# TAKING THE BUSINESS CYCLE'S PULSE TO SOME LATIN AMERICAN ECONOMIES: IS THERE A RHYTHMICAL BEAT?

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*Resumen:* Este trabajo se ocupa del comportamiento macroeconómico de Argentina, Bolivia, Chile, Paraguay y Uruguay durante el período 1970-1997, con un doble propósito. El primero, determinar si las fluctuaciones económicas han tenido una conducta similar de acuerdo con su duración, intensidad y momento de ocurrencia. El segundo, caracterizar las perturbaciones de demanda y oferta. El comportamiento de estas economías en el pasado revela que la posibilidad de armonizar políticas macroeconómicas es débil, y sugiere la ausencia de un argumento económico para una unión monetaria.

*Abstract:* The paper deals with the macroeconomic behavior of Argentina, Bolivia, Brazil, Chile, Paraguay and Uruguay for the period 1970-1997. Its aim is twofold. First, to determine whether their economic fluctuations followed a similar pattern according to their duration, intensity and timing. Second, to evaluate the demand and supply disturbances. The arrhythmical beat among these economies in the past reveals that there is little point in trying to align macroeconomic policies, and the absence of an economic argument for a monetary union.

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## 1. Introduction

The existence of similar business fluctuations is considered a necessary condition for the harmonization of economic policies and institutions among countries involved in an economic integration process (Christodoulakis, Dimelis and Kollintzas, 1995; Fiorito and Kollintzas, 1994). If business fluctuations are synchronized, harmonized policies to cope with the cycles can be successfully designed since phases are going to be similar across countries. This is of extraordinary relevance for the region, but there are no studies about Latin American economies by which one could determine the existence of such uniform behavior.[1] The Latin American countries were left out of this line of research mainly for lack of stability and lack of data (Fullerton and Araki, 1996; Mena, 1995). In other words, because of these problems, and a lack of emphasis on comparison of business cycle facts among countries, Latin America is still behind in its evaluation of the preconditions of the integration process.

A related literature investigates the extent to which the countries appear to be symmetric or asymmetric with respect to the nature of shocks underlying their economies. The argument is that if the shocks that are impinging upon a particular economy and the rest of the countries do so differently (asymmetrically), then harmonized monetary and fiscal policies cannot be carried out efficiently. The curiosity in such behavior arises because the integration process tends to its *momentum* when a monetary union takes place. If this is the case, in response to country-specific shocks governments will no longer have the option of adopting a monetary policy which differs from that of the union as a whole, and the weight attached to these arguments depends on the incidence of the shocks.

There are some studies for Europe that focus on the incidence of disturbances across a region as a critical determinant of the design of a currency area. (Bayoumi and Eichengreen, 1992b). Although with an explicit recognition that the monetary union is at all times a political decision (Eichengreen, 1993), these studies want to show the existence of an economic argument that supports the currency area.[2]

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[1] Although one should recognize the existence of some studies, their authors seem to be interested in the use of different econometric methodologies rather than in determining the existence of a rhythmical beat among the economies.

[2] Countries would find a currency area optimal whenever the nominal exchange rate is not necessary to adjust the real one every time these economies face asymmetric shocks. The starting point of the literature is the work of Mundell (1961).

Again, and not surprisingly, while numerous empirical studies have been developed for the case of the European Union, only marginal attention has been given to the case of Mercosur (Southern Common Market).

The aim of the paper is twofold. First, to explore the degree of homogeneity of Latin American economies, and hence the feasibility of policy harmonization. The countries to be examined are those related with the integration phenomenon that in the Southern Cone is named Mercosur (Argentina, Brazil, Paraguay and Uruguay). Currently, Mercosur has further extended its scope by entering into free trade agreements with Bolivia and Chile, and that is why these two countries are included in the study. The period selected for the analysis is 1970-1997, and the characterization of the GDP fluctuations during this period will be used to predict the likely outcome of the integration process. Second, to explore the mechanisms underlying the business fluctuations with special reference to the size and correlation of shocks. While this feature helps to describe the economies, it also helps to discover whether an economic argument for an optimum currency area exists.

The remainder of the paper is organized as follows. Section two is devoted to some generalities about cyclical fluctuations and shocks, together with the methodologies employed to remove the trend from the data and to discover the shocks. Section three presents the results. The concluding comments are in section four.

## 2. Fluctuations and Shocks

### 2.1. *Fluctuations*

The first step to discover the cyclical fluctuations is to separate them from the GDP growth trend.

The usual exercise for this purpose is to consider that the economic aggregates wave around a long run uniform trend line (Burns and Mitchell, 1946). This point of view is supported by the hypothesis that the growth rate of real variables is explained by exogenous factors such as population or technological changes. The notion that the secular component does not fluctuate much over short periods of time, but that it does so slowly and smoothly with respect to the cyclical component, has led to the practice of "detrending" the series using time as an explanatory variable.

However, the evidence suggests that the secular movement changes over time, and most of the theory has rejected the hypothesis

that these rates of growth are constant. Therefore, it is assumed that transitory changes modify the rate. Once this assumption is accepted, the economic literature admits the existence of a stochastic trend as a variable in modeling macroeconomic fluctuations (Beveridge and Nelson, 1981; Nelson and Plosser, 1982). These last theories arose mainly after the re-definition of the cycle made by Lucas (1977) who believes that business fluctuations are deviations of aggregate output from its trend (without an explicit explanation of what trend to use).[3] His incomplete definition gives the chance to use the trend considered more appropriate for the economies under analysis.

In short, if the rate of technological change were constant, then the natural logarithm of real GDP would be a linear function of time. Since the rate of technological change varies (both over time and across countries), detrending using a linear function of time could be inappropriate. Formally, the key question is to perceive which is the trend of GDP series, and for this one can distinguish two kinds of processes.[4]

The first one is the process through which the series could be modeled by a deterministic trend plus a stochastic process with zero mean. This is known as a "trend stationary" process.

This first procedure is associated with the traditional point of view of the business cycle through the equation $y_t = a + bt + e_t$ in which $y_t$ is formed by a stationary fluctuation $(e_t)$ around the time trend $(a + bt)$. Since $y_t$ is not stationary due to the presence of $t$, stationarity is easily achieved by removing the trend, that is, using time as an explanatory variable. In this context, a stationary fluctuation appears after the trend is removed.

The second process is related to one in which the first (or higher) difference of the series is a stationary and an invertible autoregressive moving average $(ARMA)$ process.

This procedure appears when the series is $y_t = a + y_{t-1} + e_t$, i.e., the series could be modeled using its past values, a drift $(a)$ and a stationary disturbance $(e_t)$. This is known as a random procedure with a drift, and the first difference of the series $(y_t - y_{t-1})$ is a stationary process $(a + e_t)$. The fact that stationarity is achieved

[3] His definition was completed by Kydland and Prescott (1990) who provided an explicit procedure for calculating the time series trend that successfully mimics the smooth curves most business cycle researchers would draw through the plots of the data.

[4] In other words, it is necessary to break down the GDP series into a stationary (trend) and stationary (cyclical) component, because certain characteristics of the data are valid only if the series are stationary.

through differencing justifies labeling it as "difference stationary". This model represents the unit root hypothesis.

The test of unit root is useful to distinguish which of the two processes best explains the non-stationarity behavior of the series, contributing to answering the question of whether the non-stationarity arises from a deterministic or a stochastic trend. The Augmented Dickey- Fuller test is a formal one to identify whether the variable should be considered in levels or in differences.[5]

### 2.2. *Shocks*

A rich description could be made distinguishing fluctuations as consequences of different shocks. This analysis is useful since it improves the characterization of the economies. By the way, the analysis is also related to the possible existence of an optimum currency area (as stated in Section one). The renewed interest for this concept is the result of the dynamism of the integration phenomenon (with special reference to Europe), together with monetary integration as an element of such a phenomenon.[6]

The costs and benefits of a monetary union are estimated in most of the cases based on the symmetry or asymmetry of the shocks.[7] Bayoumi and Eichengreen (1992b), for example, concluded in their study on Germany and other European countries that the European Union is divided into a core and a periphery. In the core the shocks are highly correlated, but this does not happen in the periphery.[8] Furthermore, the size of the shocks is similar among the core countries, but it is not alike in the rest of Europe. Bayoumi and Eichengreen compare their results with those of a consolidated monetary union such as the one represented by the United States, stating that the correlation among eight regions of the US is similar to that of the

[5] Each unit root needs a difference for an *ARMA* model to fit the data.

[6] Although it should be recognized that the political impulse and economic relations have improved during the last years, a monetary union in Mercosur is not in the near future. In fact, a common currency means an extraordinary sacrifice of monetary autonomy, which turns out to be useful against some specific shocks.

[7] For a fresh list of the costs and benefits of a monetary union see Fondo Monetario Internacional (1997), pp. 14-16.

[8] Although the authors correctly use the term periphery, it sounds pejorative. Hereafter, this expression will mean, strictly, the area beyond the limits of some common characteristics, but without a pejorative connotation.

central region of Europe, but is higher than that of the periphery. The shocks are obtained using the procedure described by Blanchard and Quah (1989).[9]

Consider a system in which the true model can be represented by an infinite moving average representation of a vector of variables $X_t$ and an equal number of shocks $E_t$:

$$X_t = A_0E_t + A_1E_{t-1} + A_2E_{t-2} + A_3E_{t-3} + \ldots \qquad (2.2.1)$$

where the matrixes $A_i$ represent the impulse responses functions of the shocks to the element of $X$. Specifically, let $X_t$ be made up of changes in output and in the monetary aggregate:

$$\begin{bmatrix} \Delta & y_t \\ \Delta & (m-p)^t \end{bmatrix} = \sum_{i=0}^{\infty} L^i \begin{bmatrix} a_{11i} & a_{12i} \\ a_{21i} & a_{22i} \end{bmatrix} \begin{bmatrix} \varepsilon_{dt} \\ \varepsilon_{st} \end{bmatrix} \qquad (2.2.2)$$

where $y_t$ is the logarithm of output, $m$ is the logarithm of the monetary aggregate, $p$ is the logarithm of the price level, $L$ is the lag operator, $a_{11i}$ is the $a_{11}$ element in $A_i$, and $\varepsilon_{dt}$ and $\varepsilon_{st}$ are, respectively, the demand (monetary) and supply shocks.

As stated before, supply shocks have permanent effects on the level of output while demand ones have only temporary effects. Since output is written in a difference form, this implies that the cumulative effects of demand shocks on the change in output must be zero. This implies the restriction:

$$\sum_{i=0}^{\infty} a_{11i} = 0 \qquad (2.2.3)$$

The model defined by equations (2.2.2) and (2.2.3) can be estimated using a vector autoregression. Each element of $X_t$ can be regressed on lagged values of all the elements of $X$. Using $B$ to represent these estimated coefficients, the equation becomes:

$$X_t = B_1X_{t-1} + B_2X_{t-2} + \ldots + B_nX_{t-n} + e_t$$

[9] The purpose of these authors was to reconsider the break down of GDP made by Beveridge and Nelson (1981) into its permanent and transitory components. It is with this aim that they developed a model in which supply and demand shocks may influence GDP: the demand shocks having a transitory effect on output, the supply shocks a permanent one on it.

$$X_t = (I - B(L))^{-1} e_t$$
$$X_t = (I + B(L) + B(L)^2 + ...) e_t \qquad (2.2.4)$$
$$X_t = e_t + D_1 e_{t-1} + D_2 e_{t-2} + D_3 e_{t-3} + ...$$

where $e_t$ represents the residuals from the equation in the vector autoregression. In this case, $e_t$ is comprised of the residuals of a regression of lagged values of $y_t$ and $m$-$p$ on current values of each in turn; these residuals are labeled $e_{yt}$ and $e_{pt}$.

To convert equation (2.2.4) into the model defined by equation (2.2.2), the residuals from the *VAR* must be transformed into demand and supply shocks. Writing $e_t = C\varepsilon_t$ , it is clear that in the two-by-two case considered, four restrictions are required to define the four elements of the matrix $C$.[10] Two of these restrictions are simple normalization, which define the variance of the shocks. A third restriction arises from the fact that demand and supply shocks are orthogonal. The final restriction that allows $C$ to be uniquely defined is that monetary shocks have only temporary effects.[11] In terms of *VAR* this implies:

$$\sum_{i=0}^{\infty} \begin{bmatrix} d_{11i} & d_{12i} \\ d_{21i} & d_{22i} \end{bmatrix} \begin{bmatrix} c_{11} & c_{12} \\ c_{21} & c_{22} \end{bmatrix} = \begin{bmatrix} 0 & \cdot \\ \cdot & \cdot \end{bmatrix}$$

In short, the disturbances are in general not directly observable, but can be inferred from the joint behavior of two series. This joint be-

[10] In applied work the nature of the identified shocks has differed. Some studies identify only one generic shock to aggregate demand (*e.g.* Blanchard and Quah, 1989), whereas others identify multiple shocks to aggregate demand (*e.g.* Shapiro and Watson, 1988; Galí, 1992). Likewise, some of these studies identify only a single supply shock (*e.g.* Blanchard and Quah, 1989; Galí, 1992), whereas others identify several supply shocks (*e.g.* Shapiro and Watson, 1988; Fackler and McMillin, 1998). However, one should be cautious in identifying shocks. King *et al.* (1991), for example, identify three shocks, one of which is a real interest rate shock, but it is not clear how to classify this shock because it could be interpreted either as an aggregate demand or supply shock, or as a mixture of the two. In summary, the shocks are identified by imposing a number of restrictions, and while in applied work the nature of the identified shocks has differed, they could be labeled either as demand or supply ones.

[11] This restriction excludes the possibility that aggregate demand shocks permanently affect the level of output. The assumption allows the researcher to choose a description closer to the Keynesian view in which fluctuations are predominantly transitory, or to fit a description closer to the real business cycle view in which they are largely the result of permanent shocks.

havior is characterized by a vector autoregresion, and the underlying shocks are identified by imposing some restrictions, one of which is the long-run neutrality of nominal shocks.

## 3. Results

The data used to obtain the cyclical fluctuations come from the *Anuarios Estadísticos de America Latina y El Caribe* for they provide consistent information for the period 1970–1997. The information was computed in constant prices. Although this procedure is not difficult to follow, it may show some distortions in very long periods of time as a consequence of changes in the statistical procedures.

It is difficult to obtain overlapping time series of national accounts under different base periods in Latin American countries. It is typical that, once the base period changes, the old time series (based on the previous base period) are discontinued, and the new time series are not extended backward for a significant number of years (Mena, 1995).[12] This makes unclear whether the observed differences in the output growth rate across base periods it reflect changes in the structure of the economy (input-output matrix) or merely show the peculiarities of statistical procedures. Nevertheless, this second best methodology related to the simple "chain" of the series is adopted.[13]

As to money, the construction of the series of the relevant monetary aggregate generated an additional problem since Argentina, Bolivia and Brazil were very unstable economies and had changed their currency several times.[14] To overcome this difficulties, it was necessary to consult the *International Financial Statistics* provided by the International Monetary Fund. The series constructed were checked with the information provided by *Estudios Económicos de América Latina.* These annual estudios include a short description of the performance of the economies that helps to find inconsistencies in the data and to avoid the introduction of distortions in the series.

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[12] Argentina, Chile and Uruguay are the only Latin American countries that do not present these difficulties in obtaining such national account statistics (Mena, 1995; p. 89).

[13] Macroeconometric testing in Latin American countries requires a country-specific detailed knowledge of the economic policy evolution throughout the period investigated. Such information needs to be incorporated into both the specification and estimation procedures. These "pressing restrictions" suggest the adoption of a second best methodology.

[14] This is due to the episodes of hyperinflation.

The general procedure was to use the last volume of *Anuarios Estadísticos de América Latina y El Caribe*, and then to construct the series from the present to the past, on the assumption that the most recent data was properly elaborated. The same procedure was employed for the monetary aggregate series.

### 3.1. *GDP Fluctuations and their Characteristics*

The adoption of a deterministic trend implies that the growth rate of GDP was constant. Table 1 summarizes the results for the period 1970-1997 under this assumption. The growth rates for the economies were different among the countries. It was necessary to include a dummy variable for the eighties, which was relevant for the cases of Argentina, Bolivia, Chile and Uruguay. The growth rate of Paraguay was 5.1% while the one of Brazil was 3.8%. The growth rate for the rest of the countries (dummy included) was 4.9% for Chile, 2.9% for Bolivia, 2.4% for Uruguay, and 2.2% for Argentina.

In spite of the satisfactory results obtained, the procedure could be useful only for some economies since it is probably not true that all of them followed a constant growth rate.

Augmented Dickey- Fuller, *ADF*, tests were applied to determine the orders of integration of each variable and the results are shown in table 2. The Akaike's information criterion was used to determine the lag order for the *ADF* tests. According to the results, the null hypothesis of a unit root is accepted for the level series (with the exception of Bolivia), but rejected for the first–differenced series.[15] These results lead to the conclusion that five variables seemed to be non–stationary and integrated of order one. The inspection of the correlogram suggested the series be differenced in the cases of Brazil, Chile and Paraguay.[16] The residuals are shown in graph 1

[15] The *ADF* statistics for first differenced series are not reported here, but they could be requested from the author.

[16] The *ADF* test is a formal one to identify if the variable should be considered in levels or in differences, but sometimes it tends to over difference the series (Enders, 1995; p. 251). To avoid over differencing the series, and due to the use of annual data, special care was given to the inspection of the correlograms. While the correlograms for Argentina and Uruguay did not reveal the inevitability of differencing, those of Brazil, Chile and Paraguay dampens after the GDP series were first–differenced.

(see appendix), and they are approximately white noise.[17] This graph also presents the residuals from a deterministic trend.

**Table 1**
*GDP Growth Rate for Selected Latin American Countries*

| *Countries* | *Growth Rate (a), (b)* | | $r^2$ |
|---|---|---|---|
| | (without a Dummy) | (with a Dummy) | |
| Argentina | 1.3<br>(7.84) | | 0.71 |
| | | 2.2<br>(8.30) | 0.82 |
| Bolivia | 1.7<br>(8.05) | | 0.72 |
| | | 2.9<br>(9.36) | 0.85 |
| Brazil | 3.8<br>(12.47) | | 0.86 |
| | | 4.2<br>(6.95) | 0.57 |
| Chile | 3.7<br>(12.36) | | 0.85 |
| | | 4.9<br>(5.27) | 0.89 |
| Paraguay | 5.1<br>(19.05) | | 0.93 |
| | | 5.1<br>(9.56) | 0.93 |
| Uruguay | 1.4<br>(6.85) | | 0.65 |
| | | 2.4<br>(6.99) | 0.76 |

Note: (a) in %, (b) $t$-statistic in parenthesis.

The coincidences in expansions and recessions have been checked with the description of the economies provided by *Estudios Económicos de América Latina*, and a high number of coincidences have been found. Although there is no way to do this procedure directly due to methodological matters (related to fluctuations along a trend line or

[17] Analysis of time series is not a perfect science. The researchers may be forced to terminate their analysis even though there is still fairly regular residual elements. This justifies labeling the residuals as approximately white noise.

to the previous year), one could construct a table in which expansions and contractions are listed and then compare them with those given by the publication.[18]

Once the fluctuations are obtained, the next step is to characterize them. Christodolulakis, Dimelis and Kollintzas (1995) suggest their duration, intensity and persistence as the most relevant characteristics; their simultaneity and temporal correlation are also useful to perceive the joint behavior of the countries.[19]

**Table 2**

*Unit Root Test for GDP Series*
*(Augmented Dickey-Fuller Test)*

| *Countries* | *Statistic* | *Critical Value* |
|---|---|---|
| Argentina | -1.96 | -3.23** |
| Bolivia | -4.27 | -3.63* |
| Brazil | -2.59 | -3.26** |
| Chile | -2.07 | -3.24** |
| Paraguay | -1.52 | -3.24** |
| Uruguay | 2.61 | -3.24** |

Note: (a) MacKinnon critical value for rejection of the unit root hypothesis, (*) at 5% level, and (**) at 10% level.

### 3.1.1. Duration, Volatility and Persistence

Table 3 presents the duration (in years) of the cyclical fluctuations given the alternatives selected. Argentina and Paraguay have shorter expansions; while Bolivia, Uruguay and Chile have longer ones. Brazil is somewhere in between. In the case of contractions, they are similar in all the cases with the exception of Brazil.

Since the estimated residuals show a great deal of variability, it is useful to evaluate their volatility. The volatility of the fluctuations is measured through the standard deviation of the cyclical component.

[18] A similar practice is employed in Arnaudo and Jacobo (1998).

[19] See Arnaudo and Jacobo (1997).

Table 3 shows that volatility is small for the cases of Bolivia, Brazil, Chile and Paraguay when a stochastic trend is selected, while there are no significant differences in the cases of Argentina and Uruguay. This situation seems to confirm the trend selected for the economies.[20]

**Table 3**
*Characteristics of GDP Fluctuations*

| *Type* | *Countries* | | | | | |
|---|---|---|---|---|---|---|
| | *Argentina* | *Bolivia* | *Brazil* | *Chile* | *Paraguay* | *Uruguay* |
| Duration (a) | | | | | | |
| - Expansions | 2.6 | 6.2 | 4.0 | 4.7 | 2.3 | 5.0 |
| - Contractions | 1.6 | 2.0 | 3.3 | 2.0 | 2.2 | 2.3 |
| Volatility (b) | | | | | | |
| *D* | 5.3 | 6.2 | 9.4 | 9.5 | 10.3 | 7.2 |
| *S* | 4.8 | 2.6 | 6.2 | 6.2 | 3.8 | 8.1 |
| Persistence (c) | | | | | | |
| *D (t-1)* | 0.46 | | | | | 0.29 |
| *S (t-1)* | | -0.10 | 0.01 | 0.02 | 0.36 | |
| *D (t-2)* | 0.10 | | | | | -0.12 |
| *S (t-2)* | | 0.05 | 0.45 | 0.05 | -0.07 | |

Note: (a) in years, (b) following a deterministic (D) or a stochastic (S) trend, (c) autocorrelation coefficient.

The degree of persistence is measured through the autocorrelation coefficient. The results indicate that it is not relevant, although one should recognize some persistence in the cases of Argentina, Paraguay and Uruguay.

### 3.1.2. Simultaneity

The analysis of expansions and contractions showed that the economies of these countries coincided on a number of occasions. If the

[20] It is judicious to remember that the time series trend should mimic the smooth curves most cycle researchers would draw through the plots of the data.

fluctuations were happening simultaneously, the expected number of years in which they coincide should be equal to that of the years analyzed, whereas if the fluctuations were in opposite directions the number should be zero. Thus, it is reasonable to think that half the number of periods corresponds to a random situation.

Since due to statistical procedures it was necessary to sacrifice one year in some cases, the number of periods in which the economies coincided was related to the years analyzed. This method does not invalidate what is stated above. In fact, a number near 50% suggests a random case.

Table 4 gives some information about simultaneity in these geographically linked countries. The number of coinciding fluctuations are high between Argentina and Brazil (71%). Something similar is observed between Brazil and Paraguay (71%), and between Uruguay and Bolivia (73%). Chile and Bolivia also have an interesting number of coinciding fluctuations (69%), and the same occurs in the cases of Chile and Uruguay (65%).

**Table 4**
*Simultaneity of Cyclical Fluctuations*

| *Countries* | *Argentina* | *Bolivia* | *Brazil* | *Chile* | *Paraguay* | *Uruguay* |
|---|---|---|---|---|---|---|
| Argentina | – | 65 | 71 | 65 | 54 | 67 |
| Bolivia | | – | 58 | 69 | 65 | 73 |
| Brazil | | | – | 50 | 71 | 65 |
| Chile | | | | – | 58 | 65 |
| Paraguay | | | | | – | 62 |
| Uruguay | | | | | | – |

Note: Number of coincidences over the number of years analyzed (in %).

In brief, the countries do not have a very different behavior and demonstrate a high number of coinciding expansions and recessions; with the exception of Chile and Brazil (where fluctuations do not seem to coincide).

### 3.1.3. Temporal Correlation

Up to now the analysis focuses only on the number of years during which conditions were similar, disregarding the relative size of such

relations. This difficulty could be overcome by looking at the temporal correlation of economic fluctuations. A possitive (or negative) number and a significant magnitude indicate the existence of correlation, while a number close to zero indicates that the fluctuations are uncorrelated.[21] The data included in table 5 give the temporal characteristics of the fluctuations in each country, as well as their correlation with the fluctuations of the other economies. Although one should recognize the existence of some correlation among the fluctuations, its value is very small.

The cyclical fluctuations of Brazil are simultaneously (and positively) correlated with the fluctuations of Argentina and Paraguay; while the correlation with Chile (if any) seems to be negative.

Paraguay's cyclical fluctuations are positively related to those of Bolivia and Chile. The business fluctuations of Uruguay are negatively correlated with those of Chile.

It is also possible to observe what happens when a current fluctuation in one country is compared with the fluctuation in the rest of the countries lagged one period. Although the selected indicator (cross-correlation) makes it possible to see if the fluctuation of one country leads the other country's cycle, the lack of significance of the indicator is an excuse for not giving conclusions in this sense.

While the economies of Argentina and Paraguay were contemporaneously correlated with the fluctuation of Brazil, there is no business fluctuation correlated with Brazil's lagged one. This means that even if the economies are influenced by the situation of this country, they can recover after a period (a year in this case).

### 3.2. *Monetary Shocks*

The $VAR$ was estimated using the Akaike Information Criteria giving some priority to the use of the correlograms of the residuals since the employment of an unnecessary number of lags can thus be avoided. The shocks are shown in graph 2 (see appendix). In this case, the characteristics of the shocks are concentrated in their correlation and size.

[21] The cutoff point of 0.32 roughly corresponds to the required values to reject the null hypothesis that the correlation coefficient is zero at the 10% significance level of the two-sided $t$-statistic.

## Table 5

*Temporal Correlations of Cyclical Fluctuations*

| Countries | | Argentina | | | | Bolivia | | | | Brazil | | | | Chile | | | | Paraguay | | | | Uruguay | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Lags | 0 | -1 | -2 | -3 | 0 | -1 | -2 | -3 | 0 | -1 | -2 | -3 | 0 | -1 | -2 | -3 | 0 | -1 | -2 | -3 | 0 | -1 | -2 | -3 |
| Argentina | 0 | 1.00 | 0.46 | 0.08 | -0.15 | -0.02 | -0.23 | -0.92 | 0.08 | 0.28 | 0.01 | 0.25 | -0.02 | -0.13 | -0.28 | -0.31 | 0.13 | 0.21 | -0.29 | -0.23 | -0.01 | 0.08 | 0.23 | 0.17 | 0.00 |
| | -1 | | 1.00 | 0.46 | 0.07 | 0.12 | -0.03 | -0.24 | -0.03 | 0.14 | 0.32 | 0.01 | 0.25 | 0.09 | -0.14 | -0.30 | -0.31 | 0.23 | 0.24 | -0.30 | -0.23 | -0.24 | 0.07 | 0.22 | 0.15 |
| | -2 | | | 1.00 | 0.49 | -0.04 | 0.10 | -0.03 | -0.24 | 0.19 | 0.17 | 0.35 | 0.01 | -0.01 | 0.09 | -0.14 | -0.32 | -0.05 | 0.25 | 0.23 | -0.3 | -0.25 | -0.25 | 0.06 | 0.21 |
| | -3 | | | | 1.00 | -0.3 | -0.09 | 0.10 | -0.06 | 0.11 | 0.23 | 0.13 | 0.32 | -0.01 | -0.04 | 0.04 | -0.15 | -0.02 | 0.04 | 0.26 | 0.27 | -0.21 | -0.29 | -0.29 | 0.00 |
| Bolivia | 0 | | | | | 1.00 | -0.15 | 0.03 | 0.34 | 0.25 | 0.13 | 0.21 | -0.03 | 0.02 | 0.32 | -0.44 | 0.05 | 0.49 | 0.23 | 0.02 | -0.23 | 0.05 | -0.06 | 0.34 | -0.02 |
| | -1 | | | | | | 1.00 | -0.11 | 0.04 | 0.34 | 0.23 | 0.10 | 0.17 | -0.01 | 0.02 | 0.31 | -0.44 | 0.14 | 0.58 | 0.23 | 0.02 | 0.00 | 0.05 | -0.06 | 0.33 |
| | -2 | | | | | | | 1.00 | -0.1 | -0.12 | 0.34 | 0.25 | 0.13 | 0.02 | 0.00 | 0.02 | 0.31 | 0.04 | 0.15 | 0.50 | 0.23 | -0.01 | 0.00 | 0.05 | 0.06 |
| | -3 | | | | | | | | 1.00 | 0.22 | -0.12 | 0.25 | 0.24 | -0.04 | 0.04 | 0.02 | 0.02 | 0.17 | 0.06 | 0.14 | 0.51 | 0.02 | -0.02 | 0.00 | 0.03 |
| Brazil | 0 | | | | | | | | | 1.00 | -0.17 | 0.43 | -0.16 | -0.20 | 0.07 | -0.16 | -0.23 | 0.53 | 0.12 | 0.09 | -0.13 | 0.21 | 0.11 | 0.12 | 0.21 |
| | -1 | | | | | | | | | | 1.00 | -0.07 | 0.52 | 0.03 | -0.20 | 0.07 | -0.16 | 0.00 | 0.53 | 0.12 | 0.09 | 0.02 | 0.21 | 0.11 | -0.12 |
| | -2 | | | | | | | | | | | 1.00 | 0.01 | -0.39 | 0.07 | -0.20 | 0.07 | 0.22 | 0.01 | 0.53 | 0.12 | 0.10 | 0.03 | 0.21 | 0.11 |
| | -3 | | | | | | | | | | | | 1.00 | -0.02 | -0.33 | 0.03 | -0.20 | 0.16 | 0.22 | 0.00 | 0.54 | -0.23 | 0.10 | 0.02 | 0.20 |
| Chile | 0 | | | | | | | | | | | | | 1.00 | 0.00 | -0.02 | 0.09 | 0.30 | 0.35 | -0.28 | -0.09 | -0.29 | -0.08 | -0.54 | -0.28 |
| | -1 | | | | | | | | | | | | | | 1.00 | 0.03 | -0.05 | 0.09 | 0.32 | 0.35 | -0.28 | 0.10 | -0.30 | -0.08 | -0.56 |
| | -2 | | | | | | | | | | | | | | | 1.00 | 0.01 | -0.36 | 0.12 | 0.32 | 0.36 | 0.39 | 0.08 | -0.31 | -0.11 |
| | -3 | | | | | | | | | | | | | | | | 1.00 | -0.13 | -0.37 | 0.12 | 0.32 | 0.31 | 0.40 | 0.08 | -0.32 |
| Paraguay | 0 | | | | | | | | | | | | | | | | | 1.00 | 0.23 | -0.13 | -0.12 | -0.06 | -0.03 | -0.15 | -0.11 |
| | -1 | | | | | | | | | | | | | | | | | | 1.00 | 0.25 | -0.14 | -0.24 | -0.04 | -0.02 | -0.12 |
| | -2 | | | | | | | | | | | | | | | | | | | 1.00 | 0.25 | 0.02 | -0.25 | -0.05 | -0.03 |
| | -3 | | | | | | | | | | | | | | | | | | | | 1.00 | 0.15 | 0.03 | -0.25 | -0.04 |
| Uruguay | 0 | | | | | | | | | | | | | | | | | | | | | 1.00 | 0.36 | -0.04 | -0.31 |
| | -1 | | | | | | | | | | | | | | | | | | | | | | 1.00 | 0.37 | -0.10 |
| | -2 | | | | | | | | | | | | | | | | | | | | | | | 1.00 | 0.36 |
| | -3 | | | | | | | | | | | | | | | | | | | | | | | | 1.00 |

### 3.2.1. Correlation

Table 6 presents the correlation for demand shocks. Argentina and Uruguay are weakly correlated, and something similar occurs with Argentina and Brazil. If now Brazil is the referential country, its demand shocks are weakly (and negatively) correlated with those of Bolivia and Paraguay.[22]

[22] The description only includes the most relevant correlations. In doing so, it considers Argentina and Brazil as referential countries due to their GDP size.

**Table 6**

*Correlations of Demand Shocks*

| *Countries* | *Argentina* | *Bolivia* | *Brazil* | *Chile* | *Paraguay* | *Uruguay* |
|---|---|---|---|---|---|---|
| Argentina | 1.00 | -0.28 | 0.22 | 0.08 | 0.01 | 0.42 |
| Bolivia | | 1.00 | -0.36 | 0.01 | 0.11 | -0.04 |
| Brazil | | | 1.00 | -0.02 | -0.43 | -0.10 |
| Chile | | | | 1.00 | 0.23 | -0.27 |
| Paraguay | | | | | 1.00 | -0.14 |
| Uruguay | | | | | | 1.00 |

For the supply shocks, the figures in table 7 show that the weak correlation observed in demand shocks between Argentina, Brazil and Uruguay is not preserved. Nevertheless, it is possible to find one between Brazil and Paraguay. The supply shocks of Chile are weakly (and negatively) correlated with those of Argentina and Brazil.

**Table 7**

*Correlations of Supply Shocks*

| *Countries* | *Argentina* | *Bolivia* | *Brazil* | *Chile* | *Paraguay* | *Uruguay* |
|---|---|---|---|---|---|---|
| Argentina | 1.00 | -0.16 | 0.06 | -0.31 | 0.22 | 0.03 |
| Bolivia | | 1.00 | 0.21 | 0.30 | 0.31 | -0.05 |
| Brazil | | | 1.00 | -0.42 | -0.49 | 0.15 |
| Chile | | | | 1.00 | -0.05 | -0.59 |
| Paraguay | | | | | 1.00 | -0.08 |
| Uruguay | | | | | | 1.00 |

3.2.2. Size

The methodology employed makes it possible to observe the size of demand and supply shocks. The wider the supply shocks, the greater

the usefulness of the monetary policy. In other words, it will be extraordinarily difficult to fix the exchange rates among these countries if supply shocks are not of the same size in all the economies.

In the case of demand disturbances, their interpretation is rather different. In fact, Bayoumi and Eichengreen (1992b) suggest that the different sizes of demand shocks in the different regions of the United States are due to the level of specialization of each region. In other words, if the region is diversified in its production, the demand shocks should be small. But in the cases of the economies under analysis, the size of monetary shocks seems to be more related to stabilization plans. Since these plans were based on the exchange rate, the size of demand shocks tends to confirm the importance of exchange rates as a mechanism of adjustment.

The size of demand and supply shocks was computed using the estimated residual correlation matrix from the *VAR*, but the variance-covariance one. In fact, the normal procedure assumes an identity variance- covariance matrix due to the assumption of variance equal to unity and orthogonality of the shocks. The transformation suggests only changes in the scale factor.[23]

Table 8 shows the standard deviation of the shocks. The standard deviation of Argentina's supply shock is 0.055 (0.057%). The size of the supply shocks in Brazil is 0.063 (6.3%), and in Uruguay 0.069 (6.9%). In the case of demand shocks, those of Argentina, Brazil and Bolivia were the largest.

**Table 8**
*Standard Deviation of Shocks*

| *Countries* | *Demand Shock* | *Supply Shock* |
|---|---|---|
| Argentina | 1.872 | 0.057 |
| Bolivia | 2.561 | 0.024 |
| Brazil | 3.172 | 0.063 |
| Chile | 0.774 | 0.050 |
| Paraguay | 0.118 | 0.037 |
| Uruguay | 0.146 | 0.069 |

Note: The variables are measured in logarithms, so that 0.057 is 5.7%

[23] See the modification of the *VAR* decomposition discussed in footnote 10 of Bayoumi and Eichengreen (1992a; p. 6).

In summary, supply and demand shocks are different among the economies. In addition, they seem to be bigger than those of European countries. In fact, while in the European core countries (Germany, France, Belgium, Netherlands, and Denmark) the size of supply shocks is between 1-2%, this is not the case here.[24] Moreover, the size of the supply shocks in the Latin American countries studied here is bigger than those of the European periphery (United Kingdom, Italy, Spain, Portugal, Ireland, and Greece) where the size is between 2-4%. The demand shocks are also different suggesting that monetary policy should be different.

## 4. Concluding Comments

An interesting exercise was to assume that the group of countries under analysis did not have a strong economic linkage. This was, of course, the period previous to the integration, and it could be identified as "the initial situation", opposite to the time when the integration process is taking place. This kind of partition may be applied to the countries now joining Mercosur where the *Tratado de Asunción* (1991) should be taken as the boundary between the two periods, marking the performance of the economy in the past and its likely behavior in the future. However, the results of the integration took time to emerge, and the first evidence of their existence may have occurred in the middle 1990s. Therefore, it seems more appropriate to take this latter time as a dividing point, and thus, the usefulness of extending the analysis to 1997.

To determine the feasibility of policy harmonization before the countries had started the integration process (that is what was called the initial situation), the analysis focuses on GDP fluctuations.

The macroeconomic fluctuations of Argentina, Bolivia, Brazil, Chile, Paraguay and Uruguay were variable and not time uniform during the last quarter of the century. As a consequence, the effect of homogeneous policies in the future is difficult to predict.

Although there is a high degree of discretion when separating the GDP fluctuations from the growth trend, the growth rate of these economies was different. The duration of expansions and recessions were variable, and the persistence was small.

[24] Note that some methodological differences may exist. For further details about Europe and the United States, see Bayoumi and Einchengreen (1992b).

While the expansions and recessions in these countries often coincided, with the exception of Brazil and Chile, the size of their association is small. Nevertheless, Brazil is positively correlated with Argentina and Paraguay. Paraguay is also positively correlated with nearly all the countries studied here (with the exception of Uruguay). Argentina is not correlated with Bolivia, nor is it with Chile. When lagged fluctuations are analyzed, there is not a significant relation between fluctuations in any of the countries.

As a result, the arrhythmical beats among these countries reveals that the case for policy harmonization is weak. Similar policies could work in expansions and contractions, but their strength should be different: very high in one country, very small in the other. This is probably why the alignment of economic policies up to the moment is mainly due to the abandonment of inflationary finance.

When analyzing the underlying mechanism of the cyclical fluctuations, Argentina, Brazil and Uruguay show (weakly) correlated demand shocks, while Brazil's supply shocks are closer to those of Paraguay. The supply shocks of Chile are weakly and negatively correlated with those of Argentina and Brazil.

In spite of the fact that there are three countries (Argentina, Brazil and Uruguay) whit supply shocks of similar size, these are not correlated. The only supply shocks that show some correlation are those of Brazil and Paraguay, but the size of these shocks is different.

As far as demand shocks are concerned, those of Argentina, Brazil and Uruguay are correlated, but their size is not equal. This simply means that their monetary policies are different.

A well understood rule is that if the shocks are different, harmonization of institutions and policies tend to exacerbate fluctuations since the governments are forced to relinquish their tools for stabilizing their economies. Following this rule, since the shocks underlying these economies were different, there is no economic reason for a monetary union. Nevertheless, and just to finish the paper with a small degree of optimism, one could ask oneself as Wyplosz (1997) did: "Would the United States have passed the currency area test a century ago? And had it failed, all things considered, was a mistake for the country to adopt a single currency?".

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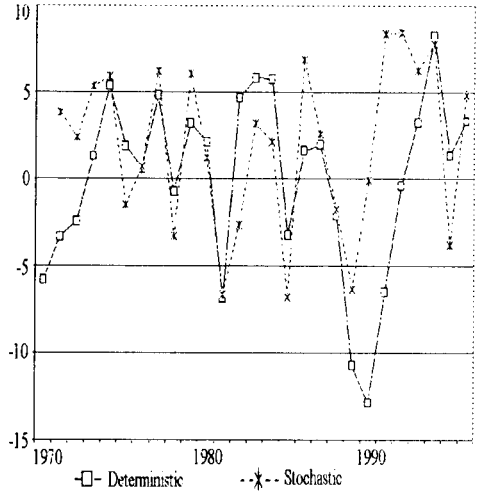
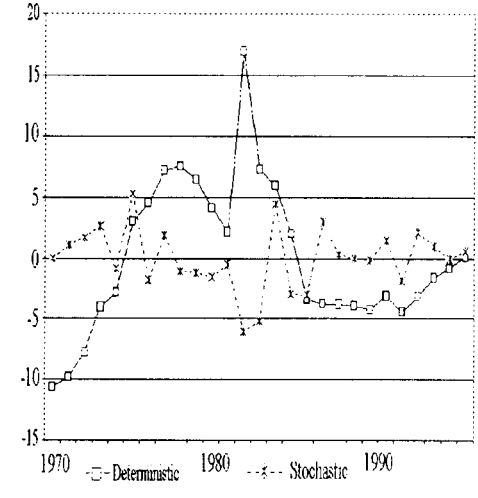
## Appendix

*Graph 1*
*GDP Fluctuations (%)*

*Argentina*




*Bolivia*



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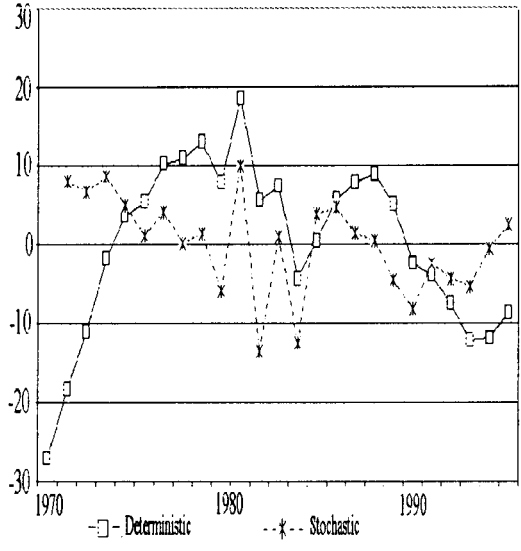


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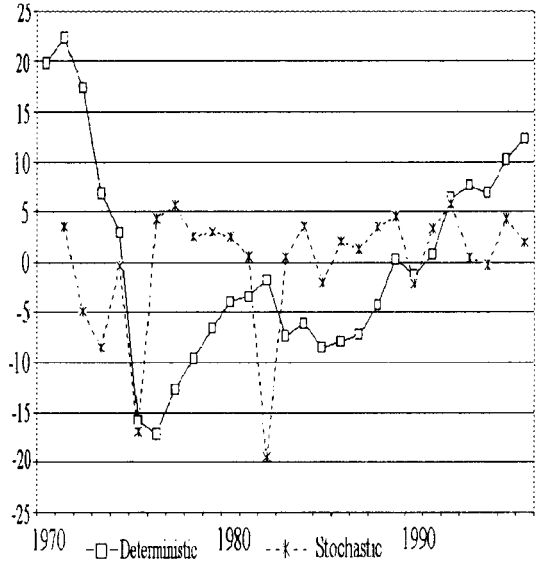

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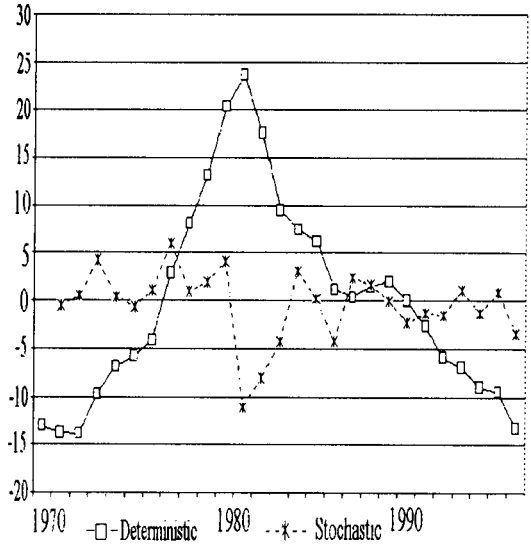


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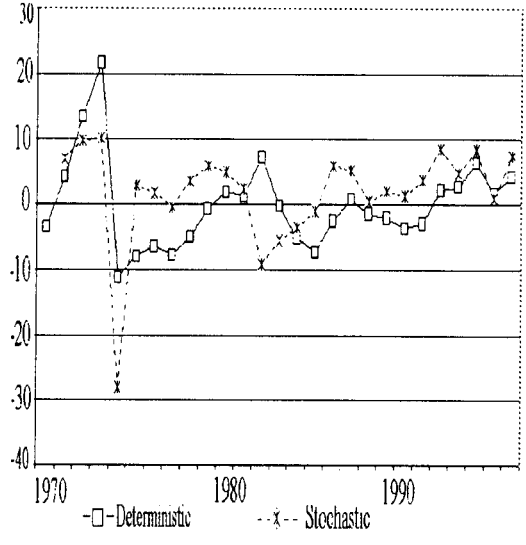
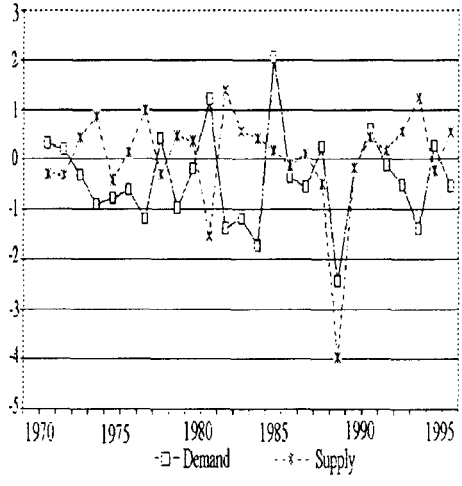
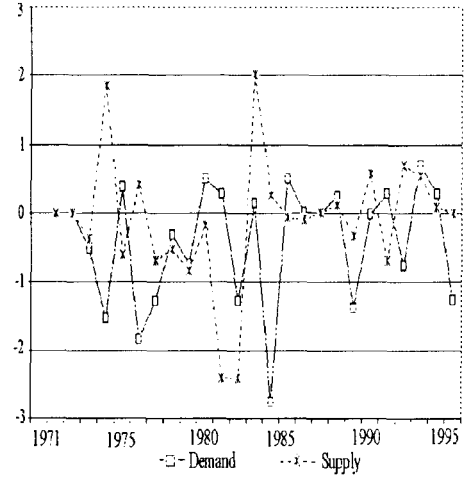


*Graph 2*
*Demand and Supply Shocks (%)*

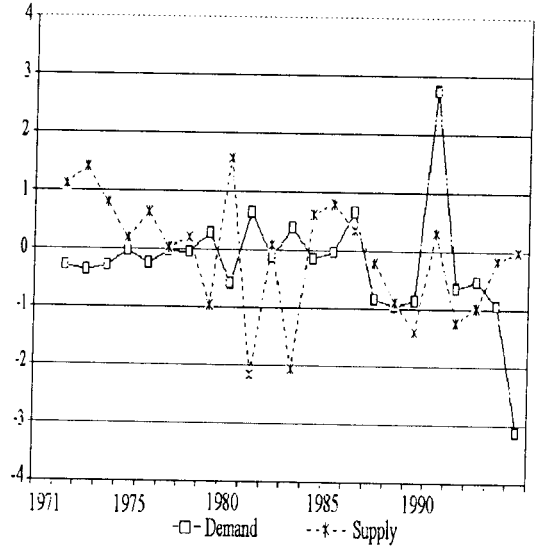
*Argentina*




*Bolivia*



*Brazil*

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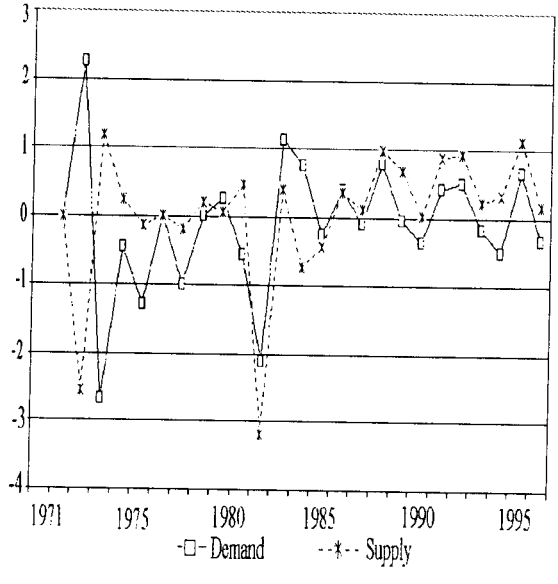

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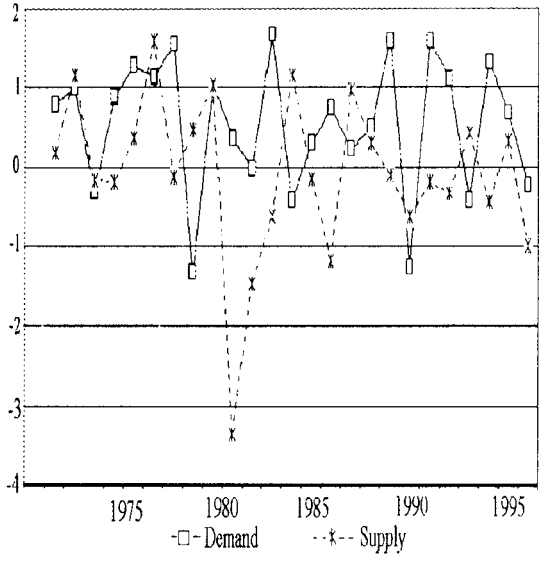


*Uruguay*