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MONEY-PRICE RELATIONSHIPS UNDER A CURRENCY BOARD SYSTEM: THE CASE OF ARGENTINA

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The relationship between money and prices, and the endogenous money hypothesis, is examined within the framework of a currency board-like system by using monthly data for the Argentinean economy in the period 1991-2001. Employing exogeneity tests, the empirical findings support the endogenous money hypothesis for the relationship between monetary variables (M1, M2, monetary base) and the producer price index, but reject it when the consumer price index is used instead as price variable.

JEL classification codes: C12, C22, E51, E58
Key words: currency board, Argentina, money supply endogeneity, exogeneity test

I. Introduction

The currency board system is a particular type of fixed exchange rate regime. In this system, money supply becomes endogenous when the national currency is convertible and the central bank doesn't make sterilizing interventions in the economy. Hence, money supply is determined by the supply-demand conditions in the foreign currency market (Hanke 2005). It is generally accepted in the literature that money supply also is endogenous under fixed exchange rate regimes. For example, according to the Mundell-Fleming model and the monetary approach to the balance of payments, money supply is endogenous under fixed exchange rate

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regimes (Mundell 1968, Bilson 1978). Similarly, the price-specie flow mechanism also endogenizes money supply (Cesarano 1998). In this perspective, in an orthodox currency board the mechanism of money supply is similar to the price-specie flow mechanism of the gold standard. Thus, the first difference between fixed and flexible exchange rate regimes is that in a fixed exchange rate regime monetary policy is passive and money supply is determined by money demand. The second difference is caused by the adjustment mechanisms as indicated by Friedman (1953). Under a flexible exchange rate regime, the change in the exchange rate (a single price) achieves full adjustment; whereas under a fixed exchange rate regime changes in both the money supply and the price level (which reflects prices of all types of goods and services) are required for adjustment.

The quantity theory of money is typically used as a starting point for analyzing the long-term relationship between the money stock and prices. Central to most thinking about monetary theory and monetary policy is some version of the quantity theory. According to monetarists, the money multiplier is stable. As a result, the central bank can control the money supply by controlling the monetary base. Since both the monetary base and the money supply are exogenous, the reason for increases in general price levels is increases in money supply. Therefore, inflation is always and everywhere a monetary phenomenon. In the analysis of post-Keynesian economists who claim that inflation is not a monetary phenomenon, two issues are fundamental. The first is the price setter behaviour of economic units in goods and labour markets. The second is the role that commercial and central banks play in meeting the credit demands of economic units. These two issues reverse the causal relationship between monetary aggregates and general price levels. Not only the money supply, but also the monetary base becomes endogenous (Moore 1988).

Which is endogenous, the money supply or the general level of prices, is an open debate in the literature. Many studies investigate the relationship between monetary aggregates and general level of prices in accordance with the quantity theory, such as Beltas and Jones (1993) for Algeria, Pradhan and Subramanian (1998) for India, Sun and Ma (2004) for China, and Pinga and Nelson (2001) for twenty-six countries. Other studies investigate this relationship within the framework of post-Keynesian money theory, for example Vymyatnina (2006) for Russia. There are few studies which empirically investigate the endogenous money hypothesis for Argentina. Ahumada (1992), in the highly inflationary environment of Argentina in the 1977–1988 period, shows that prices are weakly and super exogenous for monetary variables, therefore a constant money-demand equation inverted for inflation or interest rate may be nonconstant. Ahumada (1995) finds that inflation is weakly exogenous for narrow money aggregates. Basco, D'Amato, and Garegnani (2009) examine the regime dependence of the money-price relationship in Argentina using monthly data for the 1977-2006 period. They find that proportionality holds for the high inflation period but weakens once inflation lowers. Although this relationship weakens under low inflation, money continues to play a role in explaining inflation dynamics in Argentina.

This study analyzes the relationship between monetary aggregates – the monetary base, M1 and M2 – and general price levels – the producer price index (PPI) and the consumer price index (CPI) – during the Argentinean Currency Board. This paper aims to contribute to the literature in the following ways. First, the exogenous or endogenous nature of money supply is analyzed empirically for the first time for a country that implements a Currency Board system. Second, the Argentinean Currency Board has significant differences with the Currency Boards of Hong-Kong (1983), Estonia (1992), Lithuania (1994), Bulgaria (1997), and Bosnia Herzegovina (1997), which still continue. The Argentinean Currency Board started in April 1991 and ended in December 2001. The data set regarding the Argentinean Currency Board contains information about the transition to this system, how it worked, and how it ended. The Argentinean Currency Board has become a historical example for Currency Board discussions. Third, while the endogenous nature of the money supply in an orthodox Currency Board is emphasized theoretically, none of the modern Currency Board has the characteristics of an orthodox Currency Board (Salater 2004). One third of the assets of the Argentinean central bank (BCRA) consisted of domestic assets and the BCRA made sterilizing interventions (Hanke 2002). For this reason, the Argentinean Currency Board is not an orthodox Currency Board. Rather, it is a Currency Board-like system. Considered in this light, an answer is sought to the question: "Does the money supply become endogenous in a Currency Board-like system in which the currency is convertible and the central bank makes sterilizing interventions?" According to Hanke (2008) "unlike floating and fixed rates, pegged rates invariably result in conflicts between monetary and exchange rate policies. For example, when capital inflows become "excessive" under a pegged system, a central bank often attempts to sterilize the ensuing increase in the foreign component of the monetary base by selling bonds, reducing the domestic component of the base. And when outflows become excessive, a central bank attempts to offset the decrease in the foreign component of the base by buying bonds, increasing the domestic component of the monetary base". In this perspective provided by Hanke (2008), the Argentinean Currency board system is a pegged exchange rate system.

The concept of exogeneity has been an important research area in econometrics. Engle, Hendry, and Richard (1983) consider three definitions of exogeneity: weak, strong, and super exogeneity. Granger causality through the error correction term can be used as a test for weak exogeneity, since it shows how the short-run coefficients of the variables adjust towards their long-run equilibrium values (Engle and Granger 1987). Hall and Milne (1994) argue that tests of weak exogeneity in a cointegrated system are equivalent to the notion of long run causality. Unlike weak exogeneity, Granger causality does not involve the parameters of interest and, hence, is not related to their estimation. Indeed, Granger non-causality is neither necessary nor sufficient for weak exogeneity. Granger non-causality in combination with weak exogeneity, however, defines strong exogeneity (Ericsson et al. 1998).

Existing causality studies do not make a clear distinction between exogeneity and causality. Thus, the presence of a causal relationship from prices to money, in a Granger sense, is neither a necessary nor a sufficient condition for testing the endogenous money hypothesis. This paper analyses the relationship between money and prices during the period of the Currency Board system in Argentina, from 1991 to 2001, by using the concept of weak exogeneity as defined in Engle, Hendry, and Richard (1983) and the econometric methodology described in Johansen and Juselius (1990 and 1992).

The plan of the paper is as follows. Section II discusses the econometric methodology to test the endogenous money supply hypothesis. Section III reviews the data. Section IV presents the test results and some concluding remarks are given in Section V.

II. Econometric methodology

Engle, Hendry, and Richard (1983) consider three definitions of exogeneity: weak, strong, and super exogeneity. The joint distribution of m_t and p_t can be written as

$$f(m_t, p_t) = f(m_t \mid p_t) f(p_t), \tag{1}$$

where $f(m_t \mid p_t)$ is the conditional distribution of m_t given p_t and $f(p_t)$ is the marginal distribution of p_t. According to Engle, Hendry, and Richard, a variable p_t is said to be weakly exogenous for estimating a vector of parameter of interest, λ, if inference on λ conditional on p_t involves no loss of information. If the conditional distribution $f(m_t \mid p_t)$ involves the parameter λ, weak exogeneity implies that the marginal density $f(p_t)$ does not include the parameter λ. In other words, if there are no cross-restrictions between the parameters of the marginal and conditional distributions, p_t is weakly endogenous. Weak exogeneity is a necessary condition to have strong and super exogeneity. In addition, each of them requires an extra condition. Strong exogeneity requires that m_t does not Granger cause p_t, super exogeneity that λ is invariant to changes in the marginal distribution of p_t.

A weak exogeneity test is conducted by being used the framework proposed in Johansen and Juselius (1992). In a VAR model explaining two variables p_t and m_t, there can be at most one cointegrating vector. If there is one cointegrating vector, we estimate the following system by using the lagged residuals from the cointegrating vector.

$$\Delta m_t = \alpha_1(m_{t-1} - \beta_0 - \beta_1 p_{t-1}) + f(\Delta m_{t-i}, \Delta p_{t-i}) + \varepsilon_{1t},, \tag{2}$$

$$\Delta p_t = \alpha_2(m_{t-1} - \beta_0 - \beta_1 p_{t-1}) + f(\Delta m_{t-i}, \Delta p_{t-i}) + \varepsilon_{2t}, \tag{3}$$

where Δ is the first order difference operator. If α_1 is nonzero and α_2 is zero in the above system, it can be concluded that m_t does not contribute to the explanation of the parameters of the equation for p_t. Therefore p_t can be treated as an exogenous variable since m_t does not affect its value. Following Johansen and Juselius (1992), tests for weak exogeneity in a cointegrated system exclusively focus on the error correction coefficients in equations (2) and (3). The price level will be weakly exogenous in the money supply equation, when the error correction coefficient is significantly different from zero in equation (2), but insignificantly different from zero in equation (3): $\alpha_1 \neq 0,\ \alpha_2 = 0$.. This is known as the weak exogeneity test. If p_t is weakly exogenous and there is Granger non-causality from m_t to p_t, then p_t is said to be strongly exogenous.

If p_t is weakly exogenous, the above system can be transformed as follows:

$$\Delta m_t = \alpha_1(m_{t-1} - \beta_0 - \beta_1 p_{t-1}) + f(\Delta m_{t-i}, \Delta p_{t-i}) + \varepsilon_{1t} \,, \tag{4}$$

$$\Delta p_t = f(\Delta m_{t-i}, \Delta p_{t-i}) + \varepsilon_{2t} \,. \tag{5}$$

Equation (4) is the conditional process of m_t given p_t , equation (5) is the marginal process for p_t. If there is a structural break in the conditional model, it should correspond to a structural break in the marginal model. If there are some structural breaks, it means that the parameters of the processes are not constant within the sample. If the structural breaks for the conditional and marginal processes coincide in time, it is likely that the structural break in the conditional model has been caused by variability in the parameters of the marginal model. If this is the case, the hypothesis of structural invariance (hypothesis of super exogeneity) can be rejected (Charemza and Deadman 2003: 239). Both the marginal process for p_t and the conditional process are re-estimated by recursive least squares and the one-step recursive residuals for each process are calculated. If the structural breaks in the residuals of marginal process do not coincide with breaks in the conditional process, p_t is accepted as super exogenous in this model.

III. Data

The principal purpose of the analysis is to test the endogenous money hypothesis by using monthly Argentina data under the Currency Board system from April 1991 to December 2001. We use two alternative aggregate price variables – the PPI and the CPI – and three different measures of money – M1, M2, and the monetary base MB. The variables are *LPPI* (log of producer price index, 1995=100), *LCPI* (log of consumer price index, 1995=100), *LM1* (log of M1, in millions of pesos), *LM2* (log of M2, in millions of pesos), and *LMB* (log of monetary base, in millions of pesos).

The data set is obtained from the *International Financial Statistics* CD-ROM produced by the IMF. Figure 1 and 2 show time plots of monetary aggregate and price indexes over the sample period. The monetary aggregates and price indexes appear to have an upward trend with a non-deterministic structure. Moreover, all variables include structural breaks in 1995 and/or 2001.

Figure 1. Graphic representation of monetary aggregates

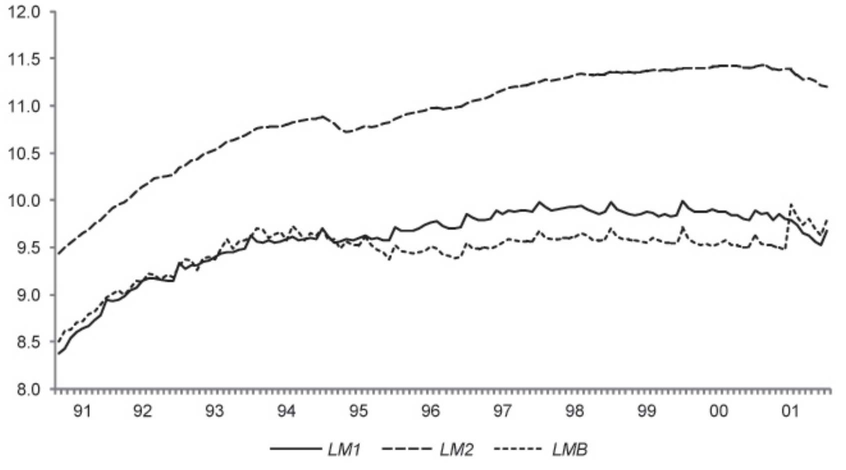
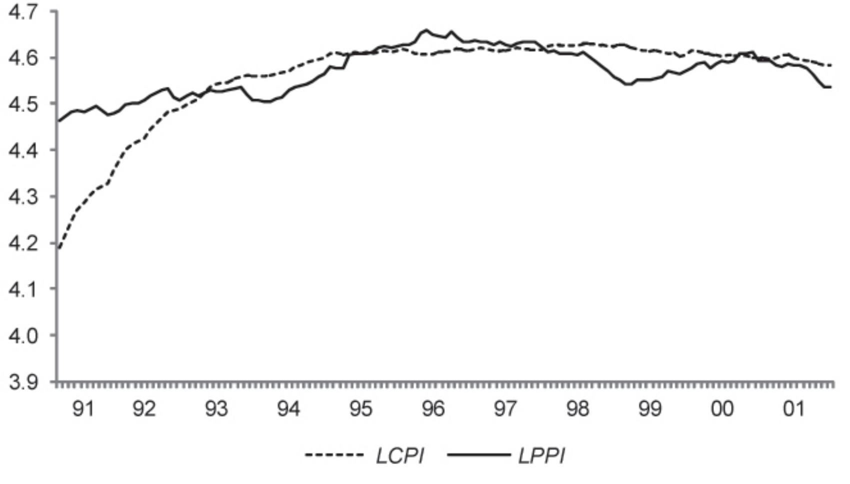


Figure 2. Graphic representation of price indexes



IV. Empirical results

In the first step, all the series are tested for unit roots. Perron (1989) shows that the power of the Augmented Dickey Fuller (1981, ADF) unit root test is reduced in the presence of a structural break. To solve this problem, Perron (1989) proposes including dummy variables that allow for one known, or exogenous, structural break. Zivot-Andrews (1992), Perron (1997), and others propose unit root tests that allow for a structural break to be determined endogenously from the data. We use the Perron (1997) test because of structural breaks in our series. Perron (1989) defines three types of models for a one-time break in the trend function. Model A allows for a one-time change in the intercept of the trend function. It is known as the "Crash Model". Model B allows only a change in the slope of the trend function at the time of the break. Model C includes a one-time change in both level and trend. As suggested in Figure 1 and Figure 2, there is only a change in the slope of the trend function after 1998 for *LM1* and after 1993 for *LCPI*. There is a change in both level and trend for the other series. Therefore, we use Model B for *LM1* and *LCPI*, and Model C is used for the other series. The results for the Perron (1997) unit root test are reported in Table 1. The unit root null hypothesis cannot be rejected at the 5% significance level. These results indicate that all series are difference-stationary processes.

Table 1. The results of the Perron (1997) unit root test

Series	Estimated break point	Model	Lag	t-statistic	Methods	Critical value at 5%
LPPI	1995:02	C	1	-3.3266	Min t_{α}	-5.08
	1995:01	C	3	-3.0474	Max $t_{\hat{\alpha},\hat{\theta}}$	-4.91
LCPI	2000:07	B	6	-2.4191	Min t_{α}	-4.36
	1993:10	B	6	-2.3682	Max $t_{\hat{\alpha},\hat{\theta}}$	-4.34
LM1	1998:02	B	6	-3.1267	Min t_{α}	-4.36
	1998:12	B	6	-2.0205	Max $t_{\hat{\alpha},\hat{\theta}}$	-4.34
LM2	2000:07	C	1	-3.3887	Min t_{α}	-5.08
	1995:03	C	0	-3.6086	Max $t_{\hat{\alpha},\hat{\theta}}$	-4.91
LMB	2001:03	C	5	-4.3088	Min t_{α}	-5.08
	2001:04	C	6	-4.2700	Max $t_{\hat{\alpha},\hat{\theta}}$	-4.91

Note: The appropriate lag length is determined through general to specific testing which is suggested by Perron (1989).

Table 2. Johansen's cointegration tests

Variables included in VAR	Number of cointegrating relations	Trace statistic	Max-eigenvalue statistic
Model 1	None	39. 90	37.10
LPPI, LM1		(0.0000)	(0.0000)
	At most 1	2.80	2.80
		(0.6189)	(0.6179)
Model 2	None	32.26	30.20
LPPI, LM2		(0.0006)	(0.0002)
	At most 1	2.06	2.06
		(0.7658)	(0.7658)
Model 3	None	21.61	19.37
LPPI, LMB		(0.0325)	(0.0136)
	At most 1	2.23	2.23
		(0.7308)	(0.7308)
Model 4	None	64.18	58.30
LCPI, LM1		(0.0000)	(0.0000)
	At most 1	5.88	5.88
		(0.2001)	(0.2001)
Model 5	None	52.40	44.75
LCPI, LM2		(0.0000)	(0.0000)
	At most 1	7.65	7.65
		(0.0961)	(0.0961)
Model 6	None	21.24	17.47
LCPI, LMB		(0.0366)	(0.0280)
	At most 1	3.76	3.76
		(0.4482)	(0.4482)

Note: Values in parentheses are MacKinnon-Haug-Michelis (1999) p-values. Maximum lag length is selected as 12. The order of models 1, 2, 4 and 5 is estimated as 2 using the Schwarz and Hannan-Quinn information criteria. For models 3 and 6, the two selection criteria determined different lag orders. The modified Wald test developed by Toda and Yamamoto (1995) was performed to eliminate lags, and the appropriate lag length for models 3 and 6 is estimated as 2 and 7, respectively.

The next step is to perform the cointegration test between money (*LM1*, *LM2* or *LMB*) and prices (*LPPI*, *LCPI*). Since the trace statistic and the maximum eigenvalue statistic may yield conflicting results, we use both the trace and maximum eigenvalue type cointegration tests of Johansen and Juselius (1990). The determination of the cointegrating rank in a VAR requires the investigator to perform a sequence of cointegration tests. As shown in Johansen (1992), this type of procedure assumes that the correct lag length of the VAR process is known. Thus, the asymptotic theory for the determination of cointegration rank is valid when the true lag order is a priori known. It is well known that the results of cointegration tests using this technique depend on the deterministic components included in the VAR and on the chosen lag length. The appropriate lag length is selected by using two types of information criteria, Schwarz and Hannan-Quinn. When the two selection criteria determine different lag orders, the modified Wald test, developed by Toda and Yamamoto (1995), is performed to eliminate lags from a general to a more specific model. In order to estimate the number of cointegrating equations, we suppose there is no deterministic trend in the data, and an intercept but no trend in the cointegrating equation since all series are difference-stationary processes. The results of the cointegration tests are presented in Table 2. The trace and maximum eigenvalue test statistics indicate that there is one cointegrating equation at the 5% significance level for the bivariate models.

Table 3 shows the results of the weak exogeneity tests for the cointegrating vector when the cointegrating rank is one. The Likelihood Ratio (LR) test statistics for zero restrictions on the adjustment coefficients show that the error correction coefficient enters significantly in the money equation, but insignificantly in the price equation when PPI is the price variable. Hence, PPI is weakly exogenous for the parameters of interest in the conditional models for money variables. This evidence implies that money does not Granger cause the PPI in the long-run, but the PPI causes money. When the CPI is used as the price variable, M1 and M2 are not weakly exogenous for prices and vice versa. The error correction coefficients are statistically significant both in the money and price equations of the vector error correction model. This indicates that there is bi-directional causality between money and CPI in the long run when M1 and M2 are taken into account as the monetary aggregate. When MB is considered, CPI is not weakly exogenous for money, but MB is. All findings from the weak exogeneity tests for the relationship between PPI and money variables support the endogenous money hypothesis. However, when CPI is taken into account as the price variable, the endogenous money hypothesis is rejected.

Table 3. Weak exogeneity results

Y_t	X_t	Test statistic (Chi-square)	P-value
LPPI	*LM1*	0.06	0.7957
LM1	*LPPI*	34.30*	0.0000
LPPI	*LM2*	1.24	0.2660
LM2	*LPPI*	27.25*	0.0000
LPPI	*LMB*	1.41	0.2354
LMB	*LPPI*	15.31*	0.0001
LCPI	*LM1*	26.42*	0.0000
LM1	*LCPI*	32.60*	0.0000
LCPI	*LM2*	23.11*	0.0000
LM2	*LCPI*	14.61*	0.0001
LCPI	*LMB*	11.50*	0.0007
LMB	*LCPI*	1.24	0.2638

Note: Null hypothesis: Y_t is weakly exogenous for the parameter of interest of the X_t conditional model. * Statistically significant at the 1% level.

Next, the Granger causality test based on the vector error correction models is conducted to check for the existence (or absence) of a causal relationship between money and prices. The existence of a cointegrating relationship among variables suggests that there must be Granger causality in at least one direction, but it does not indicate the direction of short run (temporal) causality between the variables (Granger 1988). Hence, in the presence of cointegration, the Granger noncausality hypothesis must be tested within the error correction model to examine the short- and the long-run Granger causality. Such tests are carried out on stationary time series to guarantee that inferences made from the tests are valid (Engle and Granger 1987). The definitions developed by Engle, Hendry, and Richard (1983) can be used to determine whether a variable is strongly exogenous (Charemza and Deadman 2003). Therefore, if a variable is weakly exogenous through the error correction term and the lagged values are also jointly significant, then the variable is said to be strongly exogenous.

Recalling the exogeneity concepts discussed earlier, weak exogeneity is a necessary condition for strong and super exogeneity. The investigation of strong and super exogeneity is not conducted for the CPI because it is not weakly exogenous for monetary variables. However, the LR test shows that PPI is weakly exogenous for the parameters of interest in the conditional models for monetary variables. This implies that money does not Granger cause prices in the long-run, but not vice versa. In addition, if the coefficients of lagged money variables in the PPI equation of the vector error correction model are not significantly different from zero, money variables do not Granger cause PPI in the short-run. The results in Table 4 indicate that money variables do not Granger-cause PPI in the short run at the conventional level of significance. At 5%, however, price precedes both M1 and M2. Therefore, we conclude that the price variable is strongly exogenous.

Table 4. VEC Granger causality results

Y_t	X_t	Test statistic (Chi-square)	P-value
Δ *LPPI*	Δ *LM1*	9.91*	0.0016
Δ *LM1*	Δ *LPPI*	1.44	0.2301
Δ *LPPI*	Δ *LM2*	4.92	0.0266
Δ *LM2*	Δ *LPPI*	0.00008	0.9929
Δ *LPPI*	Δ *LMB*	0.35	0.5517
Δ *LMB*	Δ *LPPI*	0.14	0.7055

Note: Null hypothesis Y_t does not Granger Cause X_t. *Statistically significant at the 1% level ; Δ is the first order difference operator.

According to our empirical results obtained from the weak and strong exogeneity tests, the conditional processes for money ($(\Delta LM1, \Delta LM2,$ and $\Delta LMB)$) and the marginal process for $\Delta LPPI$ can be written as follows:

$$\Delta m_t = \alpha_1(m_{t-1} - \beta_0 - \beta_1 p_{t-1}) + \gamma_1 \Delta m_{t-1} + \gamma_2 \Delta p_{t-1} + \varepsilon_{1t}, \quad (6)$$

$$\Delta p_t = \tilde{\gamma}_1 \Delta p_{t-1} + \varepsilon_{2t}, \quad (7)$$

where m_t and p_t stand for the log of the monetary variables and of the producer price index, respectively. The results of the vector error correction model are presented in Table 5. The diagnostic tests show that the residuals are heteroskedastic but not serially correlated. The tests for normality indicate that residuals are normally distributed in the VECM for M2, but not in the other VECMs. These results indicate that there is no misspecification for the VECM because residuals are non-autocorrelated. There is heteroskedasticity and non-normality of residuals. The homoskedasticity and normality assumptions might be rejected due to the effect of outliers. The Johansen method performs better than other estimation methods when the errors are nonnormally distributed, or when the dynamics are unknown, and the model is overparametrized by including additional lags in the error correction model (Gonzalo 1994).

The error correction coefficients in the money equations are statistically significant, confirming a long-run equilibrium relationship between money and prices. In addition, all the error correction coefficients in the money equations have a minus sign indicating an adjustment process of the short run disequilibrium in the cointegration system towards the long run equilibrium. When we examine the results of our cointegrating equation, we see that the PPI has the expected signs, but they are not statistically significant except for M1.

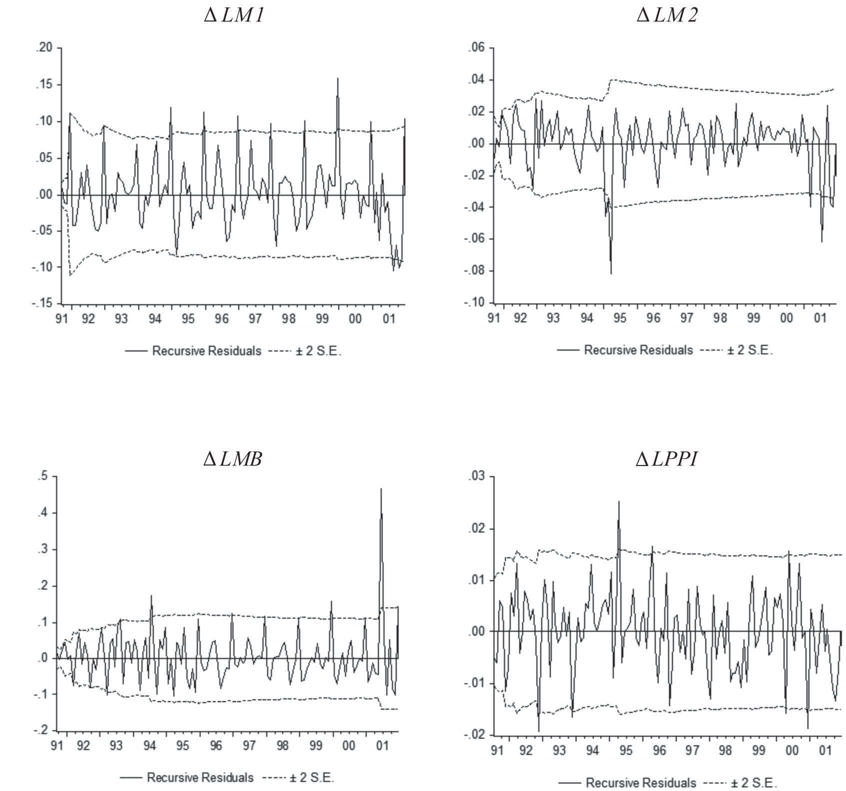
Both the marginal process for inflation (based on PPI) and the conditional processes (β_0 and β_1, normalized cointegrating coefficients, were estimated) were re-estimated by recursive least square and the one-step recursive residuals for each process were calculated. Figure 3 is the graph of these residuals. If the structural breaks in the marginal process do not coincide with breaks in the conditional models for $\Delta LM1_t, \Delta LM2_t,$ and ΔLMB_t, $\Delta LPPI_t$, is said to be super exogenous. The structural breaks of the conditional models appear at almost the same dates as the breaks in the marginal process. Therefore, we can say that $\Delta \mathrm{PPI_t}$ is not super exogenous in the conditional models with respect to the graphs of one-step recursive residuals.

Table 5. VECM results

	LM1	*LPPI*	Intercept
Normalized cointegrating coefficients	1.0000	-1.9571 (-2.2093)*	-0.8488 (-0.2095)
	Δ*LM1*	Δ*LPPI*	
Adjustment coefficients	-0.09338 (-7.2503)*	0.0000 (NA)	
Residual diagnostic test	Test	Test statistic	P-value
Normality test	Doornik-Hansen	32.42	0.0000
Serial correlation	Breusch-Godfrey	8.64	0.0708
Hetoroskedasticity	White	36.83	0.0455
	LM2	*LPPI*	Intercept
Normalized cointegrating coefficients	1.0000	-1.8426 (-1.1657)	-6.4918 (-1.5206)
	Δ*LM2*	Δ*LPPI*	
Adjustment coefficients	-0.03013 (-9.9797)*	0.0000 (NA)	
Residual diagnostic test	Test	Test statistic	P-value
Normality test	Doornik-Hansen	3.73	0.4427
Serial correlation	Breusch-Godfrey	6.18	0.1857
Hetoroskedasticity	White	45.26	0.0054
	LMB	*LPPI*	Intercept
Normalized cointegrating coefficients	1.0000	-0.2431 (-0.2309)	-8.4221 (-1.7287)
	Δ*LMB*	Δ*LPPI*	
Adjustment coefficients	-0.1179 (-4.6029)*	0.0000 (NA)	
Residual diagnostic test	Test	Test statistic	P-value
Normality test	Doornik-Hansen	35.94	0.0000
Serial correlation	Breusch-Godfrey	6.78	0.1479
Hetoroskedasticity	White	59.75	0.0001

Note: Values in parentheses are t-statistics. The vector error correction model includes two dummy variables for structural changes. These dummy variables are defined as following: *D95* = 1 between January and April 1995, *D95* = 0 otherwise; *D01* = 1 between March and December 2001, *D01* = 0 otherwise. * Statistically significant at the 5% level.

Figure 3. Recursive residuals



V. Conclusion

The currency regime which was applied during the April 1991–December 2001 period in Argentina can be called a currency board-like system. In a currency board regime, monetary aggregates are directly affected by foreign currency flows. However, the Argentine currency board system was in fact a currency board-like system, where the central bank can additionally create money by buying government bonds.

The endogenous nature of Argentina's money supply for the 1991-2001 period, when the currency board system was implemented, is tested by formal exogeneity tests under a framework proposed by Engle, Hendry, and Richard (1983). We use three monetary aggregates and two price indicators, the PPI and the CPI. The PPI has more tradable goods than the CPI, so it is most directly affected by the exchange rate, and consequently by the exchange rate regime. This price index is employed as a first indicator of the general price level to investigate the money price relationship. The CPI, on the other hand, is more likely affected by the domestic money market, as this index includes more non-tradable goods. The additional money creation behaviour of the central bank can affect the price determination mechanism of the non-tradable goods. The theoretical arguments about the price-money supply relationship indicate that money supply should be endogenous under a fixed exchange rate regime. The empirical results of the exogeneity tests indicate that monetary base, and the measures of money supply M1 and M2, are endogenous with respect to the PPI but not to the CPI.

The evidence on the relationship between the PPI and monetary variables (M1, M2, monetary base) support the claim that an attempt of a central bank in a currency board-like system to implement an active policy by controlling monetary aggregates does not yield effective results. The monetary aggregates cannot be used as a policy tool in an economy where the money supply has become endogenous. However, our evidence is mixed, because the results obtained about the relationship between the CPI and monetary variables do not support this claim. Perhaps this is due to the fact that the Argentinean currency board was not an orthodox currency board. In this context, we may argue that in a regime similar to a currency board, policy makers should pay attention to the causality relationship between the CPI and the money supply. If money supply is exogenous for the CPI, this might affect the sustainability of the currency board.

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