VARIATION IN THE CYCLICAL SENSITIVITY OF SPANISH INFLATION: AN INITIAL APPROXIMATION

The authors of this article are Luis Julián Álvarez and Alberto Urtasun, of the Directorate-General Economics, Statistics and Research.

Introduction

In the advanced economies as a whole, inflation has in recent years shown considerable downward stickiness. This is particularly striking in light of the intensity of the recession. Against this background, several recent papers have analysed the relationship between the dynamics of prices and activity, providing a set of potential explanations for the downward stickiness of inflation during this latest crisis [see, for example, IMF (2013) or Matheson and Stavrev (2013)]. It has been pointed out that the limited impact of the decline in activity on inflation might be indicative of moderate output gaps. The recently observed notable increases in unemployment rates would largely be structural in nature, so their influence on wage bargaining and price-setting would be less than if they were merely cyclical. Also highlighted is the fact that the low rates of inflation observed in recent years and their scant variability reflect the price-stability strategies pursued by numerous central banks, as is the case of the Eurosystem. In keeping with this hypothesis, the anchoring of inflation expectations around moderate levels would explain small fluctuations in price variations around reference values. Other explanations of the downward stickiness of inflation point to globalisation, attributing a greater response by prices to the degree of slack in the world economy, with less influence exerted by the national cyclical situation. Also, a lesser response to the cycle by business margins or, indeed, their countercyclical nature, would also contribute to explaining the stability of inflation in a recessionary context such as the present. Lastly, inflation rigidity might increase if companies optimise their prices less frequently when average inflation falls.

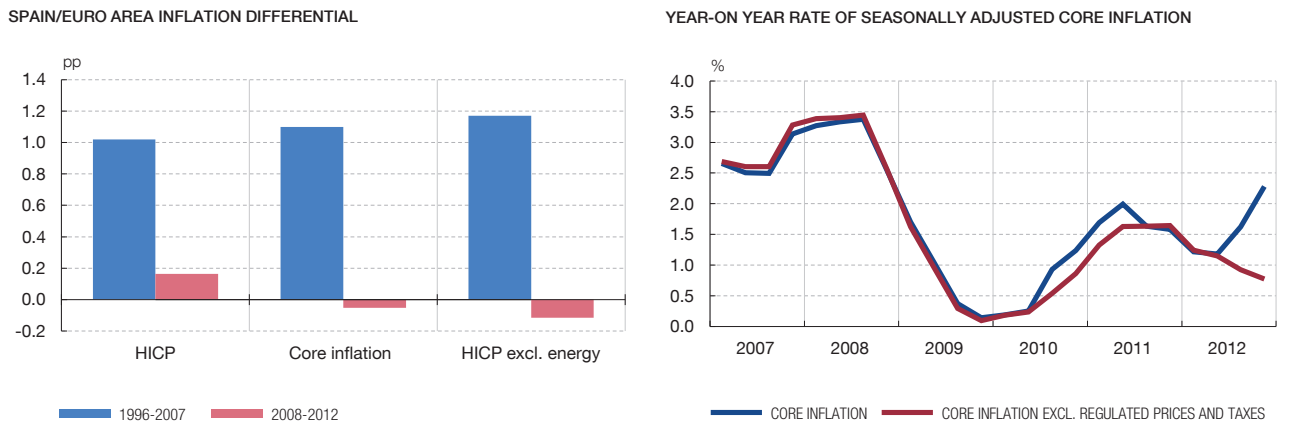
As a phenomenon, the reduction in the cyclical sensitivity of inflation has not been observed in all countries. For instance, the behaviour of the Spanish economy in the recent period has differed from this pattern. Despite the upward momentum in prices linked to the fiscal consolidation process (see the right-hand side panel of Chart 1), inflation has declined to a greater extent than in other advanced economies (left-hand side panel of Chart 1). Specifically, the differential with the euro area in terms of the overall consumer price index has dipped from approximately 1 pp on average in the 1996-2007 period to close to 0.2 pp in the recessionary phase (2008-2012), a reduction which has been even sharper in terms of core inflation. Indeed, the cyclical sensitivity of Spanish inflation appears to have increased in recent years, which would be consistent with some reduction in nominal rigidities. In the current setting, marked by weak domestic demand and the need to achieve gains in competitiveness, this response is particularly beneficial since the ensuing moderation in prices is providing for momentum in net external demand and softening the decline in domestic demand.

The aim of this article, which summarises the initial findings of a more extensive project that analyses price-setting policies, is to provide empirical evidence on the changes in the response by Spanish inflation to fluctuations in activity since the onset of the recession. Section 2 presents a description of the relationship between various measures of inflation and activity. Section 3 sets out the results of several econometric estimates. And in the final section, conclusions are drawn.

Descriptive evidence of the relationship between inflation and the cycle

This section offers an analysis of simple correlations between different measures of inflation and of the economy's cyclical position or degree of slack. To correctly interpret these relationships, it should be borne in mind that the theoretical sign of the relation-

INFLATION DIFFERENTIAL AND MEASURES OF CORE INFLATION CHART 1



SOURCES: Eurostat, INE and Banco de España.

ship between the inflation rate and the cyclical position is not predetermined. On one hand, positive (negative) demand shocks tend to raise (lower) prices and quantities, generating a positive relationship between both variables. Conversely, supply-side shocks or tax changes bear in opposing directions on prices and quantities, such that the relationship between the two variables is negative. Accordingly, two measures of inflation are considered hereafter. First, the CPI, which includes components particularly affected by supply-side shocks, such as energy and fresh food. And, second, a core inflation measure, the CPI excluding energy and unprocessed food prices, which is much less sensitive to supply-side fluctuations. In addition, in the case of this latter measure, the impact of price changes associated with changes in indirect tax and in regulated prices, such as medicines, is stripped out; accordingly, this measure may be expected to be procyclical. This adjustment has been particularly significant in recent years, given the increases in VAT rates in 2010 and 2012, and dearer regulated prices for certain goods and services, such as medicines or the charges linked to various public services. Specifically, the downward trajectory shown by the CPI measure since mid-2011 contrasts notably with the upward course of the core inflation measure (right-hand side panel of Chart 1).

The macroeconomic literature on price-setting stresses the effect of the cyclical position on prices. Empirical analysis has to take into account that the degree of cyclical slack in any economy is not directly observable, making an approximation advisable through consideration of a broad set of measures. Specifically, this section analyses four approximations to the cyclical component linked to the labour market (year-on-year change in the unemployment rate, unemployment rate, recession gap[1] and cyclical unemployment[2]), and a further four linked to changes in activity (GDP growth, change in consumption, capacity utilisation and output gap).

The analysis considers the expansionary 1996-2007 period, along with the 2008-2012 period in which the Spanish economy faced a double-dip recession. Table 1 presents the simple correlation coefficients between the different measures of inflation and cycle

1 Stock and Watson (2010) define this measure as the difference between the current unemployment rate and the minimum rate in the past 12 quarters (including the current rate).

2 This measure is obtained from an unobservable components model that enables the cyclical and structural components of the unemployment rate to be separated. A more detailed description of this methodology can be found in Watson (1986).

INFLATION AND CYCLICAL POSITION. CORRELATION COEFFICIENTS

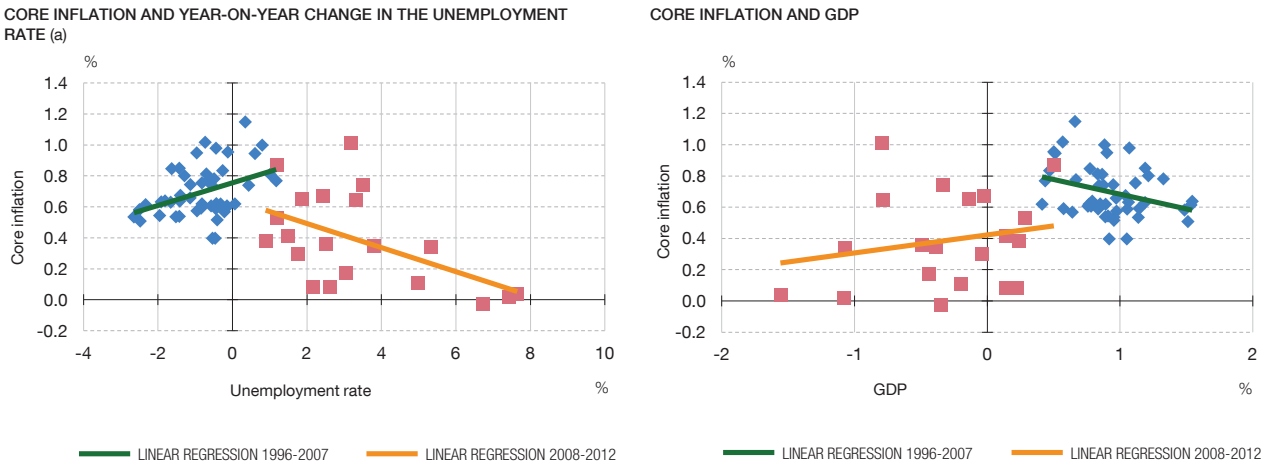
TABLE 1

		Period: 1996-2007		Period: 2008-2012	
		Year-on-year rate	Quarter-on-quarter rate	Year-on-year rate	Quarter-on-quarter rate
Core inflation excluding regulated prices and taxes	Annual change in unemployment rate	0.64	0.38	-0.17	-0.59
	Unemployment rate	-0.09	-0.28	-0.70	-0.49
	Recession gap	0.61	0.26	-0.85	-0.63
	Cyclical unemployment	-0.45	-0.27	-0.25	-0.26
	GDP	-0.71	-0.30	0.59	0.39
	Private consumption	-0.55	-0.05	0.12	-0.21
	Capacity utilisation	-0.62	-0.22	0.95	0.83
	Output gap	0.12	0.33	0.89	0.65
CPI	Annual change in unemployment rate	0.32	0.12	-0.73	-0.70
	Unemployment rate	-0.38	-0.32	-0.26	0.08
	Recession gap	0.19	0.15	-0.66	-0.25
	Cyclical unemployment	-0.50	-0.28	0.36	0.25
	GDP	-0.33	-0.11	0.87	0.68
	Private consumption	-0.25	0.10	0.51	0.13
	Capacity utilisation	-0.32	-0.07	0.81	0.24
	Output gap	0.36	0.35	0.49	0.03

SOURCES: INE and Banco de España.

RELATIONSHIP BETWEEN INFLATION AND THE BUSINESS CYCLE

CHART 2



SOURCES: INE and Banco de España.

a Core inflation excluding regulated prices and taxes.

considered. Broadly, it can be seen that, in the recession, the inflation measures are more procyclical than they were previously. Along these same lines, Chart 2 depicts dispersion diagrams of the relationship between the core inflation measure (vertical axis) and the two measures of the degree of slack (horizontal axis) that are to be used in the subsequent econometric analysis, distinguishing between the two sub-periods. Different relationships between the variables can clearly be seen here. Specifically, during the expansion period, the higher demand or better labour market situation was not accompanied

by higher inflation. Conversely, the sharp contraction in activity in recent years has brought about a change in this relationship and the increases in the unemployment rate or the declines in activity have been accompanied by a moderation in inflation.

Some estimates of the cyclical sensitivity of inflation

To analyse inflation dynamics more precisely, this section presents estimates of standard Phillips curves.[3] According to this type of relationship, current inflation (π_t) depends on expected inflation (π_t^e), on the cyclical slack in the economy (h_t) and on an error term (e_t). Current inflation is normally higher if expected inflation increases and lower if the degree of slack in the economy increases. The cyclical sensitivity of inflation is determined by the coefficient α. Specifically the estimated relationship is:

$$\pi_t = \pi_t^e + \alpha h_t + e_t$$

Expected inflation is a variable which cannot be observed, so assumptions have to be made about its behaviour. In the estimates presented, the approach of Ball and Mazumder (2011) is adopted. These authors consider inflation expectations to be a combination of a forward-looking component and a backward-looking component. The former is identified with the central bank's inflation target π^o and the latter with average inflation in the past year. For a quarterly frequency, the formula used to proxy inflation expectations is as follows:

$$\pi_t^e = \gamma\pi^o + (1-\gamma)\frac{1}{4}(\pi_{t-1} + \pi_{t-2} + \pi_{t-3} + \pi_{t-4})$$

The above expressions give rise to the equation used to make the estimate:

$$\pi_t = \gamma\pi^o + (1-\gamma)\frac{1}{4}(\pi_{t-1} + \pi_{t-2} + \pi_{t-3} + \pi_{t-4}) + \alpha h_t + e_t$$

To isolate the impact of supply shocks, use is made of the measure of core inflation (seasonally adjusted) which excludes from the overall index the components of energy and unprocessed food, as well as the effect of tax changes and regulated prices. The degree of cyclical slack in the economy is proxied by the year-on-year change in the unemployment rate or by the quarter-on-quarter rate of change of GDP.

Table 2 shows the estimates of this model of the Phillips curve. For the period 1995-2007, the higher activity gave rise to higher inflation, although the effect is not statistically significant. Also, a substantial backward-looking component is estimated in the price dynamics ($1 - \gamma$), so the inflation exhibits notable inertia.

The estimation of the models for the period 2008-2012 confirms the increased cyclical sensitivity of inflation in the most recent period.[4] Indeed, the coefficient of the measure of cyclical slack increases in absolute value and becomes significant.[5] This development would be consistent with a decrease in the degree of nominal rigidity in a recession.[6]

3 For the sake of clarity, no versions of the Phillips curve for open economies are shown. The result obtained, namely increased cyclical sensitivity, is not altered by the introduction of import prices.

4 By contrast, Ball and Mazumder (2011) report lower cyclical sensitivity in the United States for the most recent period.

5 To avoid problems of simultaneity, GDP growth is lagged by one period.

6 Using microeconomic price information, Klenow and Malin (2010) find that the frequency of price adjustments in the United States increased in the recession.

PHILLIPS CURVE ESTIMATION

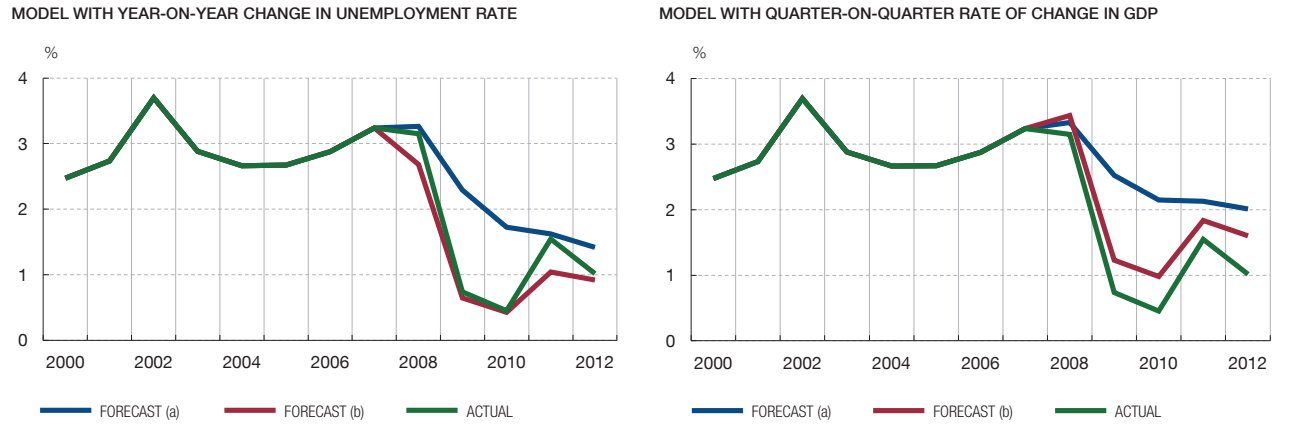
TABLE 2

	Estimated coefficients (p-value in brackets)			
	Model with year-on-year change in the unemployment rate		Model with quarter-on-quarter rate of change in GDP	
	1995-2007	2008-2012	1995-2007	2008-2012
γ	0.19 (0.10)	0.52 (0.00)	0.31 (0.03)	0.48 (0.00)
α	-0.08 (0.45)	-0.22 (0.00)	0.06 (0.13)	0.35 (0.00)

SOURCE: Banco de España.

ACTUAL VERSUS FORECAST INFLATION

CHART 3



SOURCES: INE and Banco de España.

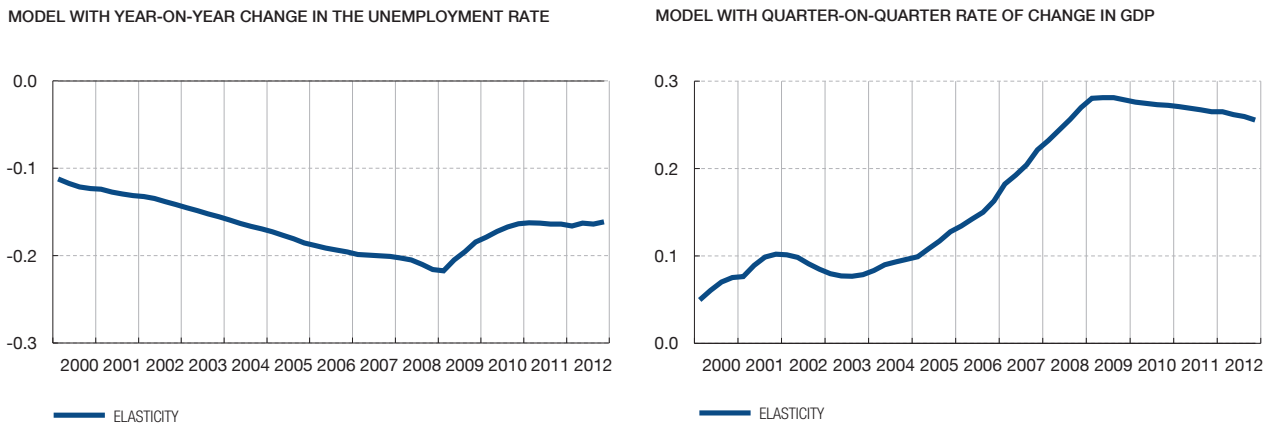
a Dynamic forecasts estimating the model to 2007 Q4.
b Dynamic forecasts assuming that the coefficients estimated with data from 2008 Q1 to 2012 Q4 are known.

On this evidence, firms would adjust downward their prices to check the decline in profit resulting from substantial falls in demand. Furthermore, the estimates show a decrease in the inertia of inflation.

Chart 3 shows the dynamic predictions obtained using the aforementioned models, beginning in 2008 Q1, and the observed behaviour of inflation. If the coefficients estimated for the first period are used, inflation during the recession is lower than that predicted by the model, perhaps due to an increase in cyclical sensitivity in the more recent years. By contrast, similar exercises for the United States show observed inflation to be higher than would be expected from historical relationships, so there was a flattening of the Phillips curve. Another vital question is whether it would have been possible to predict the behaviour of inflation in the period 2008-2012 if the change in the relationship between inflation and activity had been known. The chart shows the dynamic predictions from 2008 Q1 assuming that the estimated coefficients for the second period are known. It makes it plain that the models used have a relatively high explanatory power when it comes to accounting for the lower inflation seen in the Spanish economy in recent years.

An alternative way of analysing the changes in the cyclical sensitivity of inflation is to estimate a version of the model in which the coefficient of cyclical slack is not constant but

ELASTICITY OF INFLATION TO THE MEASURE OF THE DEGREE OF SLACK CHART 4



SOURCE: Banco de España.

rather varies with time, like that shown in Chart 4.[7] It clearly indicates that the cyclical position has had a higher impact on price changes in the most recent period.[8]

Conclusions

The last few years have seen a notable decrease in the inflation differential between Spain and the euro area countries. This article presents evidence that Spanish inflation is currently more sensitive to the high degree of slack in the economy than in the past, which contrasts with the weaker relationship between these variables observed recently in other advanced economies. This result continues to hold if different econometric specifications and different inflation and activity indicators are considered. In the current setting, this greater cyclical sensitivity of prices is prompting a sharp correction of the competitive disadvantage built up during the last expansionary cycle. This adjustment is favouring the current dynamism of the export sector and mitigating the fall in domestic demand. However, to ensure that the process of depreciation of the real exchange rate continues in the future, further reforms will be needed to raise the competitiveness of the markets for certain products and to enhance efficiency in the factor markets. This would enable the Spanish productive system to increase the comparative quality of its goods and services,[9] and to bring its selling prices more into line with the costs borne and with the specific conditions of the business cycle.

A way of building on the research reported in this article would be to determine the relative importance of the various factors determining the cyclical sensitivity of inflation. Specifically, it would be of interest to analyse possible differing responses of nominal wages, productivity or the margins set by firms. Also, it is important to look at whether this initial research has identified a change in the response of prices to fluctuations in activity or its findings are a consequence of possible asymmetries between upturns and downturns in the relationship between these two variables.

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7 This dynamic estimator of slack was obtained using the Kalman filter.

8 For purposes of comparison, models of the Phillips curve were estimated recursively using samples with a fixed number of years (specifically, five) and the results confirm the increase in the cyclical sensitivity of Spanish inflation in recent years.

9 Martín and Tello (2013) analyse the role of non-price competitiveness as a determinant of the export activity of European firms.

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