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INFLATION REGIMES AND STABILISATION POLICIES: SPAIN 1962-2001

JUAN AYUSO
Banco de España
GRACIELA L. KAMINSKY
George Washington University
DAVID LÓPEZ-SALIDO
Banco de España and CEPR

After reaching high levels in the 1970s and 1980s, inflation in Spain is significantly lower in the early 2000s. This paper estimates a switching-regime model for that variable. Our results point towards the existence of three regimes across which the average and the volatility of inflation are positively correlated. Major movements from high and volatile inflation to low and more stable inflation are identified around 1978, 1990 and 1995, when relevant economic policy decisions were made. Our empirical results also help to explain the relatively long-lived episodes of over and under prediction of Spanish inflation without requiring any sort of agents' irrationality.

Keywords: Switching-regime models, inflation expectations.

(*JEL* E31, E50)

1. Introduction

In the early 1980s, after the explosion in inflation in the 1970s following the two oil shocks, all European economies engaged -to different extents- in tight monetary policies to fight rising inflation. Many of those countries also joined the European Monetary System (EMS) in the hope that this arrangement, by accepting Germany monetary policy, would provide additional discipline, and thus, would help in

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further reducing inflation. The efforts to reduce inflation were further intensified in the late 1980s with a push for increased institutional independence for central banks. In the 1990s many countries introduced the so-called inflation target regime, with explicit quantitative inflation targets at the centre of stabilisation programs. Finally, in January 1999 those countries that joined the Economic and Monetary Union (EMU) transferred their monetary policies to a newly created supranational monetary authority, the Eurosystem, whose mandatory primary objective is to maintain price stability in the area. While the economics profession views about the role of the EMS, central bank independence, and inflation targeting in effectively reducing inflation differs, inflation did fall in Europe with inflation rates oscillating around 2 percent in the late 1990s and the early 2000s.

Spain, as the other European economies, also suffered high rates of inflation in the 1970s and in the early 1980s, but, as shown in Figure 1, inflation did decline and by the late 1990s inflation had collapsed to around 3 percent. To fight inflation, Spain implemented austere monetary programs, joined the EMS in 1989, enacted central bank autonomy in 1994, and introduced inflation targets in January 1995. In 1999, it joined the EMU. Certainly, these and other policies are in part responsible for the drop in inflation. However, it is unclear the extent of the contribution of each policy. The evolution of inflation and the implemented stabilisation policies render Spain a suitable case study.

Against this background, this paper estimates a model of Spanish inflation that allows for different regimes, with the mean rate of inflation, inflation persistence, and volatility possibly differing across regimes. The method implemented is the Hamilton (1989) filter, which allows for the endogenous identification of the dates of the switching from one regime to another. Our results point towards the existence of three regimes across which the average and the volatility of inflation seems to be positively correlated. Major movements from high and volatile inflation to low and more stable inflation are identified around 1978 (when the *Pactos de la Moncloa* were signed), 1990 (Spain joined EMS), and 1995 (a direct inflation targeting strategy was adopted)[1]. In addition, our empirical results also help to explain why relatively long period of over or under prediction of inflation may be envisaged which, ho-

[1]Our approach, however, does not allow us to directly link the changes in the inflation regime and the anti-inflationary policies adopted.

wever, do not violate the hypothesis of fully rational economic agents. During the long disinflationary episode experienced by the Spanish economy, inflation expectations reflected the observed inflation movements with some delay because, first, they ignored that a new inflation regime had emerged; and second, they still assigned some small but non-zero probability to a possible return to higher inflation records. Thus, positively correlated forecasting errors do not entail any sort of irrationality but rather they are related to incomplete information problems, as agents do not observe the prevailing inflation regime.

The rest of the paper is organised as follows. Section 2 provides a chronology of the events leading to the reduction of inflation from 25 percent in 1977 to around 3 percent in the late 1990s. Section 3 presents the methodology and the models to be estimated. Section 4.1 reports the estimation of a two-state switching-regime model for inflation. Section 4.2 generalises the model of inflation to a three-state switching-regime model. Section 5 concludes.

FIGURE 1
Inflation rate (percent per annum)

2. A chronology of anti-inflation strategies

The return of Spain to democracy in 1975 was accompanied by expansionary fiscal policies. According to the European Commission, the structural fiscal deficit increased to 0.5 percent of GDP in 1976 and continuously increased thereafter reaching 6.2 percent of GDP by 1985. In the first few years, monetary policy basically accommodated to the changes in the fiscal stance, with money supply (M1) growing around 20 percent between 1975 and 1977. By the end of 1977, inflation had reached almost 25 percent. In December 1977, with inflation rapidly accelerating, the Suárez government announced the *Pactos de la Moncloa* plan. The social pact between the government, political parties, and the labour unions included among its key features a mechanism to break the inflation inertia: wages were going to be set according to expected inflation and not to compensate for past inflation. The *Pacto* was complemented with contractionary monetary policy. In contrast with the previous accommodating monetary policy, the Banco de España started to take an active role in monetary policy by publicly announcing monetary growth target rates, with the target bands for M3 declining from 14.5-19.5 percent in 1978 to 10.5-14.5 percent in 1984. The plan was successful in bringing down inflation to less than 10 percent by 1984.

The instability of money demand brought about by the liberalisation of the banking industry starting in 1978 and the flurries of financial innovations that followed the deregulation led the Banco de España to deemphasise the targeting of monetary aggregates. Notably, around this time monetary policy started to take into account the trade-weighted exchange rate, particularly after 1986 when Spain joined the European Economic Community. With the de-facto pegging of the peseta since 1986 and the more formal pegging after Spain joined the EMS in the first half of 1989, the monetary authority lost some control over monetary policy. During the 1986-1991 period, there were large, cumulative inflows of capital attracted by the higher yields of Spanish bonds and by investor's growing belief that Spain was on an irreversible convergence path toward the Economic and Monetary Union. As it is examined in greater detail in Ayuso and Escrivá (1998), the large capital inflows could not be completely sterilised, with money supply growing at a pace extremely high to guarantee price stability. In fact, during the 1986-1991 period the growth rate of the targeted broad monetary aggregate always surpassed the target band and inflation increased rapidly, climbing from about 5 percent in 1987 to about 7.5 percent in 1989. Inflation was further fuelled by an expansionary fiscal policy. Between 1988 and 1993, the public deficit increased from 3.3 percent of GDP to 7.5 percent, with public expenditure reaching 50 percent of GDP and government debt also increasing to approximately 60 percent of GDP. Although inflation started to converge to the rate of inflation in Germany, the convergence was slow and the peseta appreciated massively. The EMS crisis in 1992, with the devaluations of the peseta in September and November, interrupted briefly this process, with inflation increasing to about 5 percent in 1994.

In 1994 the government implemented a new set of anti-inflationary policies. First, the Program of Convergence for the Spanish economy was revised and more emphasis was given to reducing public deficit according to the guidelines included in the Maastricht Treaty. Second, the labour market was given more flexibility, and third the Banco de España gained independence in 1994 *(Ley de Autonomía del Banco de España de 1994).* Also, in 1995 the Banco de España started to implement a regime of inflation targets. By the end of 1997 inflation had declined to approximately 2 percent.

Finally, in January 1999 Spain was one of the eleven countries that transferred their monetary policy to the Eurosystem. This independent institution is since that date in charge of the single monetary policy of the area made up of all countries that joined the EMU.

3. Methodology

With a changing fiscal and monetary stance, the stochastic process followed by inflation will also eventually change. To examine what type of policies were more effective in bringing inflation down, we estimate a switching-regime model for inflation. The model consists of the following equations:

$$\pi_t = \delta_0 (R_t) + \sum_{j=1}^{q} \delta_j (R_t) \pi_{t-j} + \varepsilon_t (R_t), \varepsilon_t \sim N\left(0, \sigma^2 (R_t)\right) \quad [1]$$

$$\text{Prob}\,(R_t = j/R_{t-1} = i) = p_{ij}, \quad i, j = 1, 2, ..., n, \quad [2]$$

where π_t is the annual rate of inflation, R_t is the variable representing the inflation regime, and n is the number of possible regimes. In expression [1], inflation is modelled as an autoregressive process of order q with regime-dependent constant, autoregressive parameters, and volatility. Since some of the anti-inflation programs included deindexation schemes, inflation persistence is expected to decrease after the stabilisation program is implemented, that is, the sum of the $\delta_j(R_t)$ parameters will become smaller after an anti-inflation program is implemented. Equation [2] shows the Markov chain transition probability matrix, where p_{ij} is the probability of switching from Regime i to Regime j in one period. We first explore a two-regime switching model. Next, we examine whether a three-regime switching model can best describe the inflation rate.

To estimate the model in equations [1]-[2], we use a modified Hamilton's (1989) non-linear filter. Since there is no presumption that in fact there were changes in regime, the estimation procedure does not impose the existence of two or more differentiated states. Moreover, the estimation is based on the assumption that the regime is not observed directly but must be inferred based on the observation of current and past values of inflation. For the two-regime model, the optimal forecast of this process can be thought of as the following sequence of steps.

For any period t, we have a certain prior about the probability of being in state 1 or 0 based on past information:

$$Prior\,(R_t = 1) = (1 - p_{10})\,Post\,(R_{t-1} = 1) + p_{01}\,[1 - Post\,(R_{t-1} = 1)] \qquad [3]$$

where

$$Prior\,(R_t = 1) = Prob\,(R_t = 1/I_{t-1}),\, I_t = \{\pi_t, ..., \pi_1\},$$

and

$$Post\,(R_t = 1) = Prob\,(R_t = 1/I_t).$$

We then calculate the density function of π_t

$$\begin{aligned} f(\pi_t/I_{t-1}) &= f(\pi_t/R_t = 1)\;\; Prior\,(R_t = 1) + f(\pi_t/R_t = 0) \\ &\quad [1 - Prior\,(R_t = 1)] \end{aligned} \qquad [4]$$

Finally, we update our predictions using the Bayes formula:

$$Post\,(R_t = 1) = \frac{f(\pi_t/R_t = 1)\;\; Prior\,(R_t = 1)}{f(\pi_t/I_{t-1})} \qquad [5]$$

We update repeatedly over the entire sample using [3]-[5].

The estimation procedure is as follows. We start at $t = 1$ with the unconditional probability, which we set equal to the limiting probability of being in Regime 1 of the Markov process in equation [2]. Using [3]-[5] we construct the sample log likelihood

$$\sum_{t=1}^{T} \log f\left(\pi_t / I_{t-1}\right)$$

which can be maximised numerically with respect to the unknown parameters $\delta_0\left(R_t\right), \delta_j\left(R_t\right)$ and $\sigma^2\left(R_t\right)$.

Testing a multi-regime model against single-regime models (or a multi-regime model with fewer regimes) is not straightforward because some of their parameters are not identified under the null hypothesis. We follow Hansen (1992), who proposed a method for calculating an approximation to the distribution of a valid test statistics using the empirical distribution of an upper bound of the LR statistic.

4. Data and results

As it is usual in the related literature, we use the Consumer Price Index (CPI). Our sample spans the period 1961Q1 -2000Q2. Due to the well-documented seasonality in the Spanish CPI (Matea and Regil, 1996) we focus on annual inflation[2].

4.1. The two-regime model

Table 1 shows the maximum-likelihood estimates of our preferred two-regime switching models chosen according to the standard strategy of going from the most general specification to a particular one. Three main characteristics of the inflation process can be inferred from the results in that table.

First, the autoregressive structure of the two-state model is quite simple: only the first order autoregressive parameter is found to be significant and there are no differences in persistence between both regimes. In spite of the above-mentioned problem of overlapping, we cannot reject the null of zero higher order autoregressive parameters in any of the regimes. In particular, we have followed a general-to-specific approach. We started with an AR(4) –i.e. one more lag than suggested by the overlapping nature of the data– and tested it against an AR(3)

[2] As it is well known, this implies an overlapping in the data that induces a moving average component in the residual of the univariate model.

TABLE 1
Two-regime model: maximum likelihood estimates and Hansen tests

$$\pi_t = \delta_0(R_t) + \delta_1(R_t)\pi_{t-1} + \varepsilon_t(R_t), \quad \varepsilon_t(R_t) \sim N(0, \sigma^2(R_t))$$

$$R_t = \begin{cases} 0: & low\ \pi \\ 1: & high\ \pi \end{cases}$$

$$p_{ij} = P(R_t = j \mid R_{t-1} = i)$$

Parameter	Regime	
	Low inflation *(R_t = 0)*	High inflation *(R_t = 1)*
δ_0 *(R_t)*	0.15 (0.12)	0.58 (0.29)
δ_1 *(R_t)*	0.96 (0.02)	0.96 (0.02)
σ *(R_t)*	0.68 (0.06)	2.07 (0.19)
$E(\pi \mid R_t)$	3.84 (10.96)	14.84 (6.65)
p_{0R_t}	0.99	0.01
p_{1R_t}	0.01	0.99
log *L*	-240.72	
N	157	
Hansen test		
H_0: AR(1)		
Grid1 / Grid2	7.16 (0.00) / 7.21 (0.00)	
H_0: R.Walk		
Grid1 / Grid2	7.28 (0.00) / 7.30 (0.00)	

Notes:

1. Standard errors in brackets (but for Hansen test: p-values).
2. δ_1 has been restricted to be constant across regimes after testing –and not rejecting– such a restriction.
3. Higher order –up to four– autoregressive components have been included yet it cannot be rejected that their coefficients are individually and jointly equal to zero.
4. Hansen tests computed from 1000 Montecarlo replications at each grid point.
5. Grid 1 (10000 grid points): δ_0 from 0.1 to 1 in steps of 0.1; σ from 0.5 to 2.75 in steps of 0.25; p_{00} from 0.05 to 0.95 in steps of 0.1; p_{11} from 0.05 to 0.95 in steps of 0.1.
6. Grid 2 (10000 grid points): δ_0 from 0.1 to 0.55 in steps of 0.05; σ from 0.6 to 1.5 in steps of 0.1; p_{00} from 0.5 to 0.95 in steps of 0.05; p_{11} from 0.5 to 0.95 in steps of 0.05.

making use of the standard likelihood ratio test. After not rejecting that the four-order lags were jointly equal to zero, we proceed to test the resulting AR(3) against an AR(2), and so on. Additionally, we also tested the AR(4) specification directly against the AR(1), obtaining the same result.

Second, our model is in levels, although it is well documented that the standard tests -based in single-regime models- usually reject the stationarity of the annual Spanish inflation series (see Matea and Regil, 1996). Non-stationarity, however, could be the result of a switching process between two stationary but different regimes. Unfortunately, it is not obvious how to test for unit roots in non-linear models like ours. Alternatively, we have performed a standard Monte Carlo experiment and obtained 1000 random replications of our preferred stationary two-regime model and checked whether the ADF test is able to property reject the null of the existence of a unit root in the simulated inflation series if the switching is ignored. Only in 197 cases the standard ADF test is able to properly reject the null of a unit root in the series[3].

Third, according to the estimated means and variances, there seem to be two different regimes, one of them showing a much higher volatility (2.07 versus 0.68) and also a higher unconditional mean[4] (14.8 vs. 3.8). This result is in line with those presented, among others, by Evans and Watchtel (1993), Ricketts and Rose (1995) or Bidarkota (2001). That is, in a two-state model, high inflation seems to be associated with increased uncertainty about future inflation.

According to our estimates of the transition matrix, the probabilities of staying in any regime are quite high. This is a rather standard result in the related literature (see, for example, Ricketts and Rose, 1995). Using these probabilities and expressions [3]-[5], we can construct the prior probabilities of being in different inflation regimes and the expected inflation rate according to this model. Figure 2 shows the prior probabilities of being in each of the two regimes. These probabilities point towards a change initiated around 1978 and consolidated around mid eighties, which could be related to the anti-inflation program implemented in that year, the *Pactos de la Moncloa.* As is the case with the transition probabilities, prior probabilities are most of the time close to their limits. However, the average inflation in each regime is different enough as to yield forecasting errors comparable to those in Ayuso and López-Salido (1998). As Figure 3 shows, there are different periods where systematic differences arise between the annual observed and 1-year-ahead expected inflation. During the periods of increase in the inflation rate, the two-state model tends to under-predict, but it tends to overpredict once inflation starts to decrease. In particular during the long disinflationary episode experienced by the Spanish economy, inflation expectations reflected the observed inflation move-

[3] This result does not change if the Philips-Perron test is used. The number of rejections increases to 199.

[4] The unconditional mean is equal to $\frac{\delta_0}{1-\delta_1}$.

ments with some delay. It is worth noting that these forecasting errors do not entail any sort of irrationality. Rather, they are related to incomplete information problems, as agents do not observe the prevailing inflation regime[5].

FIGURE 2
Estimated prior probabilities two-regime model

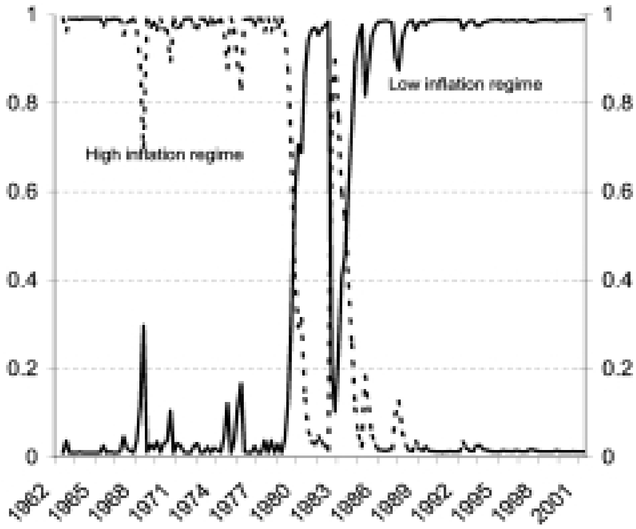
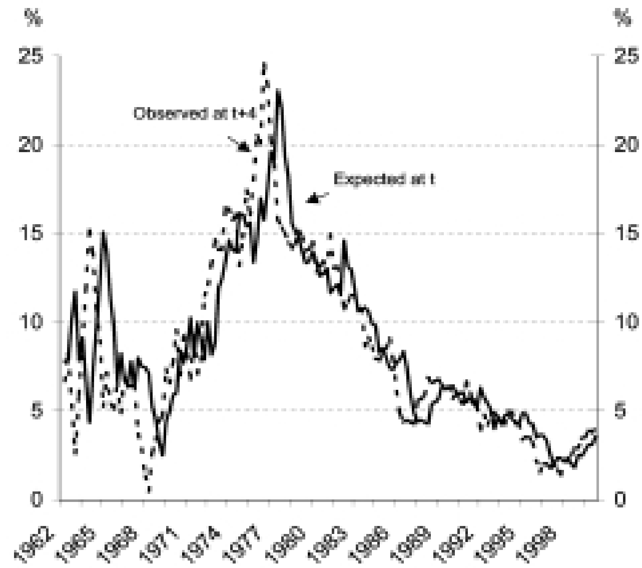


FIGURE 3
Expected and observed inflation two-regime model



Finally, at the bottom of Table 1 are the results of a formal test of the two-regime model against the alternative of a single-regime model. In particular, two single-regime models are considered, that do not exhaust the available range –which is beyond the aims of this paper– but may be of particular interest[6]. First, as in Hansen (1992), we try the single-regime version of our preferred two-regime model (i.e. an AR (1)). Second, we also consider a random walk to test our preferred model against the alternative of a non-stationary inflation rate. Following Hansen (1992), we have tried two grids for those parameters that are not identified under the null. The first one is chosen according to the range of the parameter estimates in the different regimes. The second is a finer one around the vector in the first grid that provides the maximum livelihood value. Ideally, this should allow us to cover a range wide enough with an acceptable degree of fineness, without incurring in unaffordable computational requirements[7]. As can be seen, the results of the test clearly support the two-regime model.

4.2. A three-regime model

The two regimes identified in the previous section are quite different. In this section we explore whether a third (intermediate) regime may exist, thus allowing for less sharp changes in both the average inflation and its volatility.

Table 2 shows the main results of our three-regime model estimates. They suggest the existence of three regimes, which can be characterised as follows: a low and stable inflation regime, a medium and more volatile inflation regime, and a high and volatile inflation regime. Interestingly, mean and volatility continue to be positively correlated, that is the higher the rate of inflation, the higher the volatility. According to the unconditional means in each regime, average "low", "medium" and "high" inflation are estimated to be 3.6, 6.3 and 13.5 percent, respectively, whereas "low", "medium" and "high" standard deviations are estimated to be 0.49, 0.86 and 2.07. It is worth noting that the estimates corresponding to the "low" and "high" regimes are quite similar to those of the two-regime model.

[6] Bidarkota (2001), for instance, offers an interesting analysis of the relative performance of Markov switching regime models, state space models with heavily-tailed errors and state space models with compound error distributions, concluding that all them yield similar mean squared forecast errors when used to forecast US inflation.

[7] Note that a two-regime model has to be estimated for each grid point.

TABLE 2
Three-regime model: maximum likelihood estimates and Hansen tests

$$\pi_t = \delta_0(R_t) + \delta_1(R_t)\pi_{t-1} + \varepsilon_t(R_t), \quad \varepsilon_t(R_t) \sim N(0, \sigma^2(R_t))$$

$$R_t = \begin{cases} 0: & low\ \pi \\ 1: & medium\ \pi \\ 2: & high\ \pi \end{cases}$$

$$p_{ij} = P(R_t = j \mid R_{t-1} = i)$$

Parameter	Regime		
	Low inflation $(R_t = 0)$	Medium inflation $(R_t = 1)$	High inflation $(R_t = 2)$
$\delta_0\ (R_t)$	0.21 (0.07)	0.35 (0.32)	0.77 (0.39)
$\delta_1\ (R_t)$	0.94 (0.01)	0.94 (0.01)	0.94 (0.01)
$\sigma\ (R_t)$	0.49 (0.05)	0.86 (0.11)	2.07 (0.08)
$E(\pi \mid R_t)$	3.63 (1.10)	6.31 (2.03)	13.52 (4.36)
p_{0R_t}	1.00	0.00	0.00
p_{1R_t}	0.02	0.98	0.00
p_{2R_t}	0.00	0.02	0.98
$\log L$		-235.67	
N		157	
Hansen test (H_0: 2-regime model estimated in Table 1)			
Grid1		2.48 (0.28)	
Grid2		2.36 (0.18)	
Grid3		1.93 (0.08)	

Notes:
1. Standard errors in brackets (but for Hansen test: p-values).
2. δ_1 has been restricted to be constant across regimes after testing –and not rejecting– such a restriction.
3. Hansen tests computed from 1000 Montecarlo replications at each grid point.
4. Grid 1 (10000 grid points): δ_0 from 0.57 to 1.02 in steps of 0.05; σ from 1.87 to 2.32 in steps of 0.05; p_{12} from 0.02 to 0.695 in steps of 0.075; p_{21} from 0.02 to 0.695 in steps of 0.075; $p_{02} = p_{20} = 0$.
5. Grid 2 (10000 grid points): δ_0 from 0.57 to 0.795 in steps of 0.025; σ from 1.87 to 2.095 in steps of 0.025; p_{12} from 0.02 to 0.47 in steps of 0.05; p_{21} from 0.02 to 0.47 in steps of 0.05; $p_{02} = p_{20} = 0$.
6. Grid 3 (10000 grid points): δ_0 from 0.57 to 0.615 in steps of 0.005; σ from 2.01 to 2.055 in steps of 0.005 (10 points); p_{12} from 0.01 to 0.1 in steps of 0.01; p_{21} from 0.01 to 0.1 in steps of 0.01; $p_{02} = p_{20} = 0$.

The transition probabilities among regimes are now less close to 0 or 1 but for Regime 1. Figure 4 shows the corresponding prior probabilities of being in each regime. The prior probability corresponding to the high-and-volatile inflation regime still reduces drastically between 1978 and the early eighties, thus suggesting a positive impact of the measures taken under the *Pacto de la Moncloa.* Since, the "medium" regime is perceived to be the most likely regime until the early nineties, when the low-and stable inflation regime starts to be perceived as the prevailing regime. Interestingly, this perception accelerates around 1995. This path suggests that both, EMS membership and adopting a direct inflation targeting might have had an important impact on the process followed by Spanish inflation. Both events could have helped to achieve lower and more stable inflation figures.

FIGURE 4
Estimated prior probabilities three-regime model

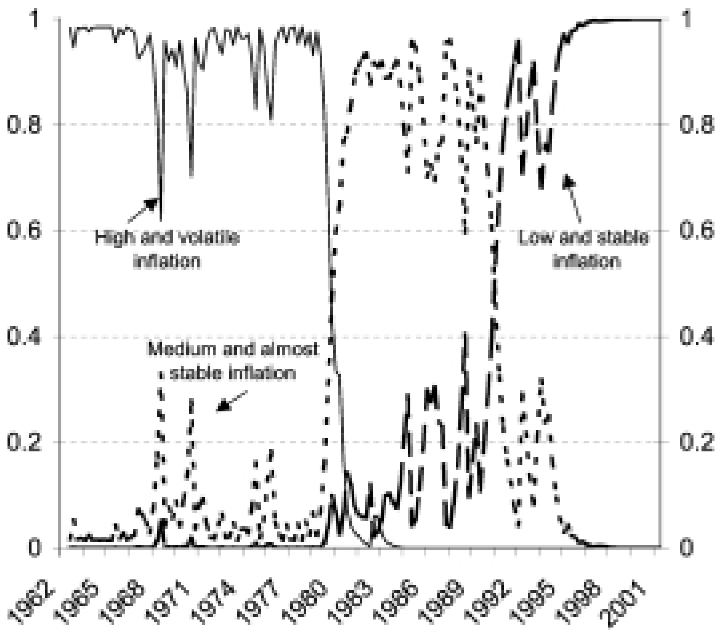
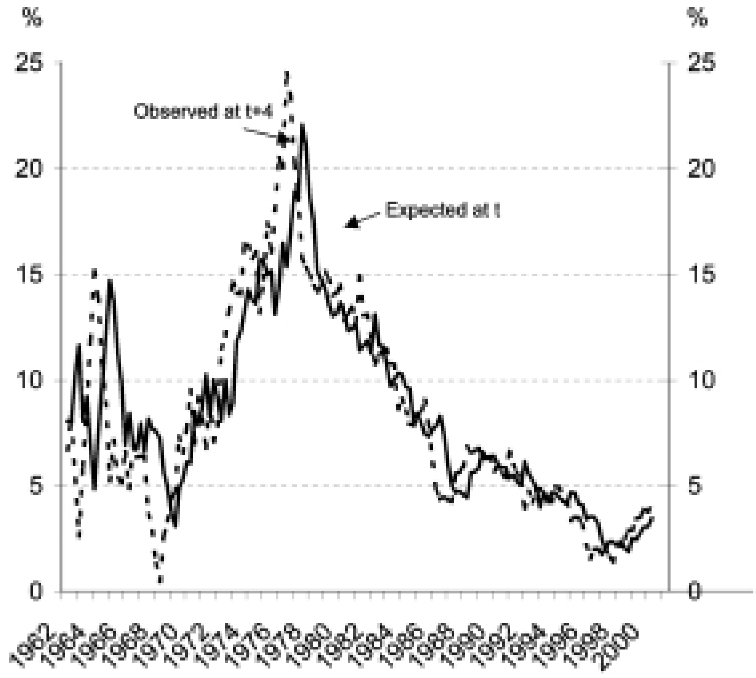


Figure 5 shows 1-year-ahead expected annual inflation under the three-regime model and the actually observed rate. This figure offers a picture rather similar to that of the two-regime model and therefore, expanding the model does not modify our previous conclusions. Doubts about the current inflation regime and -maybe to a lesser extent- non-zero probabilities of changing to a different regime can explain forecasting errors that are far from the usual white noise assumption. As examined before, it seems that agents' expectations adjust slowly over time, while the relatively protracted periods of under- or over-prediction of inflation are not a sign of irrationality but a sign of imperfect information.

FIGURE 5
Expected and observed inflation three-regime model



Finally, Table 2 also shows the results of testing the three-regime model against the two-regime model estimated in Section 4.1. Three different grids are considered, according to the same principles as in Table 2[8]. Results are less overwhelming in this case, however. Thus, the p-values of the tests vary between 0.28 and 0.08 and decline as the fineness of the grid increases. In any event, it is worth noting that Hansen's test only provides upper bounds[9] and therefore less demanding confidence levels might be more appropriate in this case. Thus, results in Table 4 do not lead to a rejection of the three-regime model.

[8] As it seems highly implausible –theoretically and empirically– that the economy may jump from the "high" regime to the "low" regime or viceversa, and have not been allowed to vary across the different grids. This has significantly reduced the computational burden of the test.

[9] And therefore, "suffer a loss in effective power (the ability to reject the null when it is false)". See Hansen (1992), p. S66.

5. Conclusions

This paper examines whether the stochastic process followed by the rate of inflation in Spain from 1962 to 2001 can be better characterised as following a switching-regime model. Our preferred model is the one with three regimes.

We found that both the average and the volatility of inflation are positively correlated across regimes. Thus average low, medium and high inflation are estimated around 3.6, 6.3 and 13.5 percent, respectively, whereas low, medium and high standard deviations are estimated at 0.5, 0.9 and 2.1. According to our estimates, agents perceived a change from high to medium inflation around 1978 and a change from medium to low inflation around 1990, which accelerates in 1995. These three dates are important in the evolution of the Spanish policy-mix: in 1978 the *Pactos de la Moncloa* marked an important change in the economic environment, in 1989 Spain joined the EMS and in 1995 a direct inflation targeting strategy was adopted.

Finally, we also illustrate that the existence of different inflation regimes has major implications for inflation forecasting. With imperfect information, agents do not observe the current regime nor they are able to fully anticipate a switch to another one. Thus, there are protracted periods in which inflation expectations are over or under the ex-post observed inflation and, therefore, ex-post expectation errors are correlated over time. These expectation errors, however, are not a sign of agents' irrationality but can be explained in terms of the existence of an imperfect information framework.

References

Ayuso, J. and J.L. Escrivá (1998): "Trends in the monetary policy strategy in Spain", in Molina, J.L., Viñals, J. and Gutiérrez, F. (eds) *Monetary Policy and Inflation in Spain,* McMillan, pp. 138-158.

Ayuso, J. and J.D. López-Salido (1998): "Ex-post real interest rates versus ex-ante real rates: a CCAPM approach", *Spanish Economic Review* (formerly *Revista Española de Economía*) 15, pp. 379-401.

Bidarkota, P.V. (2001): "Alternative regime switching models for forecasting inflation", *Journal of Forecasting* 20, pp. 21-35.

Dahl, C. and B.E. Hansen (1999): "The formation of inflation expectations under changing inflation regimes", Working Paper, Center for Non Linear Modelling in Economics.

Evans, M. and P. Watchel (1993): "Inflation regimes and the source of inflation uncertainty", *Journal of Money Credit and Banking* 25, pp. 475-520.

Hamilton, J. (1989): "The new approach to the economic analysis of non stationary time series and the business cycle", *Econometrica* 57, pp. 357-84.

Hansen, B.E. (1992): "The likelihood ratio test under non-standard conditions: testing the Markov switching model of GNP", *Journal of Applied Econometrics* 7, pp. 61-82.

Matea, M.Ll. and A.V. Regil (1996): "Indicadores de inflación a corto plazo", *Estadística Española* 38, pp. 83-114.

Ricketts N. and D. Rose (1995): "Inflation, learning and monetary policy regimes in the G-7 economies", Bank of Canada, Working Paper 95-06.

Resumen

Tras alcanzar niveles elevados en los setenta y los ochenta, la tasa de inflación española a comienzos de la presente década era mucho más moderada. En este trabajo, se estima un modelo de cambio de régimen para esta variable. Los resultados obtenidos apuntan hacia la existencia de tres regímenes durante el período considerado, en los que la inflación media y su volatilidad están positivamente correlacionadas. Los principales cambios desde un régimen de inflación alta y volátil hacia otro de inflación reducida y más estable se produjeron alrededor de 1978, 1990 y 1995, fechas en las que se tomaron importantes decisiones en el ámbito de la política económica. Adicionalmente, estos resultados permiten explicar la existencia de períodos relativamente largos durante los cuales los agentes sobre o infrapredijeron de la tasa de inflación española pese a formar sus expectativas de manera racional.

Palabras clave: Modelos de cambio de régimen, expectativas de inflación.

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