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### Introduction

The existence of divergences between the inflation rates of the countries or regions belonging to a monetary union is a phenomenon common to all such unions and does not by itself hamper their proper functioning. In fact, the dispersion of national inflation rates within the euro area is comparable to that seen across regions in the United States. Uneven growth of national price indices may, in principle, be a direct result of specific developments, such as changes in regulated prices and in indirect taxes, of differences in the cyclical positions of the economies in question or of their varying degree of exposure to particular shocks, such as those affecting the oil market [see, for example, ECB (2003)].

However, a singular feature of the inflation differentials within the euro area is their high degree of persistence. That is to say, some countries, like Germany and France, have had inflation rates systematically below the average, while others, like Portugal, Spain, Ireland and Greece have regularly had positive inflation differentials with respect to the euro area as a whole. This observation has given rise to the recent appearance of theoretical, empirical and economic analyses seeking to study the determinants and normative implications of the persistence of inflation differentials across the euro area member countries.

It has sometimes been argued that the persistence of inflation differentials may be associated with real convergence or catching-up. Countries in this situation tend to record higher relative productivity growth in the sector exposed to international competition, which may lead to a larger increase in wages and prices than in the mature economies of the monetary union. This is known as the Balassa-Samuelson hypothesis, according to which inflation differentials result from efficient adjustment by the various economies to productivity developments and do not, therefore, entail any change in their competitiveness or any direct adverse effects on the efficacy of the single monetary policy. However, although productivity developments may explain the medium and long-term dynamics of relative prices [see Ortega (2003)], the Balassa-Samuelson hypothesis cannot be reconciled with the sectoral price and productivity developments in Spain [see Estrada and López-Salido (2002 and 2005) and other euro area countries [see ECB (2003)] since 1999, so that it cannot provide a general explanation of the inflation differentials observed in the euro area.

An alternative hypothesis, enjoying greater empirical support, associates the persistent inflation differentials across the various national economies belonging to the euro area with the rigidities characterising the price and wage adjustments in each of them. These give rise to uneven developments in the national price indices in the face of common or specific shocks. According to this reasoning, inflation differentials are not a benign development, but a reflection of imperfections in factor, goods and services markets that affect the economies' competitiveness and may make implementation of the single monetary policy more complex [see, for example, Benigno and López-Salido (2003)].

This second line of analysis has important normative implications that can, however, only be specified to the extent that the type of shock and the nature of the frictions (or rigidities) which

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1. This article is based on Banco de España Working Paper No. 0514, entitled *Inflation differentials in EMU: the Spanish case*, which was also co-authored by Javier Vallés.

contribute to generating the inflation differentials are identified. In particular, it would be appropriate to analyse whether the discrepancy in price growth is a consequence of common shocks transmitted in a different way in each economy or, rather, a consequence of idiosyncratic shocks in each economy. Also, the relative importance of supply and demand shocks needs to be estimated and, in particular, evidence needs to be obtained on those aspects of price and wage formation that have the strongest influence on inflation differentials.

Recent literature provides abundant evidence on these issues, usually making use of general equilibrium models with nominal rigidities in the neo-Keynesian tradition<sup>2</sup>. However, these studies do not provide evidence which might enable the determinants of the inflation differentials observed in the euro area to be characterised generally. On the contrary, the heterogeneity of the findings would seem to suggest that the observed discrepancies in price growth across countries do not always stem from the same causes. Thus, a proper understanding of the phenomenon requires each economy to be examined in greater depth. It is precisely this strategy that has been followed in the research on which this article is based, with the aim of identifying the specific causes of the Spanish economy's persistent inflation differential with respect to the euro area average, the effects of such differentials on economic activity and certain implications for the conduct of economic policy.

The rest of this article is structured as follows: Section 2 describes those characteristic features of Spanish macroeconomic developments in recent years that may be relevant to explaining the path of the inflation differential. Section 3 explores the factors determining the path of consumer prices in Spain on the basis of a general equilibrium model. Section 4 describes the macroeconomic adjustment in response to the shocks that generate the observed inflation differentials. Finally, Section 5 provides certain normative conclusions.

### ***Five characteristic features of the Spanish economy***

HIGH AND STABLE GROWTH, PRINCIPALLY BASED ON THE EXPANSION OF DOMESTIC DEMAND

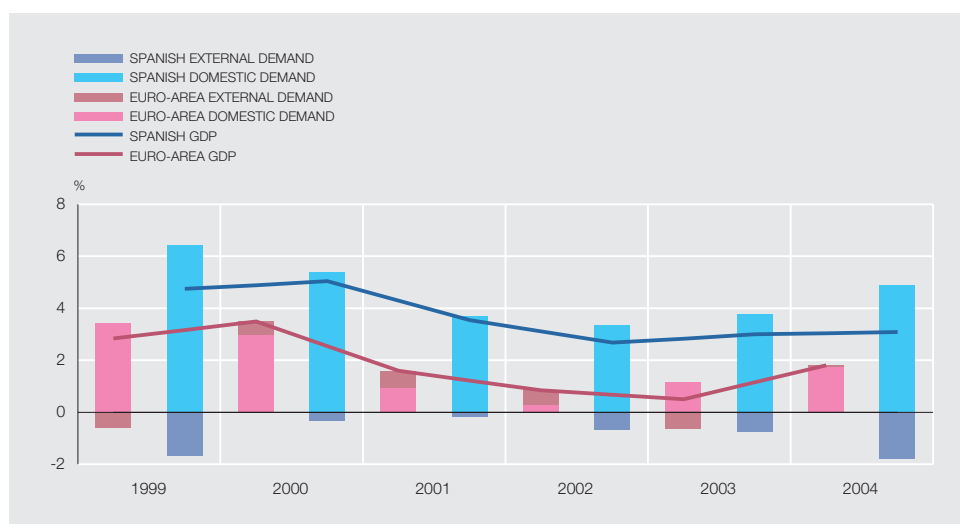
Chart 1 shows GDP in Spain and in the euro area since 1999, distinguishing between the contributions of domestic demand and net exports. It can be seen that the Spanish economy has sustained growth rates significantly above the euro area average. The reason for this has been the strong expansion of domestic demand, since the contribution of net external demand has been increasingly negative. More specifically, the strength of private consumption (especially of services) and of residential investment has been notable, with growth rates clearly above the average GDP growth rate<sup>3</sup>. These developments have been a direct consequence of the drastic reduction in interest rates associated with the convergence process and euro area accession, as well as of the strength of job creation.

MODEST PRODUCTIVITY GROWTH

Chart 2 shows labour productivity and total factor productivity (TFP) in Spain and in the euro area. The former has slowed progressively since the beginning of the 1990s, but more sharply in Spain than in the euro area. The reforms undertaken in the labour market, along with the substantial increase in labour supply, contributed to a significant reduction in the capital-labour ratio and, therefore, in labour productivity, which has grown at rates persistently below the euro area average. Likewise, TFP growth in Spain has been particularly disappointing, which suggests that technological progress has not been sufficiently incorporated into productive processes. The sector data

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2. For example, Andrés et al. (2003) use a two-sector model to illustrate how the possibility of price discrimination provided by the existence of monopolistic competition means that common shocks can have a different impact on prices. Duarte and Wolman (2002) use the same type of model to conclude that supply shocks are better candidates than demand shocks to explain a persistent inflation differential. By contrast, Altissimo et al. (2004) point out that if labour markets are not sufficiently integrated with one another, demand shocks may generate prolonged periods of misaligned relative prices across sectors and countries. 3. The growth rate of services consumption is more than one percentage point higher than that of consumption of processed food and goods. At the same time, during the period 1999-2004, the growth rate of residential investment was above 6%. The data for GDP and its components used in Chart 1 are based on the Spanish National Accounts, base 2000.



SOURCE: Eurostat.

show that the poor productivity performance affects both the manufacturing and the services sectors and is, therefore, a general feature of the recent performance of the Spanish economy.

#### DEVIATIONS FROM PURCHASING POWER PARITY AND DUAL INFLATION

Table 1 gives a breakdown of the Spanish inflation differential vis-à-vis the euro area, distinguishing between the contribution of the manufacturing/industrial sectors, subject in principle to international competition, and that of the dual inflation component, i.e. the difference between the inflation observed in the prices of tradable goods and in those of services<sup>4</sup>. Also, the contribution of unit labour costs (distinguishing between wages and productivity) and mark-ups is estimated for each component. The table shows, first, the presence of a high inflation differential in the tradable goods sector. It also shows the significant contribution of the phenomenon of dual inflation, which accounts for somewhat more than one third of the average inflation differential vis-à-vis the euro area. At the same time, the high growth of mark-ups since 1999 (especially in services) explains a large part of the differentials. Finally, wages also make large contributions in both sectors, that are similar in magnitude.

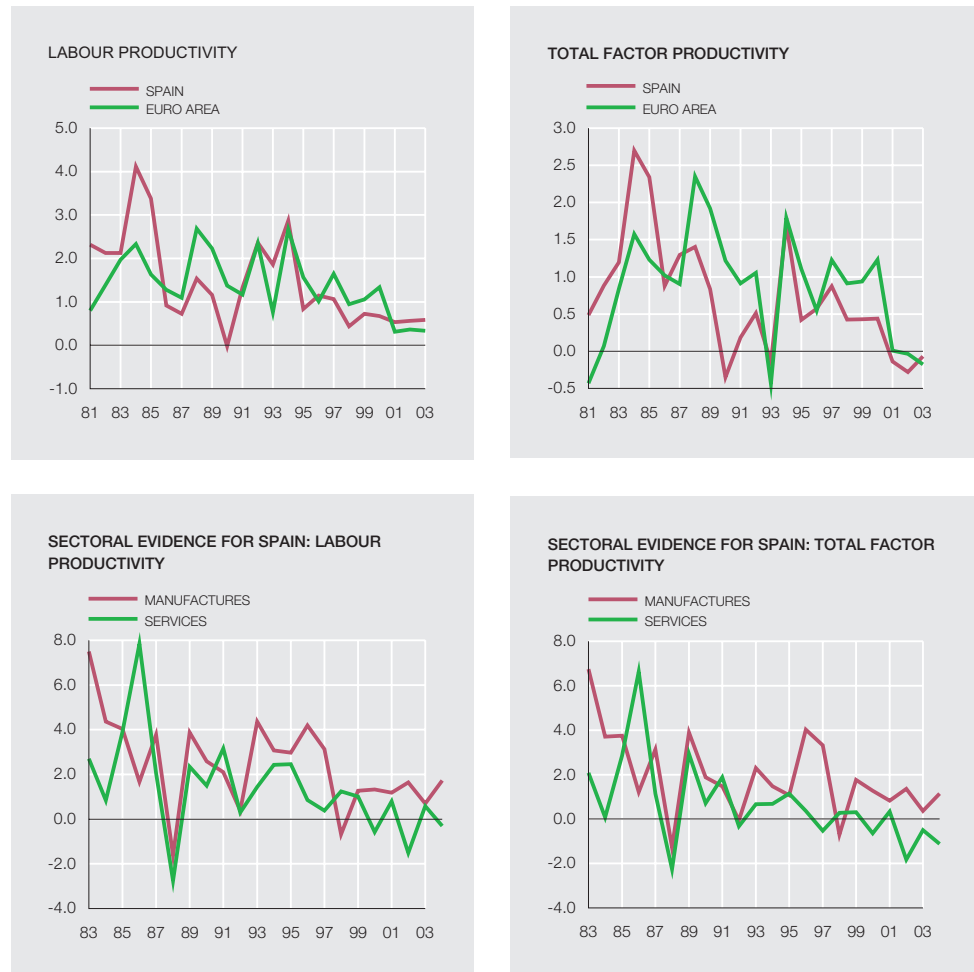
#### PERSISTENT LOSSES OF COMPETITIVENESS WITH AN INCREASING EFFECT ON THE BALANCE OF PAYMENTS

Chart 3 shows various measures of competitiveness for the Spanish economy with respect to the euro area from 1998 to 2004. The persistent inflation differential has been reflected in the progressive deterioration in the indicators, which have fallen by 5-8%, depending on the measure used. Chart 4 shows the export share of Spanish products in the euro area and the penetration of products imported from the euro area since 1991. As a consequence of the progressive opening up of the Spanish economy and its higher growth both variables have displayed a clear upward trend. However, export shares seem to have fallen slightly in 2004, which would suggest that the Spanish economy's price and cost differentials are having an increasing impact on the trade balance.

#### NOTABLE STRUCTURAL RIGIDITIES, ESPECIALLY IN THE LABOUR MARKET

There are not many sufficiently detailed comparative studies of the degree of rigidity existing in factor (labour and financial) and goods (and services) markets in different euro-area countries, but those that are available would seem to imply that the degree of competition and price flex-

4. A detailed analysis of this breakdown can be found in the working paper on which this article is based and, also, in López-Salido and Pérez-Quirós (2005). Table 1 includes a concise description of this breakdown of inflation differentials.



SOURCES: European Commission and Banco de España.

ibility in goods markets is not generally lower in Spain than in the rest of the euro area [see, for example, Nicoletti et al. (1999) and Brandt et al. (2005)]. Moreover, the available microeconomic evidence on the degree of price rigidity indicates that there is little difference between the behaviour of companies in Spain as compared with the other euro area countries. In particular, in a recent paper, Álvarez and Hernando (2004) find that the frequency of price changes and the proportion of downward adjustments are similar in Spain to those estimated for most euro-area countries. The evidence on the functioning of the labour market is somewhat different. According to the few analyses available, the Spanish labour market, despite recent reforms, is characterised by a degree of inefficiency that is above the euro-area average [see Brandt et al. (2005)]. This inefficiency would appear to be generated by the structure of social benefits and by the bargaining systems and procedures followed, with the result that wages are inflexible in the face of changes in relevant economic conditions. An example of these rigidities are indexation clauses, whereby wage rates are automatically adjusted ex-post if observed inflation exceeds the rate projected at the time of bargaining. Unlike the situation in most countries, these clauses are present in the great majority of collective agreements signed in Spain.

**The determinants of inflation differentials**

The empirical regularities indicated in the previous section offer, in themselves, some important clues to help identify the causes of the higher growth of prices in Spain than on average in the euro area. Thus, it seems likely that demand shocks, particularly in the shel-

Inflation differential	Tradables				Dual inflation			
	Total	Wages	Productivity	Mark-ups	Total	Wages	Productivity	Mark-ups
(1) + (2)	(1)	(3)	(4)	(5)	(2)	(6)	(7)	(8)
1.2	0.8	0.4	-0.1	0.3	0.4	0.1	0.4	0.7

SOURCE: Banco de España.

Note: The inflation differential between Spain and the euro area can be written as follows:

$$\pi_t - \pi_t^* = \text{TRADABLE}_t + \text{DUAL}_t$$

where  $\text{TRADABLE}_t$  represents the differences in the inflation of tradable goods, that can be decomposed as the sum of the differences in mark-ups ( $\mu$ ) and in wages ( $w$ ), minus relative productivities ( $x$ ):

$$\text{TRADABLE}_t = (\pi_{T,t} - \pi_{T,t}^*) = (\Delta\mu_{T,t} - \Delta\mu_{T,t}^*) + (\Delta w_{T,t} - \Delta w_{T,t}^*) - (\Delta x_{T,t} - \Delta x_{T,t}^*)$$

while  $\text{DUAL}_t$  represents the contribution of the differences in sectoral inflation differentials (i.e. relative dual inflation), that can also be decomposed as follows:

$$\begin{aligned} \text{DUAL}_t = & (1 - \alpha)\theta[(\Delta w_{N,t} - \Delta w_{T,t}) - (\Delta w_{N,t}^* - \Delta w_{T,t}^*)] \\ & - (1 - \alpha)\theta[(\Delta x_{N,t} - \Delta x_{T,t}) - (\Delta x_{N,t}^* - \Delta x_{T,t}^*)] \\ & + (1 - \alpha)\theta[(\Delta\mu_{N,t} - \Delta\mu_{T,t}) - (\Delta\mu_{N,t}^* - \Delta\mu_{T,t}^*)] \end{aligned}$$

An additional and negligible term needs to be added to this expression to capture fluctuations in the terms of trade. Note that  $\alpha$  represents the share of the imported goods in total consumption and  $\theta$  is the share of private consumption of nontradable in total private consumption minus imported consumption. See Estada et al. (2004) for details.

All the numbers represent average annual rates of growth in percentage points.

According to the previous expressions, it is straightforward to see that column (1) has been obtained as (3) – (4) + (5), and column (2) as (6) – (7) + (8).

tered sectors, have been more important than supply shocks, that the relative degree of price flexibility is not a crucial factor and that wage rigidity, by contrast, may have played a larger role.

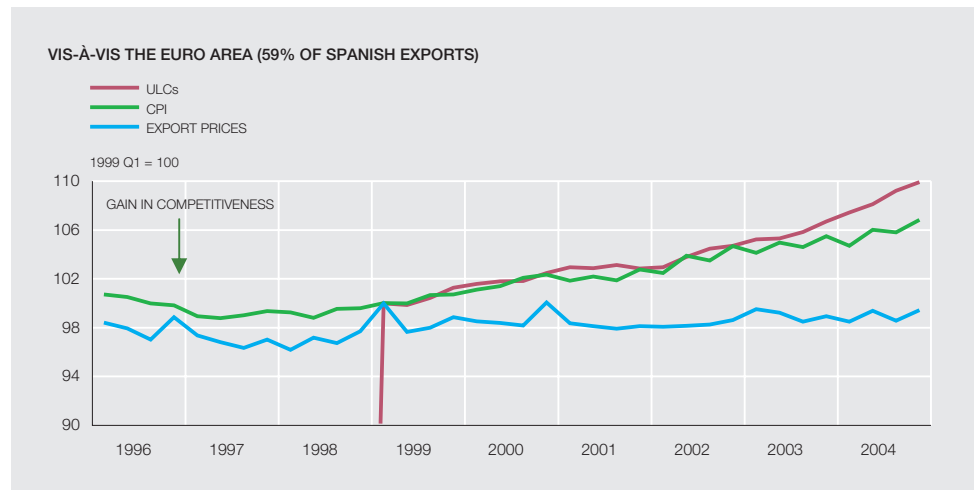
In order to be able to offer a complete and coherent analytical explanation of the phenomenon we should, however, start from a structural model that enables the reactions of prices in the Spanish economy and in the euro area to specific types of shock to be described. By its very nature, the model can only be a stylised representation of reality. The challenge is obviously to include those elements that are most important for characterising the behaviour of prices and, in general, the adjustment processes of the Spanish economy.

MODEL DESCRIPTION

The model has two countries that form a monetary union with a central bank that fixes a single interest rate with the aim of maintaining price stability across the area as a whole. National inflation rates are equal in the stationary state, but may differ in the short-term, which would entail different real interest rates in each country.

We consider two sectors in each country; one producing tradable goods and the other specialised in goods not traded on international markets. Agents' preferences are defined for the consumption of both types of goods and incorporate habit. It is also assumed that the domestically-produced and imported tradable goods are not perfect substitutes, so as to allow departures from the law of one price. Another feature of the model, which limits crowding out effects between government and private consumption, is that some consumers have no access to capital markets, so that their consumption is limited by their current income.

Finally, the model incorporates various nominal and real rigidities commonly found in recent neo-Keynesian literature. In particular, it is assumed that markets are monopolistically competitive and that only a fraction of prices and wages are adapted at a given moment to the desired level. Prices and wages that are not adjusted vary in accordance with the aggregate inflation observed in the previous period.



SOURCE: Banco de España.

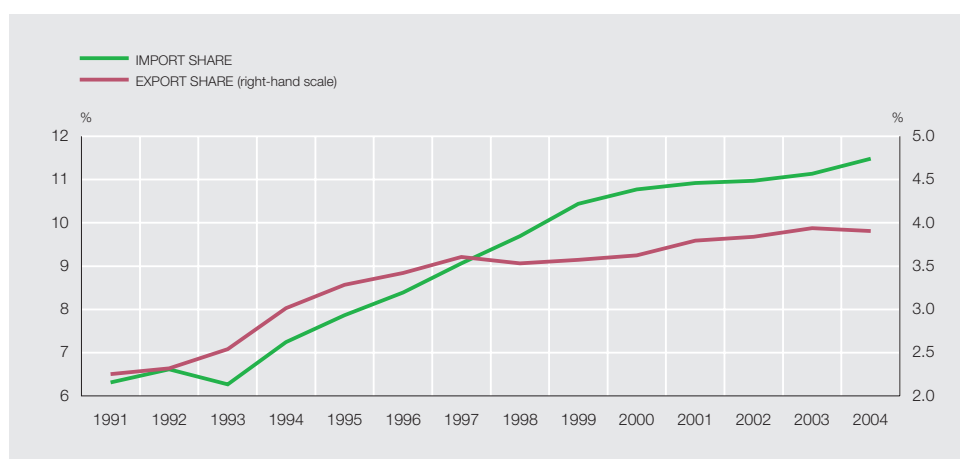
a. An increase in the index denotes a loss of competitiveness.

The model is calibrated using conventional values. The basic calibration assumes parameters consistent with the situation of the Spanish economy in the euro area. Thus, the domestic bias of demand in the domestic country (Spain) is less than that in the other (the rest of the euro area), given the larger size of the latter. It is also assumed that the monetary policy (which follows a Taylor rule with inflation as the sole argument) assigns a lower weight to the inflation in the first country (0.1) than to that in the second (0.9). Given the evidence described in the previous section, the parameters that measure price rigidity are considered to be the same in each country. By contrast, the degree of wage indexation is assumed to be higher in the domestic country.

THE EFFECT OF SHOCKS ON PRICES

Given the structure of the economy, the next step is to use the model to study the effect that different types of shocks have on inflation differentials. For this purpose, the model is subjected to a large number of aggregate and sectoral supply and demand shocks that are either common to the area as a whole or specific to each country. López-Salido, Restoy and Vallés (2005) present the effects on the inflation differential and dual inflation of five shocks: i) a rise in interest rates in the monetary union; ii) a positive supply shock in the domestic economy; iii) a positive supply shock in the domestic tradable sector; iv) an exogenous increase in aggregate consumption in the domestic economy; and v) an exogenous increase in the consumption of non-durable goods in the domestic economy.

These simulations provide a series of useful results to understand the determinants of the Spanish inflation differential. First, despite the greater wage inertia assumed for the Spanish economy, the common shocks are unlikely to generate significant persistent inflation differentials. Second, aggregate-productivity shocks tend to reduce, rather than increase, the inflation differential and do not generate dual inflation. Also, technical change in the tradable goods sector tends to reduce the relative costs of production and, therefore, generates dual inflation. However, this type of shock also reduces inflation in the economy as a whole, so that its effect on the inflation differential is ambiguous (in fact, in the simulation the effect is negative). Third, both the expansion of aggregate consumption and that of spending on non-tradable goods help to generate a positive inflation differential in the domestic economy. Although the former has a larger effect on the inflation differential, only the latter generates the dual inflation that we



SOURCES: Instituto Nacional de Estadística, Aduanas, Ministerio de Economía and MFI.

observe in the Spanish economy. The effects of this latter type of shock are summarised in Table 2.

Thus, the exercises performed with the artificial economy described provide new evidence against the Balassa-Samuelson hypothesis. At the same time, they indicate that the Spanish inflation differential seems to be mainly the consequence of expansionary demand shocks, biased towards the consumption of services or non-tradable goods, which interact with price and wage rigidities.

### ***The economy's adjustment process***

Having identified the main determinants of the inflation differential, the model is then used to investigate the economy's adjustment mechanisms; i.e. the pattern followed by the main macroeconomic variables when shocks giving rise to inflation differentials occur. In this respect, it is particularly interesting to see the impact of shocks on the economy's competitiveness and the effect of the latter on real activity.

It may be inferred from the foregoing sections that the most important shock for the Spanish economy is a demand expansion that is strongest in the non-tradables sectors, like services and construction. Such a shock is modelled by assuming a shock to aggregate consumption combined with a specific shock to the demand for non-tradable goods. This combination of shocks should enable a significant inflation differential to be generated, which is particularly high in the sheltered sector.

Also, in order to increase the persistence of the effect on dual inflation, it makes sense to assume that the inertia in the process of price formation in the non-tradable goods sector is greater than in that in the exposed sector. This assumption is consistent with the abundant evidence of greater price rigidity in services than in manufacturing [as analysed in Álvarez and Hernando (2004)].

Chart 5 shows the response of several macroeconomic variables to the combined shock described above. This shock has been calibrated so as to have an immediate 1% impact on GDP and to be persistent (the autocorrelation coefficient is 0.9). As expected, the shock generates an increase in the consumption of both types of goods that puts pressure on prices in both sectors and generates a positive and persistent inflation differential. Given that the demand for



	Demand for non-tradables		
	$\pi_H - \pi_F$	$\pi_N - \pi_H$	$\pi - \pi^*$
1	0.27	0.44	0.6
2	0.09	0.60	0.54
3	0.12	0.42	0.46

SOURCE: Banco de España.

NOTES: Case 1: No price indexation in the foreign economy. Case 2: Case 1 plus price indexation in the domestic economy only in non-tradable goods sector. Case 3: No price indexation at home or abroad. Simulations based on model with rule-of-thumb consumers.

non-tradables grows more than that for other goods, inflation in the sheltered sector increases to a greater extent, generating the dual inflation effect. In the foreign economy (the euro area), there is a minor contraction, as a consequence of the slight tightening of interest rates caused by the application of the Taylor rule by the common monetary authority. This helps to reduce the exports of the domestic economy and to progressively moderate the impact of the initial shock on the domestic prices of tradable goods.

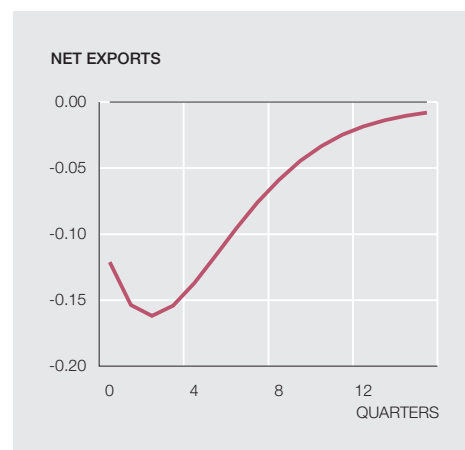
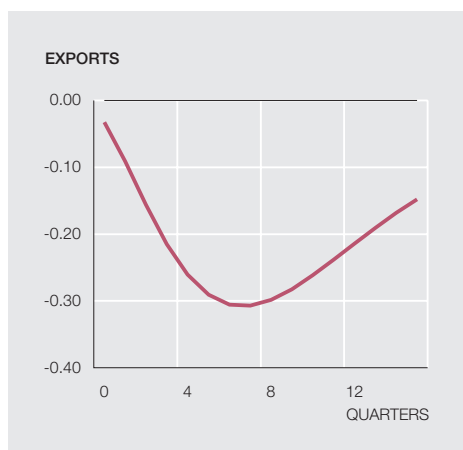
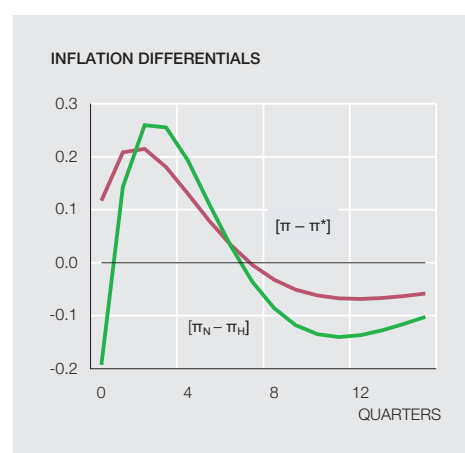
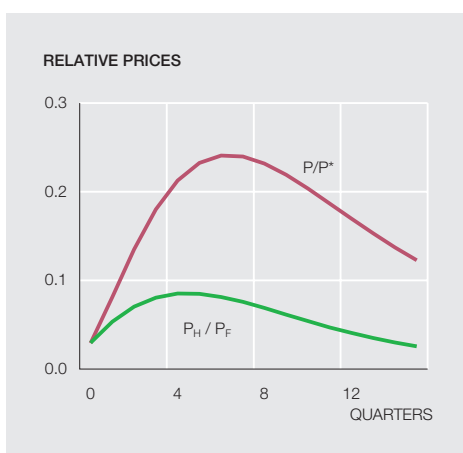
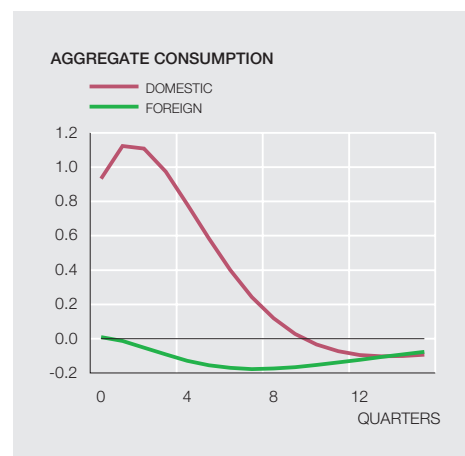
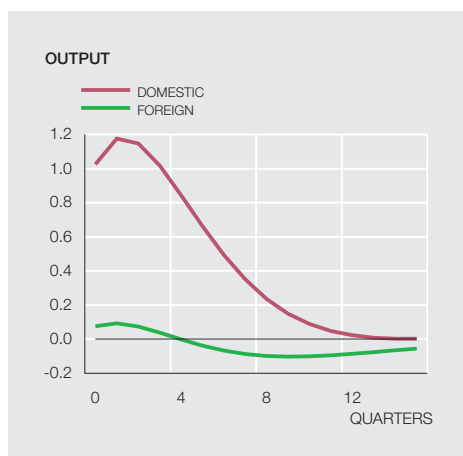
One interesting result is that net exports fall only mildly and gradually, so that their stabilising effect on activity and on domestic prices is not very strong. However, the effect of the shock on the terms of trade, although not very pronounced, is very persistent, implying continuous losses of competitiveness over a relatively prolonged period. As indicated in the previous section, this moderate but increasing effect of competitiveness on trade is another of the characteristic features of the recent Spanish economic performance.

## Conclusions

This article has set out descriptive evidence and analytical results that enable us to improve our understanding of the determinants of the Spanish economy's persistently positive inflation differential vis-à-vis the euro area.

In particular, the expansion of aggregate demand (biased towards spending on services and housing) would appear to be the fundamental factor behind the behaviour of relative prices in Spain, with respect to the euro area. The persistence of the effects of these shocks on price indices would seem to be attributable to inertial components in price and wage formation processes in the Spanish economy. In this respect, the frictions that prevent wages from adjusting flexibly to economic conditions (such as wage indexation clauses) seem to play an important role. Also, the size and persistence of the inflation differentials, along with the phenomenon of dual inflation, suggest, in line with recently published macroeconomic evidence for Spain and the rest of the euro area, that the prices of non-tradable goods are more rigid than prices in sectors exposed to international competition. Moreover, the analysis indicates that the deterioration in competitiveness caused by the cumulative effect of positive inflation differentials does not exert a significant stabilising effect in the short term, although its contractionary impact on net exports is very persistent. Thus, the inflation differential of the Spanish economy is not a direct consequence of virtuous real convergence processes, but rather reflects inertial elements (associated with price and wage rigidities) that give rise to sustained losses of competitiveness over prolonged periods.

Given the nature of the shocks that explain the inflation differentials and the absence of an autonomous monetary policy, a restrictive fiscal policy would appear to be a potentially useful instrument to mitigate the misalignment of prices in the Spanish economy. At the same time,



SOURCES: López Salido, Restoy and Vallés (2005).

Note:  $P_H$  and  $P_F$  are prices of home-produced and imported goods.  $P$  and  $P^*$  are domestic and foreign consumer prices. The inflation differentials are changes in these relative prices.

although the degree of flexibility of the Spanish economy is possibly no less than that of other European economies, the adverse effect on competitiveness of the rigidities in Spanish markets may be more significant than in other countries that have not experienced expansionary demand shocks of the same strength. Finally, labour market institutions require special attention, since a significant part of the frictions that explain the persistence of the Spanish inflation differential would appear to reside therein.

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