E C O N O M I C S   B U L L E T I N

Is Mercosur an optimum currency area? An assessment using generalized purchasing power parity

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Abstract

We consider the cointegration approach of generalized purchasing power parity to show that a necessary condition for Mercosur to be an optimum currency area is met. Yet there are still large cross-country differences as to cast doubt on the success of either monetary union or official dollarization. The PPP puzzle is also found to occur in Mercosur.

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1. Introduction

In an optimum currency area (Mundell 1961) efficiency is maximized if the area shares a single currency. One rationale behind the creation of the euro, for instance, is that the individual countries of Europe do not each form an optimum currency area but Europe as a whole does. Even if the fundamental economic variables determining real exchange rates are nonstationary (Da Silva 2002) and accordingly the rates are nonstationary, the fundamentals can still be sufficiently integrated as in a currency area. Here the real rates will share common trends (Enders and Hurn 1994). The existence of at least one cointegration vector in a set of national economies' nonstationary series suggests both an optimum currency area and generalized purchasing power parity (G-PPP). One purpose of this paper is to evaluate whether Mercosur (the South American trade group) is an optimum currency area in that sense.

The idea of G-PPP was pioneered by Enders and Hurn (1994), who apply it to Pacific Rim countries. G-PPP was rejected and the Pacific Rim nations were found not to constitute an optimum currency area. Enders and Hurn (1997) also tested G-PPP to the G7 countries. They found one cointegration vector at the 5 percent significance level, which means that those countries' real exchange rates seem to be linked by a single long run equilibrium relationship, and a shock to any one rate is likely to affect the long run values of the others. Liang (1999) found that G-PPP holds for China, Hong Kong, Japan, and the United States, and then that those countries constitute an optimum currency area. Bernstein (2000) tested G-PPP for the euro area and found that the null of noncointegration cannot be rejected. Lee (2003) found that Australia, New Zealand, and Japan comprise an optimum currency area, but this is not true of Australia, New Zealand, and the USA. And the East Asia countries were found not to constitute an optimum currency area (Choudhry 2005, Ahn *et al.* 2006, Kawasaki and Ogawa 2006).

Previous work on Mercosur roughly suggests that it is still a mirage. Hallwood *et al.* (2006) examined the case for either Latin American monetary union (Argentina, Brazil, Chile, Uruguay, and Venezuela) or monetary union with the USA through official dollarization. Using VAR techniques they found that macroeconomic shocks are so highly asymmetric in Latin America and between the Latin American countries and the USA as to make monetary union or official dollarization questionable. We will replicate this finding below. It contrasts with Fratianni (2004) and Alexander and Von Furstenberg (2000), who argued that the Mercosur members are suited to creating a common currency (though not to adopting the US dollar). Of course, one cannot neglect the hypothesis that an optimum currency area may be endogenous (Frankel and Rose 1998) in the sense that there can be a positive association between trade intensity and business cycle correlation. But empirical evidence suggests that this is unlikely for Mercosur (Hallwood *et al.* 2006, Ahumada and Martirena-Mantel 2001, Licandro-Ferrando 2000). Intraregional trade in Mercosur is still modest, thanks mainly to the low openness of the Argentine and Brazilian economies (Machinea 2004). The Brazilian economy can be considered more relatively diversified than Argentina's (Barenboim 2004) and, as a result, less prone to large asymmetries of shocks (Kenen 1969, Calderon *et al.* 2007). But increasing intra-Mercosur trade is unlikely to make it more suitable for monetary union because the macroeconomic shocks between the countries and between them and the USA do not become more symmetric as time goes by (Hallwood *et al.* 2006). This contrasts with the experience of the European countries (Bayoumi and Eichengreen 1994).

The issue of the usefulness of monetary union for the Mercosur countries has also been addressed in a number of other papers (e.g. Busse *et al.* 2006, Camarero *et al.*

2006, Berg *et al.* 2002, Hochreiter *et al.* 2002, Corbo 2001, Salvatore 2001), but usage of the G-PPP approach is novel. Our contribution in this paper is thus to show that although a necessary condition for Mercosur to be an optimum currency area is met, there are still large cross-country differences as to cast doubt on the success of either monetary union or official dollarization. Here we abstain from any discussion of the policy implications of our findings, and confine ourselves to make our case in a rather technical way. However, our results can still be contextualized in the debate by considering the above references.

The rest of this paper is organized as follows. Section 2 presents data. Section 3 analyzes the data. And Section 4 concludes.

2. Data

We considered quarterly data from 1973Q3 to 2006Q3 for the Mercosur's full members (Argentina (ARG), Brazil (BRA), Paraguay (PAR), Uruguay (URU)), the applicant Venezuela (VEN) as well as the USA, considered as the benchmark country. We also used data for Bolivia (BOL) and Chile (CHI) in the stationarity tests. The series of consumer price index (CPI) and average dollar price of the currencies were taken from the IMF's International Financial Statistics. Yet our results could be replicated for wholesale price indices rather than CPIs (available upon request).

The series of real exchange rates were built according to the formula $r_{i,t} = \ln \frac{E_{i,t} \times \mathrm{CPI}_t^*}{\mathrm{CPI}_{i,t}} = e_{i,t} + p_t^* - p_{i,t}$, where $r_{i,t}$ is the natural log of the real exchange rate in country i at time period t, $e_{i,t}$ is the natural log of the nominal exchange rate in country i, $p_{i,t}$ is country i's natural log of the CPI, and p_t^* is the natural log of the US CPI. Figure 1 displays the real exchange rates. A first look suggests that the Mercosur rates are nonstationary. This will be confirmed by the unit root tests below.

3. Analysis

Table 1 presents results of the unit roots tests of Dickey-Pantula (DP) (1987), augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Elliott-Rothenberg-Stock (ERS) (1996). The DP tests suggested that the series do not present two or more unit roots. The ERS tests are more appropriate for slow adjustment processes, and thus were performed for the cases where the autoregressive parameter in the ADF tests fell above 0.9. The ADF and PP tests suggested rejection of the null of unit root for Bolivia and Chile at the significance level of one percent. However, the tests did not provide evidence of rejection (at one percent) of the null for the Mercosur countries. Thus Bolivia and Chile could be left out from the subsequent cointegration analysis.

Because the series present structural breaks, we also performed Lee-Strazicich (2003, 2004) minimum Lagrange multiplier unit root tests, which allow for one and two endogenous breaks under both the null and alternative hypotheses. The series' volatility made it hard for us to tell whether the breaks occurred in either intercept or trend. So we considered two cases, namely (1) a crash model where the breaks occur in the intercept, and (2) a trend model with breaks in both intercept and trend. Apart from Bolivia (one percent significant), the tests did not reject the null (Table 2), thus confirming those in Table 1. We also performed Zivot-Andrews (1992) and Perron (1997) unit root tests with one endogenous break and the result of nonstationarity appeared again (output available upon request). The break dates identified in the Lee-Strazicich tests (Table 2) captured the breaks related to both the oil shock of 1979 and the financial crises of the eighties. Yet we further considered in the cointegration analysis the changes occurred in the countries' monetary regimes (as in Singh *et al.* 2005) (Table 3). And an oil shock dummy was also inserted to track the short run dynamics.

Then we carried out the cointegration analysis allowing for two breaks in the long run relationship (as in Johansen *et al.* 2000). We also considered the traditional Johansen (1988, 1991) full information maximum likelihood approach without breaks. Here, the likelihood ratio test statistics were adjusted by the Cheung-Lai (1993) correction term. We performed the cointegration tests through two types of model, namely (1) a restricted deterministic linear trend (RDLT) model, and (2) a deterministic linear trend (DLT) model. The RDLT model takes only one intercept (or none) in the deterministic linear trend, and the DLT model considers both intercept and trend. Table 4 shows the results of the bivariate cointegration analysis. We rejected the null of noncointegration for Argentina-Uruguay (at one percent), Brazil-Paraguay and Paraguay-Venezuela (at 5 percent), and for Argentina-Venezuela and Paraguay-Uruguay (at 10 percent). Overall the cointegration vector parameters βs were significant. In particular, for Argentina-Uruguay and Paraguay-Uruguay the sum of the βs were not significantly different from zero. This at first suggests leaving the USA out from the potential currency area (see Enders and Hurn 1994).

However, the cointegration vector parameter reflects not only the trade relation but also broader fundamental macro variables tracking the linkages between the countries, such as technology transfers, immigration, and financial resource movements (Enders and Hurn 1994). The more similar the aggregate demand parameters, the smaller the cointegration vector parameter. Tables 5–9 show that all the cointegration vector parameters fell above 0.8 in absolute value (see also Figures 2–6). This means that the countries are very dissimilar, regardless of whether a long run relationship exists. The αs in the tables are the adjustment speed parameters from the short run to the long run. The significant absolute values were lesser than 0.21, which means large deviation persistence. It is necessary from 1.2 to 4 years for the short run deviations to damp out. This finding is consistent with the 'PPP puzzle', i.e. high short run real exchange rate volatility accompanied by slow adjustment process toward the long run path. Whenever the αs were nonsignificant (meaning 'weak exogeneity'), we also performed extra Granger-causality tests to check for 'strong exogeneity', which means that the other country in a relation does not affect the country with the nonsignificant adjustment coefficient. The null of strong exogeneity could not be rejected at one percent in the bivariate relations.

By first considering 'core' Mercosur (without Venezuela), we could reject the null of noncointegration at one percent (Table 10 and Figure 7). The βs were all significant at one percent, and their sum was not nil (10 percent significant). This means that the USA cannot be excluded from the potential currency area. The core Mercosur countries depended on the US fundamentals. Moreover, the aggregate demand parameters revealed cross-country dissimilarities. In particular, the coefficients of adjustment speed for Brazil were nonsignificant, and the null of strong exogeneity could not be rejected. For Argentina, Paraguay, and Uruguay the α-persistence ranged from 1.3 to 3.7 years.

The null of noncointegration could also be rejected for 'full' Mercosur (including Venezuela). Table 11 shows the estimates of the cointegration vector and the adjustment coefficients (see also Figure 8). The βs were all significant and their sum was not nil (5 percent significant). This replicated the former finding that the USA cannot be excluded from the potential currency area. Also, the βs all fell above 0.5 in absolute value, thus reinforcing the finding of cross-country dissimilarities. The estimates of the adjustment speed parameter also presented the PPP puzzle. And Argentina and Venezuela were found to be strongly exogenous to the other Mercosur partners. In short, G-PPP held for Mercosur and then a necessary condition for an optimum currency area was met. Yet we cannot push this result too far and conclude that Mercosur is ready for either a single currency or official dollarization because we also found large dissimilarities between the countries.

4. Conclusion

Mercosur's real exchange rates were found nonstationary, and this allowed us to assess whether G-PPP holds through a cointegration analysis. Our findings suggested that the null of noncointegration could be rejected for Mercosur. But one cannot jump to the conclusion that it constitutes an optimum currency area because the cointegration vector estimates pointed to large cross-country dissimilarities. We also found that Mercosur presents the PPP puzzle.

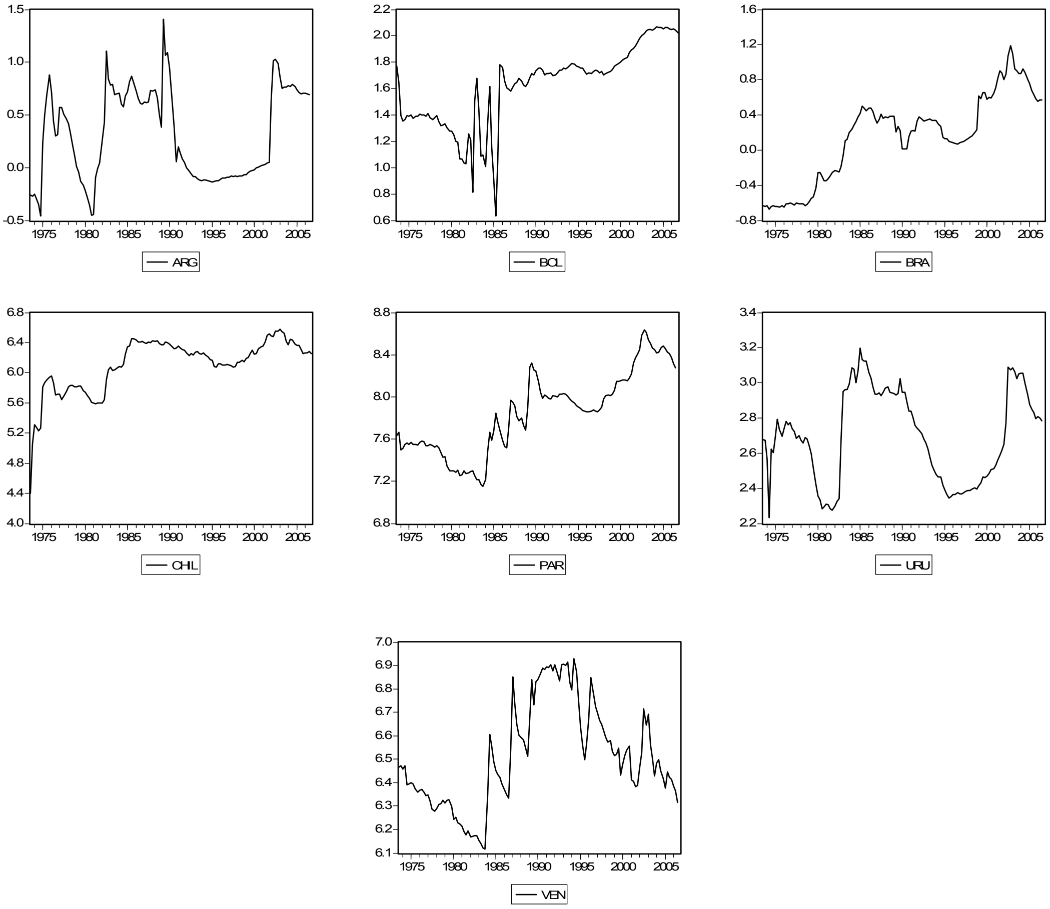

Figure 1. Real exchange rates against the US dollar, 1973Q3−2006Q3

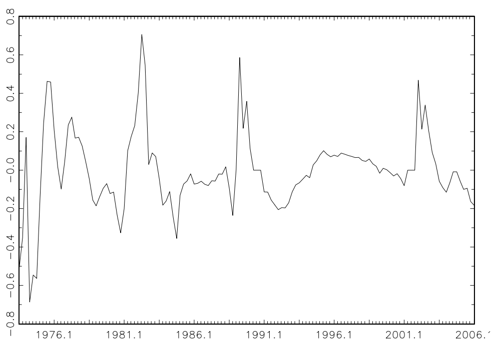

Figure 2. Cointegration relation in the DLT model: Argentina and Uruguay

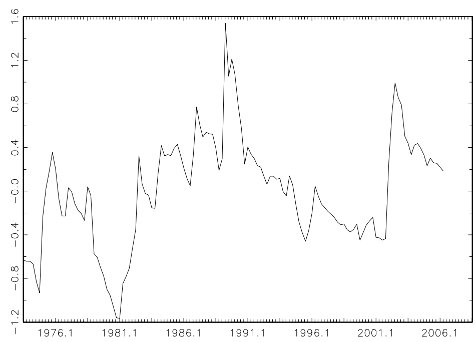

Figure 3. Cointegration relation in the RDLT: Argentina and Venezuela

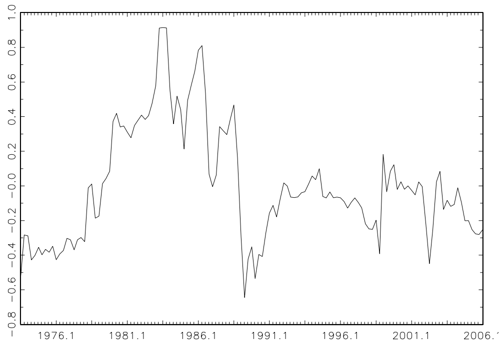

Figure 4. Cointegration relation in the RDLT model: Brazil and Paraguay

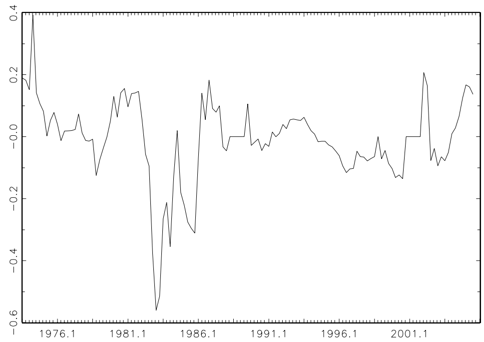

Figure 5. Cointegration relation in the DLT model: Paraguay and Uruguay

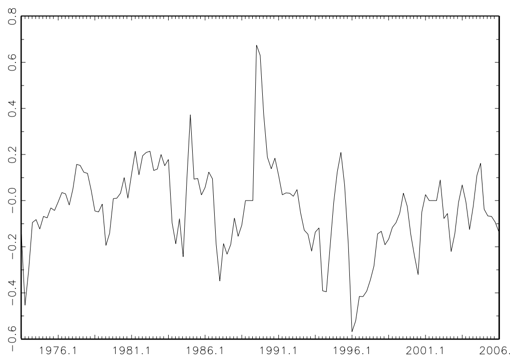

Figure 6. Cointegration relation in the DLT model: Paraguay and Venezuela

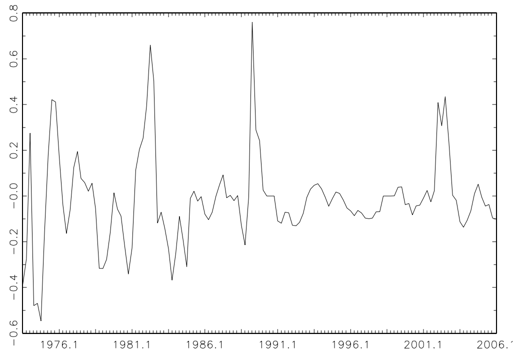

Figure 7. Cointegration relation in the DLT model: core Mercosur

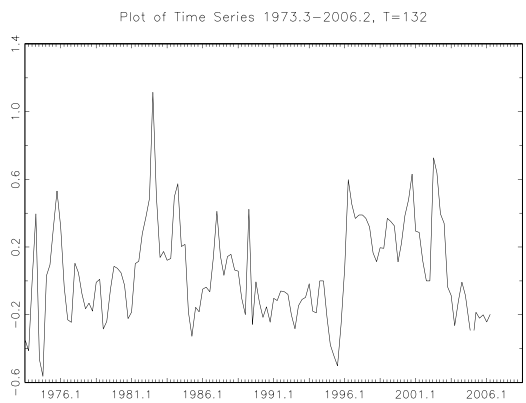

Figure 8. Cointegration relation in the DLT model: full Mercosur

Table 1. Unit root tests

Country	Series with	DP	ADF	PP	ERS
ARG	Intercept	–10.539*	–2.392	–2.646***	–1.446
	Deterministic Linear Trend	–10.539*	–2.380	–2.639	–2.121
BOL	Intercept	–10.452*	–0.705	–3.263**	–0.576
	Deterministic Linear Trend	–10.452*	–3.295***	–4.934*	–
BRA	Intercept	– 8.753*	–1.484	–1.415	–0.170
	Deterministic Linear Trend	– 8.753*	–1.869	–1.672	–1.951
CHI	Intercept	–4.809*	–5.081*	–4.589*	–0.716
	Deterministic Linear Trend	–4.809*	–4.836*	–4.235*	–
PAR	Intercept	–8.490*	–0.975	–1.076	–0.816
	Deterministic Linear Trend	–8.490*	–2.763	–2.798	–1.867
URU	Intercept	–10.305*	–1.742	–2.144	–1.591
	Deterministic Linear Trend	–10.305*	–1.754	–2.154	–1.656
VEN	Intercept	–9.803*	–2.224	–1.600	–2.240**
	Deterministic Linear Trend	–9.803*	–2.244	–1.480	–2.280

* significant at 1%, ** significant at 5%, *** significant at 10%

Table 2. Lee-Strazicich unit root tests

Country	Series with model of	Break Date 1	Break Date 2	*t*-statistic
ARG	Crash	1982Q2*	1990Q1**	-2.808^{NS}
	Trend Break	1990Q1*	2002Q1**	-4.306^{NS}
BOL	Crash	1985Q1*	–	-1.688^{NS}
	Trend Break	1983Q1*	1986Q4*	–6.970*
BRA	Crash	1979Q4**	2002Q2*	-3.090^{NS}
	Trend Break	$1984Q3^{NS}$	1998Q3*	-4.018^{NS}
CHI	Crash	1982Q2*	1999Q4***	-0.592^{NS}
	Trend Break	1985Q3*	1999Q2***	-4.373^{NS}
PAR	Crash	1986Q4*	–	-2.438^{NS}
	Trend Break	1983Q3*	1986Q3**	-4.035^{NS}
URU	Crash	1982Q3*	2002Q2*	-3.332^{NS}
	Trend Break	$1985Q2^{NS}$	2000Q4*	-4.512^{NS}
VEN	Crash	1986Q4*	1999Q3***	-2.857^{NS}
	Trend Break	1989Q3*	–	–4.516***

* significant at 1%, ** significant at 5%, *** significant at 10%,
^{NS} nonsignificant

Table 3. Monetary regime changes

Country	Break Date 1	Break Date 2
ARG	1991Q2	2001Q4
BRA	1994Q3	1998Q4
PAR	1989Q2	2001Q4
URU	1990Q4	2001Q4
VEN	1989Q2	2002Q1

Table 4. Bivariate cointegration analysis

		ARG	BRA	PAR	URU
BRA	λ_{trace}	0			
PAR	λ_{trace}	0	1** (no break)		
URU	λ_{trace}	1* (breaks)	0	1*** (breaks)	
VEN	λ_{trace}	1*** (no breaks)	0	1** (breaks)	0

* significant at 1%, ** significant at 5%, *** significant at 10%

Table 5. Cointegration vector for Argentina and Uruguay (breaks at 1990Q4 and 2001Q4)

Country	Deterministic Linear Trend Model	
	C0 = 3.024*	T0 = –0.002^{NS}
	C1 = 0.246^{NS}	T1 = 0.000^{NS}
	C2 = 4.901**	T2 = –0.037**
	α_i	β_i
ARG	–0.210*	1.000*
URU	0.158*	–1.224*
Total		–0.224^{NS}

* significant at 1%, ** significant at 5%,
*** significant at 10%, ^{NS} nonsignificant

Table 6. Cointegration vector for Argentina and Venezuela

Country	Restricted Deterministic Linear Trend Model	
	α_i	β_i
ARG	–0.094*	1.000*
VEN	–0.002^{NS} (1)	1.367**
Total		2.367*

* significant at 1%, ** significant at 5%,
*** significant at 10%, ^{NS} nonsignificant
(1) The hypothesis that ARG does not Granger-cause VEN could not be rejected at 1%

Table 7. Cointegration vector for Brazil and Paraguay

Country	Restricted Deterministic Linear Trend Model	
	α_i	β_i
BRA	0.009^{NS} (1)	1.000*
PAR	0.062*	–1.404*
Total		–0.404***

* significant at 1%, ** significant at 5%,
*** significant at 10%, ^{NS} nonsignificant
(1) The hypothesis that PAR does not Granger-cause BRA could not be rejected at 1%

Table 8. Cointegration vector for Paraguay and Uruguay (breaks at 1989Q2 and 2001Q4)

Country	Deterministic Linear Trend Model	
	C0 = –5.128*	T0 = –0.001^{NS}
	C1 = 0.907**	T1 = –0.015*
	C2 = –3.917***	T2 = 0.032**
	α_i	β_i
PAR	–0.179*	1.000*
URU	0.059^{NS} (1)	–0.868*
Total		0.132^{NS}

* significant at 1%, ** significant at 5%,
*** significant at 10%, ^{NS} nonsignificant
(1) The hypothesis that PAR does not Granger -cause URU could not be rejected at 1%

Table 9. Cointegration vector for Paraguay and Venezuela (breaks at 1989Q2 and 2001Q4)

Country	Deterministic Linear Trend Model	
	C0 = 5.995*	T0 = 0.003^{NS}
	C1 = 3.846*	T1 = –0.037*
	C2 = –1.583^{NS}	T2 = 0.014^{NS}
	α_i	β_i
PAR	–0.033$^{NS\,(1)}$	1.000*
VEN	0.110*	–2.138*
Total		–1.138*

* significant at 1%, ** significant at 5%, *** significant at 10%, ^{NS} nonsignificant

(1) The hypothesis that PAR does not Granger -cause VEN could not be rejected at 1%

Table 10. Cointegration vector for core Mercosur (breaks at 1990Q4 and 1998Q4)

Country	Deterministic Linear Trend Model	
	C0 = 1.306^{NS}	T0 = –0.013*
	C1 = 0.291**	
	C2 = –0.100^{NS}	
	α_i	β_i
ARG	–0.193*	1.000*
BRA	–0.017^{NS}	0.578*
PAR	–0.068**	0.466*
URU	0.164*	–1.722*
Total		0.322***

* significant at 1%, ** significant at 5%, *** significant at 10%, ^{NS} nonsignificant

The hypothesis that ARG, PAR, and URU do not Granger-cause BRA could not be rejected at 1%

Table 11. Cointegration vector for full Mercosur (breaks at 1994Q3 and 2002Q1)

Country	Deterministic Linear Trend Model	
	C0 = 1.457^{NS}	T0 = –0.012**
	C1 = –7.284*	T1 = 0.073*
	C2 = 9.490*	T2 = –0.076*
	α_i	β_i
ARG	–0.060^{NS}	1.000*
BRA	0.070*	0.549***
PAR	0.059*	–1.853*
URU	0.108*	–1.371*
VEN	–0.023^{NS}	2.570*
Total		0.895**

* significant at 1%, ** significant at 5%, *** significant at 10%, ^{NS} nonsignificant

The hypotheses that BRA, PAR, URU, and VEN do not Granger-cause ARG, and that ARG, BRA, PAR, and URU do not Granger-cause VEN could not be rejected at 1%

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