ARE CURRENCY CRISES SELF-FULFILLING? THE CASE OF ARGENTINA

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Abstract

This paper analyzes the 2002 Argentine crisis using the Jeanne and Masson (2000) model with sunspots. Testing this model empirically through a Markov-switching model suggests that self-sulfilling prophecies is a reasonable explanation for the devaluation of the *peso*.

Keywords: Currency crises, multiple equilibria, Markov-switching.
JEL Classification: C22, D84, F31

1 Introduction

Throughout the eighties, the Argentine economy suffered from very high levels of inflation. To tackle hyperinflation, the convertibility system was introduced in 1991; it involved a currency board in which the peso was pegged one-to-one to the US dollar. Its success was undeniable in this respect as it provided Argentina with its longest period of price stability within the last fifty years. Nevertheless, at the end of the nineties, domestic interest rates increased dramatically above US levels, putting Argentina's economy into severe recession. By the beginning of 2002, the peso had been devalued by approximately 50% and sovereign debts of over 150 billion dollars were in default.

According to Fronti, Miller and Zhang (2002), this final stage can be interpreted in two different ways. The Fenix plan (2001) pointed out the unsustainability of the peg because of adverse economic fundamentals. The appreciation of the dollar against the euro, the devaluation

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of the Brazilian *real*, and the increased foreign debt made the peso over-valued and the debt burden unsustainable. In contrast, Mr. Cavallo (Economy Argentinian Minister) insisted that a credible peg offered the prospect of low interest rates and continued economic growth. That means that advocating devaluation and default would wipe out the credibility gains achieved since the beginning of the currency board.

Without denying the important role of economic fundamentals, the aim of this paper is to investigate whether the crisis in Argentina was, to some extent, self-fulfilling. Our theoretical basis is the so-called "second-generation" models which explain a currency crisis as follows: the cost of maintaining the peg (an increase in unemployment or public debt for example) brings the sustainability of the fixed rate into question. Therefore, expectations of devaluation induce a policy change (typically an increase in the interest rate) that makes the crisis self-validating (Obstfeld, 1994; Jeanne, 1997). These models allow for multiple equilibria, and a crisis can occur, even though economic fundamentals do not change, simply because private agents expect it. In the recent literature on self-fulfilling crisis, a very appealing approach was proposed by Jeanne and Masson (2000). They provide a model with sunspots (multiple equilibria), which theoretically justifies the use of the Markov-switching regimes approach in empirical work on currency crisis. As a result, they show that the switch across regimes corresponds to jumps between different equilibria explained by abrupt shifts in devaluation expectations. We apply their methodology to the Argentine *peso* to assert whether a model with multiple equilibria fits well and therefore whether this crisis can be explained by self-fulfilling prophecies.

The structure of the paper is as follows. Section 2 reviews and explains the estimation procedure. Section 3 describes the results. Section 4 summarizes and concludes.

2 The Model

We use a two-state Markov-switching regimes of devaluation expectations. The dependant variable (π) is the probability of devaluation. As Svensson (1993), and Jeanne and Masson (2000), we use as a proxy the differential between Argentine and US interest rates.[1] The drift adjustment method of Svensson (1993) which refers to a target zone is not required in our case where the exchange rate remains totally fixed. Our sample includes quarterly data from 1992:1 to 2001:4 taken from the IMF databank provided by Datastream. The economic fundamentals that we consider include the growth rate (gr), the deficit to GDP ratio (def), the real exchange rate (rer)[2] and the trade balance as a ratio of GDP ($trbal$).[3] These fundamentals are those

[1] The proxy is expressed in percentage terms to ensure that the devaluation probability belongs to [0,1].

[2] The real exchange rate is expressed by the ratio of domestic prices over US ones. The nominal exchange-rate does not appear because it is fixed and equal to one.

[3] It is important to note that we have experimented with other fundamentals variables including foreign direct investment flaws, money growth (narrow and wide definition) and unemployment rate. All of them were statistically insignificant. It is also worthy to mention that we used deficit instead of the stock of public debt

underlined by the authors of the Fenix plan. The real exchange rate is essential to capture tensions related to the strength of the dollar. Furthermore, the trade balance allows us to also consider problems of competitiveness due, to a large extent, to the devaluation of the *real* in Brazil (its largest trading partner) in 1999. The equation for the devaluation probability is thus specified as[4]:

$$\pi_t = \gamma_{s_t} + \beta_g gr_t + \beta_d def_t + \beta_r rer_t + \beta_b trbal_t + \nu_t, \qquad t \in \mathbb{T} \tag{1}$$

where the value of the constant term γ depends on the state $\{s_t\}$. The latter are random variables in $\mathbb{S} = \{1, 2\}$ that indicate the unobserved state of the system at date t (credible versus non-credible). Throughout, the regime indicators $\{s_t\}$ are assumed to form a homogeneous Markov chain on $\mathbb{S}$ with transition probability matrix $\mathbf{P'} = [p_{ij}]_{2\times 2}$, where

$$p_{ij} = \Pr(s_t = j | s_{t-1} = i), \qquad i, j \in \mathbb{S},$$

and $p_{i1} = 1 - p_{i2}$ ($i \in \mathbb{S}$). It is also assumed that $\{s_t\}$ and $\{v_t\}$ are independent with the errors, ν_t, normally distributed, with variance σ_v^2.

Therefore, shifts across regimes affect the devaluation probability by changing the constant term of equation (1), but leave the coefficients of the fundamentals unchanged (Jeanne and Masson, 2000). More particularly, a jump to a state of higher devaluation expectations makes the devaluation more likely by increasing the constant term.

3 Empirical Results

We first estimate the model without multiple equilibria using ordinary least squares, in order to test a purely fundamentals-based model. The parameter estimates, together with associated p-values, likelihood function values, and diagnostic statistics are presented in Table 1. Tests for serial correlation and heteroskedasticity in the standardized forecast residuals are also reported. The forecast values for the probability of devaluing are plotted against the data in Figure 1 (first graph). The explanatory power of the fundamentals seems to be poor. The coefficients have the expected sign only for growth and deficit but not for the real exchange rate and the trade balance. From Figure 1 (first graph), it can be seen that the fitted values follow the trend of π_t, but do not capture movements associated with episodes of speculative attacks.

The null hypothesis of linearity against the alternative of a Markov regime switching cannot be tested directly using a standard likelihood ratio (LR) test.[5] Therefore, we apply Hansen's

because all series available for the latter are discontinued.

[4]This equation corresponds to the linearized reduced form of the Jeanne and Masson (2000) model with sunspots (see p. 340).

[5]This is due to the fact that standard regularity conditions for likelihood-based inference are violated under the null hypothesis of linearity, as some parameters are unidentified and scores are identically zero. However, appropriate test procedures that overcome the former or both of these difficulties do exist (Hansen, 1992, 1996; Garcia, 1998).

standardized likelihood ratio test. This procedure requires the evaluation of the likelihood function across a grid of different values for the transition probabilities and for each state-dependent parameter. The value of the standardized likelihood ratio statistics is 4.751 which has zero P-values under the null hypothesis[6] (Table 2). We also test for the presence of a third state (Table 2). The results provide strong evidence in favor of a two-state regime-switching specification.

Insert Tables 1 and 2

As shown in Table 1 (second column), the relation improves when the model is estimated taking into account an additional state. The fit of the model is considerably better, as evidenced by a lower σ_v, a higher log likelihood and very different values of γ in the two states. Indeed, the value of the constant is substantially bigger in the "crisis" regime than in the other one. Therefore, for a same level of economic fundamentals, a jump in devaluation expectations leads to a much higher probability of devaluation. Each coefficient now has its expected sign and all are significant at the conventional level. Furthermore, the plot in Figure 1 (second graph) shows that the model with multiple equilibria seems to capture well the episodes of sharp movements in the devaluation probability.

Insert Figure 1

Based on the parameter estimates of γ, we can estimate the filter probabilities, which are the probabilities that each observation is in the high or the low state. The filter probabilities of a high γ are displayed in the bottom part of Figure 1 (third graph). The probability of staying in the low mean regime is 0.997, while episodes of high mean last shorter. The diagnostic tests show no sign of either serial correlation or heteroskedasticity. On the whole, the empirical results suggest that a Markov-switching model is able to capture the features of the data, allowing for periods of unusually high mean through regime switches. The filter seems to match the evolution of the probability of devaluation quite well. A first jump appears in the second quarter of 1992. This jump lasts until the beginning of 1993 and then the low regime prevails until 2001 (third quarter). In that quarter, a second jump to the high regime occurs, proving that higher private devaluation expectations have considerably increased the probability of devaluation before the crisis[7]. This is illustrated in Figure 1 (second graph) where the probability of devaluation substantially increases due to a shift in the constant from 2.759 to 22.53. It seems very difficult here to find the political events or news which could explain these jumps as it would require a higher data frequency than quarterly. However, our results show that the explanatory power of economic fundamentals improves considerably when abrupt shifts in devaluation expectations are allowed. This would suggest that, despite adverse economic fundamentals, the peg might have been maintained with lower devaluation expectations and, therefore, that the crisis in Argentina was, at least to some extent, self-fulfilling.

[6]The P-value is calculated according to the method described in Hansen (1996), using 1,000 random draws from the relevant limiting Gaussian processes and bandwidth parameter $M = 0, 1, \ldots, 4$, see Hansen (1992) for details.

[7]Note that by the third quarter of 2001, the country risk premium was about 1500 basis points in Argentina.

4 Conclusion

By using a Markov-switching model, this paper found compelling evidence that self-fulfilling prophecies have played an important role in the Argentina currency crisis of 2002. Indeed, the model performs remarkably well when two states are considered, thus allowing for abrupt shifts in devaluation expectations.

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TABLE 1

Parameters	Linear	Markov
γ_1	55.17 (0.009)	2.759 (0.000)
γ_2		22.53 (0.000)
β_g	-37.41 (0.116)	-9.704 (0.001)
β_d	0.301 (0.101)	0.080 (0.021)
β_r	-75.68 (0.024)	2.345 (0.001)
β_b	0.186 (0.679)	-0.065 (0.046)
p_{11}		0.997 (0.001)
p_{22}		0.522 (0.001)
σ_ν	5.132	2.867
LogLik	-119.51	-114.58
$Q_{(5)}$	0.521	0.167
$Q^2_{(5)}$	0.854	0.244

Note: $Q_{(5)}$ and $Q^2_{(5)}$ are respectively the Ljung-Box test statistics for 5 lags in the standardized and standardized squared residuals. P-values are reported in parentheses.

TABLE 2

	Standardized LR test	
	Linearity versus two-states Markov switching model	Two states versus three-states Markov switching model
LR	4.751	0.8734
$M = 0$	(0.0001)	(0.4352)
$M = 1$	(0.0001)	(0.4351)
$M = 2$	(0.0001)	(0.4352)
$M = 3$	(0.0001)	(0.4355)
$M = 4$	(0.0001)	(0.4367)

Note: See Hansen (1996) for details of the test statistic, such as the definition of M. P -values are in parentheses.

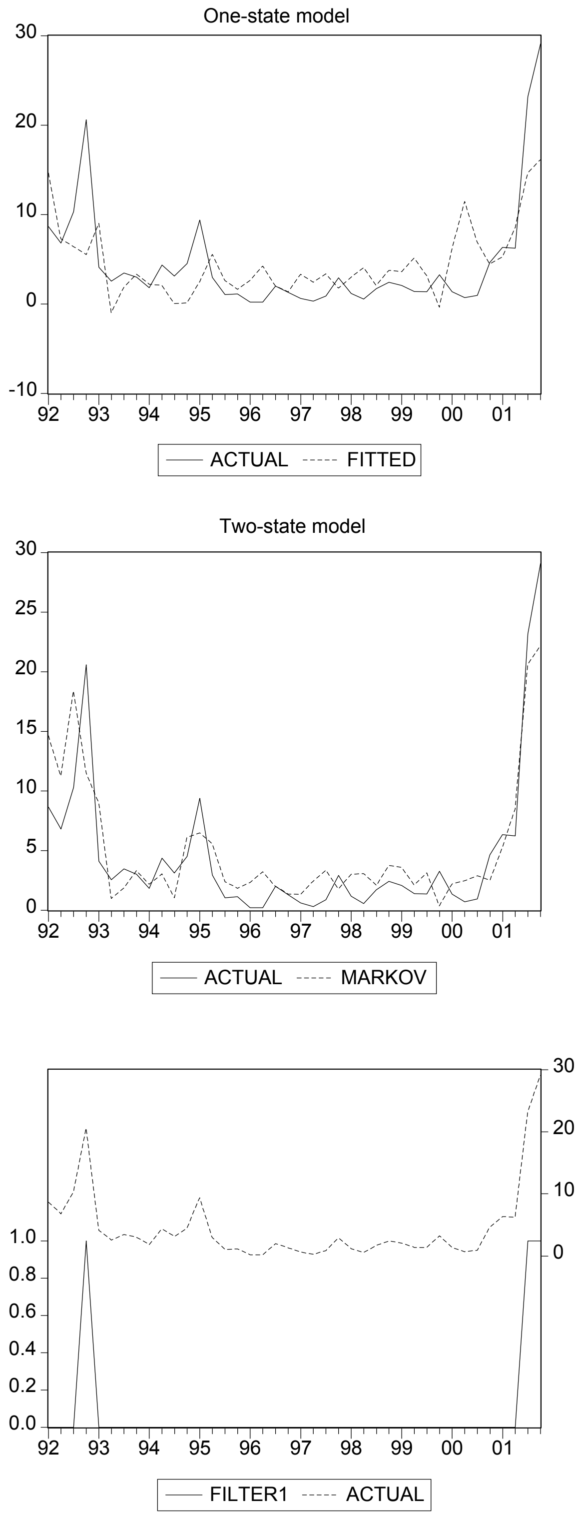
One-state model
ACTUAL
FITTED
Two-state model
ACTUAL
MARKOV
FILTER1
ACTUAL

Figure 1