes in the capital depreciation rate considered in deriving the stock of capital.

Dolado et al. (1986) study the evolution of demand, employment, prices and real wages for the 1964-1984 period, using the model proposed by Layard and Nickell (1986b). This in turn allows them to identify the determinants of the NAIRU. The results indicate that the main determinants of unemployment during the period considered are real import prices, technical progress, union power and indirect taxes. The NAIRU is estimated at a level close to actual unemployment, which reveals very little margin for a non inflationary expansion of the economy.

Dolado and Malo de Molina (1987) compare alternative approaches to labour demand equations estimation suggested by Nickell (1984) and Sachs (1983) and Symons (1984) to obtain a robust procedure for estimating labour demand elasticities and differentiating substitution and output effects. They apply the procedure to Spanish manufacturing employment demand during 1964-83. They find a total long-run real labour cost elasticity of the demand for labour very close to -1 which largely contributes to explain the fall in manufacturing employment in Spain since 1975. This elasticity may be split into the substitution effect (-0,15) and the output effect (-0,80).

More recently, de Lamo and Dolado (1993) have reconsidered the basic model of Dolado et al (1986) in the context of an open economy, so that the Phillips trade-off gets enlarged to include the current account. In these conditions they estimate, yearly, what they call the NAIRUE, that is, the NAIRU compatible with equilibrium of the current account. At present this "equilibrium" rate of unemployment is extremely high, leaving no margin for non inflationary and non current-account-deteriorating expansions of the economy.

Andrés et al. (1990) consider a disequilibrium macroeconomic model based in the work of Layard and Nickell (1986b), Sneessens and Drèze (1986) and Sneessens (1987), to study the determinants of unemployment during the 1964-1985 period. The results show that cyclical demand (proxied by capital utilization in industry), Social Security

contributions, indirect taxes, import price wedge, a mismatch index for aggregate supply and demand in the labour market, the growth of the union's pressure, and unemployment benefits are the main determinants of unemployment. The authors conclude that both demand and capital constraints, rather than the increase of real labour costs, have been relevant factors in determining the high rates of unemployment registered during those years.

Ballabriga et al. (1990) extend the analysis of Andrés et al. (1990) for the 1964-1988 period. The results corroborate that demand and capital constraints are important determinants of unemployment, but they find a significant negative impact of labour costs and the degree of structural mismatch on employment.

Viñals (1991) examines the role of real labour costs in the substantial fall of employment in Spain since 1974, using the wage gap model (see Bruno and Sachs, 1985). He finds evidence consistent with the model and suggests that this is related to the high rigidity of real wages, both in the short and long term. He also evaluates the reinforcement to the domestic restrictions imposed by the real wage rigidity through its influence on international competitiveness and the balance of payments.

Benelbas, Sastre and Taguas (1987) evaluate the effects of a reduction in employers' contributions to Social Security compensated by an increase in VAT in such a way that public revenue is unchanged. To this end, they consider a model comprising a set of equations for the production function, costs function, production prices, labour supply, effective private employment and consumption prices. The results show a contraction in demand for labour as a result of that change in fiscal policy. Zabalza (1988) offers further evidence on this results, using a two-equation model for employment and real labour cost.

2.2. Production and cost functions

The estimation of aggregate output and productivity equations for the Spanish economy has recently been the object of some research done from the disequilibrium approach "à la Drèze", and from the new approach to productivity determination based on the role of public capital "à la Aschauer". These two novelties add much value to the conventional production function approach to estimate aggregate product.

Ballabriga and Molinas (1990) use a disequilibrium macroeconomic model based on the work of Sneessens and Drèze (1986) to evaluate the role played by demand constraints and factors availability in the evolution of employment and production in the Spanish economy during the 1965-1988 period.

The model considers n firms which operate in a monopolistic competition framework. Each firm fixes its price in order to maximize expected profit, and they may find themselves constrained by the available labour supply, by capacity or by demand. The actual level of employment and production results from a combination of these three rationing regimes, the respective weight depending upon the proportion of firms in each regime. Assuming a Cobb-Douglas production function, they derive and estimate final equations for labour and capital productivities and for aggregate production (see below the description of the supply block in the MOISEES Model).

Bajo-Rubio and Sosvilla-Rivero (1993a) examine the possible influence of public capital accumulation on private sector economic performance. To this end, they postulate a simple (Cobb-Douglas) aggregate production function for private output, in which government-owned capital is included as a separate factor of production. The rate of capacity utilization is also included, in order to pick the influence of the business cycle, and the estimation of the model by cointegration methods (robust to endogeneity bias) show a positive and statistically significant effect of public capital on private capital productivity.

Argimón et al. (1993) advance further in the treatment of the productivity effects, by considering the effects of public infrastructure capital, using both an enlarged Cobb-Douglas production function and a total factor productivity relationship. They confirm the Aschauer (1989) results, obtaining larger estimates for the productivity effect of public infrastructure capital than those reported in Bajo-Rubio and Sosvilla-Rivero (1993a) for total public capital. In particular transport and communications infrastructure have a larger productivity effect than private capital.

3. DEMAND-SIDE EMPIRICAL RESEARCH

3.1 Consumption and saving

This two magnitudes (private consumption and savings rates) are closely related to each other from both an accounting and a behavioral perspective as they add up to the households disposable income.

The standard determinants of consumption are some form of disposable income, either current or permanent, accumulated savings (wealth) and the intertemporal reward on savings (interest rate). Less conventional determinants are "pension wealth expectations" under pay-as-you-go Social Security schemes or expected taxes, proxied by current government deficits as long as the ricardian equivalence theorem holds.

To the extent that households face liquidity constraints, both the life-cycle hypothesis and the permanent income hypothesis may not be easy to test, since excessive volatility of consumption would not necessarily mean that these theories do not hold but rather that households are facing imperfect capital markets and thus suffering some sort of liquidity constraints.

Of course, current fiscal provisions determine disposable income; (national) saving, however, is made out of three components: private, corporations' and governments savings and besides their specific determinants, or rather, because of the interplay of these determinants, the issue of the substitutability among the three components has deserved some attention, also in the Spanish recent literature. What is at stake is the validity of the (ricardian) equivalence between current deficits and future taxes and the best policy design to encourage national savings.

Andrés, Molinas and Taguas (1990) specify private consumption as a long-run function of disposable income and private wealth. In the short-run equation, an error-correction model is adopted to relate changes in private consumption to changes in long-run determinants (disposable income and private wealth) and changes in the inflation tax, the real interest rate, and the unemployment rate.

Berenguer (1990) examines for the Spanish case the hypothesis, justified by both the permanent income and the life cycle theories, that current consumption is independent of current income. His results for the 1955-1987 period are not consistent with that hypothesis. He finds evidence of significant liquidity restrictions affecting the consumers.

Berenguer (1991) also analyses the stochastic properties of the aggregate consumption function in Spain, confirming the empirical evidence for the US economy presented by Campbell and Deaton (1989), in the sense that, contrary to the behaviour suggested by the permanent income theory, consumption does not respond in a rather sensitive way to anticipated changes in disposable income.

Werling (1990) offers a detailed description of the aggregated consumption equation in the MIDE model (see below). Changes in per capita private consumption are assumed to be a function of changes in per capita real disposable income, per capita private wealth, the unemployment rate and the nominal interest rate. Per capita real disposable income enters the equation with a lag, indicating that increases in income are not immediately translated into increases in consumption, but they are partially absorbed by savings (permanent income effect).

López Salido (1992) uses pannel data techniques to test the life-cycle hypothesis (LCH) and to search for liquidity constraints, among other things, controlling by type of household. He concludes that, for a sufficiently richly specified household intertemporal optimization problem, the LCH has limitations. He also finds excessive variability of the growth rate of consumption (both total and durable) in relation to the rate of growth of lagged income recognising in this a symptom of liquidity constraints (see above, Berenguer (1990)).

In an attempt to derive conclusions on the effects of Social Security pensions on savings, Herce (1985) follows Feldstein (1974) by estimating a life-cycle consumption function for the Spanish economy between 1956-1982. Contrary to Feldstein's findings, he obtains a negative effect of Social Security wealth on consumption, and thus a positive one on savings. The estimation is carried out both in levels and in log-differences. Relevant elasticities are, however, small but significant.

Further work by Herce (1986), using more accurate Social Security wealth series (Herce and Moreno, 1986), support these results. More recently, Martín and Moreno (1990) assess the effects of Social Security on savings and on the level of employment for the Spanish case. They find that pensions wealth do affect negatively households' decisions but, again, very slightly, thus contradicting earlier findings by Herce (1985, 1986). However, the level of employment is positively influenced through the labour supply by better pensions wealth expectations, confirming thus an intertemporal substitution effect via earlier retirement.

In Herce (1986) the Social Security effects appear secondary, the main aim being to evaluate the possible substitutability between different components of savings (i. e., personal saving, corporations' saving and government saving), and their broad determinants. Some evidence of substitutability is found, but only between private and government savings, not between personal and corporations' saving, therefore reducing the extent to which an increase in public expenditure crowds out private investment. The no-substitutability result concerning the two private saving components (personal or households' and corporations') contradicts also Feldstein's "ultrarationality" hypothesis, which states that households are able to see through the "corporations' veil", and increase their savings when the latter are reducing theirs through a more active dividend policy. As for the determinants of savings, Herce finds direct taxes to affect negatively households' savings, and profits (proxied by gross operational surpluses from the national accounts) to be the main determinant of corporations' savings. Government deficit is closely determined by government savings the latter being mostly caused by the social security own deficit.

The study of savings determinants and substitutability among its components in Spain has been considerably developed in recent years by Raymond (1990), Argimón (1991), Zabalza and Andrés (1991) and Molinas and Taguas (1991).

Raymond (1990) summarises some of his previously published work to find that households seem to embody Ricardian equivalence a la Barro between government deficits and taxes in their saving decisions. Besides direct taxes, wealth effects appeared to be relevant in Spain at least in recent years. He failed to find evidence of substitutability between households and corporations savings, thus confirming earlier evidence provided by Herce (1986). Corporations undistributed dividends seem to be determined by profits, both

proxied as indicated before or measured through a pannel of firms. He offers illustrative computations of the likely consequences of different policies for national savings.

Argimón (1991) shows that the average savings rate for the 1964-1978 period is significantly higher than that for the 1979-1989 period, thus establishing the need for looking at the determinants of this change. She concentrates her search on substitutability among the different saving components (household's corporations', government's), finding that both household's and corporations' savings substitute significantly, but not completely, for government's savings and vice-versa. This has important implications for any policy seeking to inference national saving. As in previous studies [Herce (1986), Raymond (1990)], no significative evidence is found of substitutability among private saving's components.

Zabalza and Andrés (1991) attribute to government savings the major responsibility for the fall in the national savings rate, given that the two components of private savings have roughly compensated each other in recent years, keeping the latter more or less stable. As for the determinants of household's saving, their main concern in this contribution, they conclude that the increase in effective tax rates has lowered savings more conclusively than private wealth, one of the factors currently blamed by the fall in consumption during the eighties in Spain.

However, Molina and Taguas (1991), although not denying the role played by savings, suggest that the very peculiar joint evolution, during the eighties, of disposable income and private wealth has greatly contributed to the fall of the household's savings rate.

3.2 Investment

Applied research on aggregate investment tends to produce little conclusive evidence given the industry-specific or even firm-specific nature of this important economic decision. However, data availability and also genuine macroeconomic concerns have led traditionally to these kind of research.

Aggregate investment can be approached in two ways from the macro perspective:

- Its relationship with saving and thus the important question of its financing by domestic or foreign funds.
- Its determinants or, in other words, the macroeconomic factors that determine capital formation in the economy.

The findings by Feldstein and Horioka (1980), concerning the degree to which domestic capital formation is financed by domestic saving, initiated a series of studies, to some extent also replicated for the Spanish economy. As for the determinants, profits, user costs or real net of depreciation interest rates, credit constraints, etc. have been typically investigated.

More recently a series of studies have exploited the availability of panel data at the firm level being able to establish better evidence on the determinants of the firms' decisions to invest and their specific circumstances concerning financial situation, industry type, etc. (see Mato (1988 and 1989), Hernando and Vallés (1992), Martínez Pagés and Mato (1992), Alonso-Borrego and Bentolila (1993)).

Herce (1986) finds that investment, as a ratio to output, is highly and significantly correlated with the national savings ratio, irrespective of lag specification. Roughly, 0.6 of each extra peseta saved gets transformed into capital formation. However, no causality à la Sims can be claimed for this relationship. This result, which confirms the Feldstein-Horioka (1980) original findings should be attributed, according to Bacchetta (1990), to the segmentation of international financial markets rather than to national policies aimed at current account stabilisation.

Mauleón (1985) searches for equipment investment determinants between 1966 and 1982 in the Spanish economy. He finds that, for the most part of this period, profits explain investment far better than interest rates or credit availability. The model, however, breaks-down in the last years reflecting the uncertainty attributed by firms to the profits recovery that was then taking place.

Andrés et al. (1990) estimate a model where the ratio between real private productive investment and real GDP at factor costs has as long-run explanatory variables the user cost of capital, the degree of capital utilization and the rate of inflation. This work

not only confirms accelerator type results but finds that capacity utilization plays a strong role in determining investment. User costs and inflation have both negative and highly significant coefficients in the regression equation.

Espasa and Serna (1993) suggest to include the product of real GDP at factor prices and the relative price of energy imports to improve the performance of the model estimated by Andrés et al. (1990). By doing this the equation gets considerably simplified. Also the significativeness of the accelerator coefficient gets dramatically improved while capacity utilization, user's costs and inflation diminish their coefficients and significativeness.

3.3 International trade

The existing evidence on import and export equations for Spain can be subdivided into time-series and cross-section studies. Special attention has been paid in the empirical studies to the effects on international trade of the Spanish entry into the EEC in 1986.

Bonilla (1978) studies the demand for both real imports and exports as functions of income and relative prices. He uses quarterly data for the 1962-1972 period. For the imports equation, the estimated long-run elasticities with respect to relative prices and with respect to income are -1.52 and 1.16, respectively. The estimated long-run elasticities of exports to relative prices and the world trade trade are -1.21 and 1.71.

Mauleón (1986b) presents an estimation of the export function for the Spanish economy based on quarterly data for the 1972.II-1984.I period. When using the relative price of Spanish exports, the estimated long-run elasticities of exports to relative prices and the world trade trade are -1.3 and 0.48, and when using alternatively the real effective exchange rate (lagged two periods), they were -1.35 and 0.44.

García-Solanes and Beyaert (1989) try to include in the exports function variables that can affect the supply of exports. To this end, they estimate for the 1963-1984 period a total exports equation that includes an index of world trade, the relative price of exports and the terms of trade. The estimated elasticities are 1.64, -0.63 and -0.43,

respectively. Alternatively, they consider the degree of capital utilization instead of the terms of trade, being then the estimated elasticities 1.91, -0.73 and -1.28.

Fernández and Sebastián (1989) estimate export and import functions for the 1964-1988 period. Real exports (excluding tourism) are considered to be a long-run function of an index of real world trade, a competitiveness index (built as a relative price of Spanish exported goods to world imports prices times the exchange rate), and the degree of capacity utilization (as a measure for internal demand). When modelling the short-run dynamic, an error-correction model is adopted to relate changes in real exports to changes in long-run determinants (in addition to the second difference of real world trade index) and the inflation differential with respect to the OECD countries, as well as to some dummies for 1976 and 1986. The long-run explanatory variables of real imports are found to be the real GDP, a competitiveness index (defined as the price of non-energy imports relative to the GDP deflator) and the degree of capital utilization. In the short-run equation the change in real investment (both current and lagged) was found to play a significant role in addition to changes in the long-run determinants. The estimated long-run elasticities of real exports with respect to world trade and competitiveness are 1.70 and -1.19, respectively, and those of real imports with respect to real GDP and competitiveness are 1.66 and -0.25, respectively (see Molinas et al., 1990).

Sebastián (1991) analyses the stability of the equations estimated by Fernández and Sebastián (1989) when extending the estimation period to 1990. He does not find any sign of instability, except for the equation for non-energy imports. The estimated long-run elasticities of real imports with respect to real GDP and competitiveness are now 1.76 and -0.68, respectively.

In contrast to the above-mentioned papers, which refer to time-series aggregate export and import functions, Martín and Moreno (1991) use the sectoral panel data approach to investigate the determinants of Spain's industrial exports to other EC countries during the 1978-1986 period. In addition to relative prices and foreign demand, they consider the degree of product differentiation as another explanatory variable for sectoral export behaviour. This additional variable is proxied by the "technological effort" (R&D expenditures plus payments for technological imports) and by the advertising expenditures in each sector.

Their results indicate that the price elasticities of export demand differ widely among sectors, ranging from -2.85 for textiles, leather and clothing, to 2.50 for office and data-processing machines. The authors also find a significant influence of advertising expenditure and, to a lesser extent, technological effort on Spain's industrial export performance to the rest of the EC.

Moreno (1993) extends the analysis by Martín and Moreno (1991) to the 1979-1989 period. Her results suggest that the relevant variable for foreign demand is the real desaggregated GDP and that the relevant variable for prices is that which relates the unitary value indices of Spain and non-EC countries that compete with Spain in the EC market. She does not find a significant effect for capacity utilization as a proxy for internal demand, and confirms the positive effect on export performance of advertising expenditure and capital effort (proxied now by the technological capital). Finally, her results indicate also a positive effect of Spanish entrance into the EC.

4. PRICES, MONEY AND CAPITAL MOVEMENTS

4.1 Prices and wages determination

The determination of wages and prices has been studied for the Spanish economy by Dolado et al. (1986) and López (1991) making use of the model proposed by Layard and Nikell (1986b). In this model, real wages (defined in terms of expected price level), are determined by both demand and supply factors: relative input prices, cyclical demand, the stock of capital, the labour force and supply shift variable. The mark-up of prices on cost is supposed to be a function of cyclical demand, relative import prices, capital-labour ratio and expectational errors.

Dolado et al (1986) estimate this model (including another equation for labour demand) on annual data on the industrial sector for the period 1964-1983. They find that the rate of unemployment and taxes play an important role in wage determination, the first factor exerting a very significant restricting influence on real wages. They also find that a mismatch index, the replacement ratio, firing costs and union pressure also have some effects on real wages. Regarding the price equation, the real price of materials, technical progress, union pressure, productivity and the tax wedge exert an influence on prices.

López (1991) estimates those same equations for the whole economy using annual data for the 1967-1988 period. He relates real labour costs (divided by Social Security contributions) with the unemployment rate, taxes, "push factors" (proxied by the ratio of imported goods prices over the consumer prices index to take into account terms of trade effects) and productivity (measured as (lagged) capital over employment). His price equation relates the GDP deflator costs with nominal labour costs, productivity (measured as before) and the wedge between consumer prices and producer prices.

4.2 Money and interest rates

Supply and demand equations for money continue to be the object of much empirical research due to the intrinsic difficulties surrounding the role of the various determinants, the continuous change in the operation and technology of money markets, and the change in the definitions of monetary objectives of the corresponding policy.

However, the conventional money demand motives continue to be explored by the researchers, in particular the transactions and the store of value motives. All the typical determinants are scrutinized: income, prices both current and expected, interest rates, bank reserves, wealth, financial innovations, etc. The stability of money demand equations has been particularly analyzed. Results point towards no particular instability in this equation. Cointegration, error-correction and VAR techniques have been used.

Dolado (1985) jointly estimates the following demand for and the supply of money with quarterly data for the period 1974.III through 1984.IV:

$$M^d = D(Y, P, \pi, R)$$

$$M^s = S(AC, R)$$

where M are monetary balances ($M3$ and ALP , where $ALP = M3 + \text{other liquid assets}$), Y is income, P is the price level, π is the inflation rate, R the interest rate and AC bank reserves. The results suggest a stable relationship between those variables, though the predictive capacity is greater in the ALP equation than in the $M3$ equation.

Mauleón (1987) reevaluates the stability of the demand for money equations in the light of the financial innovation process experienced in the Spanish economy in the mid 1980s. He concludes that for the 1974-1986 period there are not stable relationships between M2 or ALP and their determinants, and that the velocity of circulation is not constant. He does not find a significant effect of expected inflation on money demand, but real private wealth and wages seem to play a role.

Dolado (1988) uses the cointegration analysis and its closely related concept of error correction model to estimate, with quarterly data for the 1975.I-1987.II period, the demand for real balances using ALP as the monetary aggregate. As with his previous work, the results do not show any clear signs of instability.

Mauleón (1989) offers an estimation of the demand for ALP for the 1974.II-1985.IV period using the Almon (1965) lag technique where the changes in the log of ALP are found to be determined by lagged values of changes in the log of the price index, the interest rate on public bonds quoted in the stock exchange, the real GDP, the real private wealth and a measure of firms' profits.

Manzanedo and Sebastián (1990) differentiate between money demand for transactions and the demand for money as store of value. Using cointegration analysis they specify both equations as error correction models. The result shows that the long-run determinants of the former are domestic absorption, interest rates of liquid assets and a proxy for financial innovation, while wealth and inflation as a measure of the opportunity cost are the long-run explanatory variables of the latter.

Dolado and Escrivá (1992) evaluate the possible relationship between the reduction of the dimension of the monetary aggregate considered and the stability of such aggregate in the demand for money. To this end they analyze, both with transference functions and error correction models, the ALP aggregate and some redefinitions of ALP subtracting some of its components. They conclude that, both from in- and out-of-sample performance of the estimated equations, a monetary aggregate narrower than ALP should be used, in line with the definitions of liquidity in other EC countries.

Raymond and Palet (1989) study the determinants of the long-run real interest rate (RLP). Their results suggest that, in addition of the lagged values of RLP and the output/capital ratio, the expected public deficit and the lagged stock of money (both over detrended GDP) are its main determinants.

Ballabriga and Sebastián (1992) examine the causality between public deficit and interest rates through the specification, estimation and identification of two- (public deficit and interest rate), three- (public deficit, interest rate and money), and four-variables (public deficit, interest rate, money and inflation) VAR models. They conclude that the apparent positive relation between public deficit and interest rates observed for the 1964-1991 period is not the result of an interaction between those variables.

4.3 International capital movements

Unlike trade flows, international capital movements have been the subject of a much lower amount of academic research, both from a theoretical and empirical point of view. However, last years have witnessed a renewed interest for the study of international capital movements, given their impressive growth among the increasingly internationalized Western economies. In particular, the recent liberalization of capital movements within the European Community raises the need for empirical studies addressed to identify the main factors underlying the behaviour of international capital movements.

The evidence concerning capital movements in the Spanish economy is rather scant. We just can quote the papers by Bajo-Rubio and Sosvilla-Rivero (1992, 1993b), and Carrascosa and Sastre (1992).

Bajo-Rubio and Sosvilla-Rivero (1992) study the possible determinants of foreign direct investment (FDI) inflows received by the Spanish economy during the 1964-1989 period. They consider a theoretical model of investment expenditures by a multinational firm, which related FDI to the real gross domestic product, the inflation rate, unit labour costs, the user cost of capital, a measure of trade barriers, the real effective exchange rate, as well as a dummy variable for the Spanish integration into the European Community (EC).

The results show a long-run relationship between total FDI inflows and the level of real GDP, the rate of inflation, the level of trade barriers, and the real effective exchange rate. Roughly similar results are found when splitting total FDI in its two components of manufacturing and non-manufacturing, and for the FDI inflows coming from the EC. In general, the results tend to support the view that foreign investors in Spain are concerned with a growing domestic market, in addition to the favourable prospects of macroeconomic stability associated with the Spanish integration into the EC, rather than with relative cost considerations.

Carrascosa and Sastre (1992) estimate an equation for foreign investment in housing in Spain for the 1964-1990 period, finding that its long-run determinants are tourism expenditures and competitiveness (defined as the deflator of housing investment times the effective exchange rate, over a weighted index for industrial countries' GDP deflator). In the short-run equation a long-term real interest rate (representative of industrial countries) was found to play a role in addition to changes in tourism expenditures and competitiveness.

The role of capital movements in the Spanish economy is the subject of Bajo-Rubio and Sosvilla-Rivero (1993b), by making use of a portfolio-balance model in the line of those reviewed by Branson and Henderson (1985). A model of three equations, which includes equations for the net foreign asset position of the economy (i. e., a measure of the net financial claims on foreigners) together with the demand for and supply of money, is proposed and jointly estimated with quarterly data for the period 1977.I through 1990.IV, using robust cointegration methods. The results show a stronger effect from the domestic, as compared to the foreign, interest rate, on the net foreign asset position of the Spanish economy during that period. Other variables showing a significant influence were domestic wealth, and foreign and domestic income levels. On the other hand, capital controls, proxied by deviations in covered interest parity, proves also to play a significant role in the short-run.

5. ECONOMETRIC MODELLING

5.1 Spanish econometric models

In this Section we offer a brief overview of the main macroeconometric models that have been built for the Spanish economy. Special account will be given of the MOISEES model which has been extensively used in policy applications.

The HERMES-Spain Model

The HERMES-Spain Model is the Spanish version of the HERMES (Harmonized European Research Macrosectoral Energy System) Model sponsored by the European Commission to evaluate the interconnections between energy and economic performance in the European Community.

Spain joined the project in 1986, through the L. R. Klein Prediction Center at the Universidad Autónoma de Madrid.

HERMES-Spain is a dynamic macrosectoral econometric model, based in data from National Accounts and in Input-Output Tables.

The model is divided in three main blocks: demand, production, and price and wage.

The demand block has an aggregated private consumption equation (based in Friedmans' permanent income theory) and a set of equations that distribute the aggregate consumption among the 15 types of goods considered in the model.

The production block considers a putty-clay technology with three factors (labour, capital and energy) in the production of intermediate, capital and consumption goods. Special attention is paid to the substitution and complementarity between production factors.

The price-and-wage block models the production and market prices of the 15 different types of goods considered in the model, as well as the cost of use of capital and wages.

Dones-Tacero, García-Sánchez and Pena-Trapero (1990) offer an overview of the model.

The MIDE model

MIDE are the Spanish initials for a Macroeconomic Intersectoral Model of Spain build at the Fundación Tomillo, a private organization that offers economic research.

MIDE is associated with the Interindustry Forecasting Project at the University of Maryland (INFORUM).

As HERMES-Spain, MIDE is a dynamic macro-sectoral econometric model. It is based in the 1980 Input-Output Table, which considers 43 activity branches, complemented with information from National Account data.

The MIDE model consists in three blocks: the production, income-prices and accounting identities. The first block determines the final demand, the intermediate consumption, and the production, productivity and employment in each of the 43 activity branches at constant prices, being the sum of final demands equal to the GDP. The income-prices block determines the sectoral value added at current prices (i. e. wages, profits, taxes and price index for each branch); the sum of these value added gives the nominal GDP. The final block, through macroeconomic identities and behavioural equations, converts the nominal GDP into disposable income, and distribute it among households, firms and the government. The model is closed by the specification of relationships between the variables in the production block and those in the income-prices block.

Collado (1992, Appendix 1) gives detailed account of the model structure.

The WHARTON-UAM model

This model is the result of a collaboration between Wharton Econometric Forecasting Association (WEFA) and the Universidad Autónoma de Madrid (UAM) initiated in 1978. The current version is Wharton-UAM/5, dated in 1989.

From 1982 the model joined the LINK project for worldwide macroeconomic modelling.

The model comprises 558 equations, of which 122 are behavioural equations and 436 are identities. There are 558 endogenous variables and 185 exogenous variables (122 domestic variables and the other 63 foreign ones).

The model is divided in seven blocks for exchange rates, interest rates, prices and wages, domestic and foreign demand, income, employment and gross value added.

Fernández and Pulido (1990) offer a detailed exposition of each of these blocks.

The MOISEES model

MOISEES is a macroeconomic model of the Spanish economy, specially designed in the Ministry of Economy and Finance to be used in the evaluation of different fiscal policies by means of simulations.

The main characteristic of MOISEES is that it is a disequilibrium model, and as such it is based on the fundamental assumption that if, for some reason, relative prices and wages are rigid, then quantitative constraints are taken into account in the agents' optimization plans.

MOISEES (which stands in Spanish for Research and Simulation Model of the Spanish Economy) has 150 equations for 150 endogenous variables and has 45 exogenous or instrumental variables. Only 18 of the 150 equations correspond to behavioural equations, being identities the remainder 132 equations. The 18 behavioural equations can

be divided in five different blocks of equations (see Chart 1), apart from those concerning public sector consumption, transfers and capital expenditures.

CHART 1: BEHAVIOURAL EQUATIONS IN THE MOISEES MODEL	
BLOCKS OF EQUATIONS	EQUATIONS
1. AGGREGATE SUPPLY AND EMPLOYMENT	- Labour productivity - Capital productivity - Aggregate supply
2. DOMESTIC DEMAND	- Private consumption expenditure - Residential investment - Private productive investment
3. FOREIGN SECTOR	- Exports - Imports
4. PRICES AND WAGES	- GDP deflator - Nominal labour costs
5. MONETARY SECTOR	- Demand for money - Interest rate - Exchange rate

a) The supply block:

From Ballabriga and Molinas (1990), the modelling of the aggregate supply is based on the following assumptions: in the long run production factors are substitutable along a Cobb-Douglas type technology, and in the short run technical coefficients are relatively rigid.

The consequence of these assumptions is that at any period the technical coefficients and the available quantities of factors are given and, therefore, effective

production is limited either by deficient demand, by a lack of profitable equipment, or by an insufficient or inadequate supply of labour:

$$Y = \min(YD, YP, YS) \quad (1)$$

where Y is the effective domestic production, YD is the "notional demand" for the domestic production of goods and services (i. e., the demand addressed to the domestic productive sector by national and foreign agents at the prevailing relative prices but without regard for the productive capacity), YP is the potential production of the economy achieved by operating the existing capital stock at the current level of technical capital productivity, and YS is the potential full employment capacity (i. e., the production achieved when the available supply of labour is employed at the prevailing level of technical labour productivity), and where

$$YP = BK \quad (2)$$

$$YS = ALS \quad (3)$$

being A and B the technical productivities of labour and capital, respectively, K the capital stock measured at the end of the period, and LS the supply of labour.

Since it is very unlikely that all firms will be submitted simultaneously to the same type of constraints, Lambert (1988) proposed to aggregate the heterogeneous individual situation with a CES function type aggregator:

$$Y = [YD^{-\rho} + YP^{-\rho} + YS^{-\rho}]^{-1/\rho} \quad (4)$$

where ρ is a parameter implying the simultaneous existence at the aggregate level of an insufficient demand on some markets and of some unused production capacities on others.

The counterpart on the labour market of equation (4) can be obtained by multiplying each term of (4) by A^{-1} , the inverse of the technical labour productivity

$$\begin{aligned} A^{-1}Y &= A^{-1}(YD^{-\rho} + YP^{-\rho} + YS^{-\rho})^{-1/\rho} \\ \Leftrightarrow A^{-1}Y &= [(A^{-1}YD)^{-\rho} + (A^{-1}YP)^{-\rho} + (A^{-1}YS)^{-\rho}]^{-1/\rho} \end{aligned}$$

$$\Leftrightarrow \tilde{L}S = [LD^{-\rho} + LP^{-\rho} + LS^{-\rho}]^{-1/\rho} \quad (5)$$

where LD is the employment required to satisfy demand YD (or notional demand), LP is the employment firms would require to operate at full capacity YP (or classical employment), LS is as before the labour supply, and $\tilde{L}$ is the theoretical short-term employment.

Adjustment delays, hiring and firing costs etc will imply that the effective employment L will be greater than $\tilde{L}$. L is equivalent to effective production divided by a short-term measure of labour productivity A^* :

$$L = Y/A^* \quad (6)$$

Since (4) and (5) are CES Functions, the elasticities of Y or $\tilde{L}$ with respect to the inputs are less than unity, and they are variables. It can be shown that the elasticities with respect to YD, YP and YS, denoted by PK, PC and PRI, respectively, are given by the following expressions:

$$\begin{aligned} PK &= \frac{YD^{-\rho}}{YD^{-\rho} + YP^{-\rho} + YS^{-\rho}} \\ PC &= \frac{YP^{-\rho}}{YD^{-\rho} + YP^{-\rho} + YS^{-\rho}} \\ PRI &= \frac{YS^{-\rho}}{YD^{-\rho} + YP^{-\rho} + YS^{-\rho}} \end{aligned} \quad (7)$$

PK, PC and PRI represent the portion of firms under keynesian, classical or repressed inflation rationing regimes, being endogenous variables in the model.

Note that

$$A \equiv Y/LU \quad (8,A)$$

$$B \equiv Y/KU \quad (8,B)$$

where CU and KU are unobservable variables representing the use of labour and capital inputs. A relationship between them and their observable counterparts L and K can be established by the mean of some measure of the degree of utilisation of factors:

$$KU = \exp[-V_K \log(GUK_{MAX}/GUK)]K, \quad V_K > 0 \quad (9,A)$$

$$LU = \exp[-V_L \log(GUL_{MAX}/GUL)]L, \quad V_L > 0 \quad (9,B)$$

where GUK and GUL denote the degree of capacity utilization of the equipment and a measure of labour hording, respectively.

The optimal technical coefficients A^* and B^* can be different in the short run to those effectively registered in the economy. The relation between the given technical coefficients A and B and their optimal values A^* and B^* can be assumed to follow a partial adjustment process

$$A = A^{*\theta_A} A_{-1}^{1-\theta_A} \quad (10,A)$$

$$B = B^{*\theta_B} A_{-1}^{1-\theta_B} \quad (10,B)$$

Combining (8), (9) and (10), and taking into account that

$$A^* = \frac{1}{1-\alpha} \frac{W}{P}$$

$$B^* = \frac{1}{\alpha} \frac{CC}{P}$$

we can be obtain

$$\frac{Y}{L} = h_1[(\frac{Y}{L})_{-1}, \frac{W}{P}, GUL, GUL_{-1}] \quad (11)$$

$$\frac{Y}{K} = h_2[(\frac{Y}{K})_{-1}, \frac{CC}{P}, GUK, GUK_{-1}] \quad (12)$$

where W and CC are the nominal wage rate and the user cost of capital, respectively.

Expressions (11) and (12) (i.e. labour and capital productivities), together with (4) (i. e., the aggregate production function) are the bases of the supply block.

b) The domestic demand:

Following Andrés, Molinas and Taguas (1990) the private consumption (C) is assumed to be a function of real disposable income of households (Y^d), real private wealth (WE) and other factors (Z):

$$C_t = f(Y_t^d, WE_t, Z_t)$$

where WE is defined as the sum of real productive plus residencial capital, real bonds and money holdings. In the short-run equation, changes in the inflation tax, the real interest rate, and the unemployment rate, the latter picking up distributional effects, appear to have a very significant influence.

Optimal stock of residential property (KIR^*) is assumed to be a function of expected values of real disposable and relative prices (PRIR):

$$KIR_t^* = f(E_t(Y_{t+1}^d), E_t(PRIR_{t+1}))$$

Optimal stock of private productive capital (KPP^*) is assumed to be a function of expected values of real user cost of capital (CC/P) and notional demand (YD):

$$KPP_t^* = f(E_t[(\frac{CC}{P})_{t+1}], E_t(YD_{t+1}))$$

Following Andrés et al. (1990), an investment function can be obtained from the determinants of capital stocks:

$$\log(\frac{KPP}{Y})_t = \alpha_0 + \alpha_1 \log(\frac{CC}{P})_t + \alpha_2 \log(\frac{YD}{Y})_t$$

under the standard assumption of existence of adjustment costs that make that firms do not continuously achieve their optimal capital stock:

$$KPP_t = (1-\delta)KPP_{t-1} + I_t$$

and where the YD/Y ratio is proxied as a function of the degree of capital utilization:

$$\log(\frac{YD}{Y})_t = f(\log(CU_t))$$

Therefore, the investment function depends on the determinants of the demand for capital stocks, as well as on their rate of change:

$$\log\left(\frac{I}{Y}\right)_t = \alpha_0 + \alpha_1 \log\left(\frac{CC}{P}\right)_t + \alpha_2 \log(CU)_t + \frac{1}{\delta} (g_Y + g_{CC/P} + g_{CU})$$

where g_i denotes the rate of change of the variable i .

c) The foreign sector:

It is assumed that domestic absorption is never rationed and that any potential excess demand is satisfied increasing imports or reducing exports.

Notional exports (XD) and imports (MD) are functions of their fundamental determinants:

$$XD = XD(WT, PRX)$$

$$MD = MD(Y, PRM)$$

where WT is an index of world trade, Y is real GDP, and PRX and PRM are some competitiveness indices for exports and imports, respectively.

The discrepancies between the actual and notional values of foreign trade will depend upon how tight domestic markets are. Using the deviations of capacity utilization with respect to its minimum value as a proxy for such tightness, the following specifications can be obtained:

$$\log(X) = \log[XD(.)] - \phi_X [\log(CU) - \log(CU_{MIN})]$$

$$\log(M) = \log[MD(.)] - \phi_M [\log(CU) - \log(CU_{MIN})]$$

where ϕ_X and ϕ_M are positive parameters: as internal demand overheats, actual exports go below their notional levels and imports above theirs.

d) Prices and wages:

It is assumed that each firm sets its price as a mark up over nominal unit costs defined at the full employment level of resources:

$$\frac{P_j}{W_j} = f\left(\frac{K_j}{L_j}, V\right)$$

where P , W , K , L , V denote price, wage, capital stock, labour and a vector of fiscal policy or imported price effects that may also influence.

It can be possible, however, that firms cannot fully adjust its price in the short-run when wages and/or productivities change. The following specification has as a particular case the possibility of a partial adjustment mechanism in the price:

$$\log(P_t) = \beta_0 + \beta_1 \log(P_{t-1}) + \beta_2 \log(W_t) - \beta_3 \log\left(\left(\frac{K}{L}\right)_t\right) + \beta_4 V_t$$

The wage equation can be obtained as the output of a bargaining process over ex-ante desired real wages, which can be thought as coming from a Nash bargaining type model:

$$\frac{W}{P} = f\left(\frac{K}{L}, TECS, U, V\right)$$

where U is unemployment, $TECS$ are social security contributions and V is a vector of possible factors including some measure of union power. The empirical equation is as follows:

$$\begin{aligned} \log(W_t) = & \gamma_0 + \gamma_1 \log(P_t) + \gamma_2 \log\left(\frac{K_{t-1}}{L_t}\right) \\ & + \gamma_3 \log(1+TECS_t) - \gamma_4 U_t + \gamma_5 Z_t \end{aligned}$$

e) The monetary sector:

In this block, the monetary aggregate considered is ALP (i. e., liquid assets hold by the public), the aggregate used by the Bank of Spain as its monetary target (ALP=M3+other liquid assets).

Following Manzanedo and Sebastián (1990), the modelling of the demand for money is addressed separating its two components: the transaction demand for money (represented by M2), and the demand for money as store of value (ALM=ALP-M2).

The demand for M2 is assumed to be a function of domestic demand (Y), interest rate of ALM (R), and of a dummy variable proxing the effects of financial innnovation (DINNO):

$$M2 = M(Y, R, DINNO)$$

The demand for ALM is assumed to be a function of real private wealth (WE), inflation (INFL), interest rates on ALM (R), and interest rate on alternative financial assets (R'):

$$ALM = M'(WE, INFL, R, R')$$

The long-run interest rate changes to equal the demand for real balances and the supply of real money:

$$R = R(M2R, DNR)$$

where M2R is real M2 and DNR is real domestic demand.

The exchange-rate equation is based in the absolute version of the purchasing power parity hypothesis:

$$TC = \frac{P}{P^*}$$

where TC is the nominal Peseta/US Dollar exchange rate, and P and P* are the domestic and foreign price indices, respectively.

f) Estimation procedure:

MOISEES makes use of the cointegration analysis to evaluate long-run relationships (see Dolado et al. (1990) for a survey). The short-run dynamics is modelled by error-correction model, where the error correction term represents the extent of the disequilibrium between the levels of the variables in the long-run relationship.

The model was estimated by blocks using annual data -mostly taken from the National Accounts, homogenatized by Corrales and Taguas (1990)-, by three-stages least squares estimation methods.

5.2 Policy applications

HERMES-Spain have been used for medium-term economic forecasting.

MIDE has been used to evaluate the effects of the Single Market in the Spanish economy through simulations of the elimination of border controls, the openness of public sector to foreign suppliers, the liberalization of financial services, and the total impact as the sum of these factors (see Collado, 1992).

MOISEES is currently used to analyse policy decisions at the Ministry of Economics and Finance. Some of the simulations have been published:

- * Canadell and Molinas (1990) evaluate the effects of several fiscal policies: a permanent reduction in public investment in an amount equivalent to 1% of GDP, a permanent 10% increase in employers' contributions to Social Security, and a 10% increase in both VAT and the Income Tax.
- * Andrés et al. (1991) assess the macroeconomic consequences of different paths for real labour unit cost growth, as well as the possibilities for fiscal policy as an instrument to control inflation in a context of strong increase in wages, and its effects on production and employment.
- * Burgos et al. (1991) considers the effects of an energy shock under several scenarios regarding the price of oil, the competitiveness, the world trade, and the monetary policy.
- * Mestre and Taguas (1991) evaluate the short-, medium- and long-run effects of a reduction in the public sector, proxied as a slowing down in both public revenue (taxes and employers' contributions to Social Security) and spending (investment, wages, transfers and purchasing of goods and services).

6. CONCLUDING REMARKS

This survey remains an open one. Our main concern in first writing it was to carry out preparatory work within a particular project for which this kind summary was needed. Needless to say that as we progressed, it soon became apparent that the literature to review was not easy to confine within clear borders as in recent years, many old results have been reassessed, new applied techniques implemented, new data sets made available, etc.. All this has kept spanish applied researchers rather busy and it is difficult, within the narrow marging of our exercise, to adequately capture and do justice to such an effort by the profession.

The agenda, however, as said before, still contains this item that the authors would like to fully develop in the near future. So that all comments on this paper will be most welcomed.

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