

## CLASSICAL BUSINESS CYCLES IN AMERICA: ARE NATIONAL BUSINESS CYCLES SYNCHRONISED?

MEJÍA-REYES, Pablo\*

---

### Abstract

This paper provides further evidence on the synchronisation between business cycle regimes in seven American countries by using a classical business cycles approach. Despite recent increasing international economic transactions within this continent, our results suggest that national business cycles are largely idiosyncratic, except for the United States and Canada. Thus, international coordination of macroeconomic policies may not be effective, at least in the short-run. Also, as a by product, we find evidence of asymmetries between expansions and recessions in mean, volatility and duration in most countries.

JEL classification: C51

Key words: Business cycle regimes, international synchronization, North America, South America.

---

### 1. Introduction

The last two decades have experienced a strong revival of both national and international business cycles analyses. In particular, it is now widely recognised that movements in macroeconomic aggregates are related among countries due to any of the following reasons. First, country-specific shocks can be rapidly transmitted to other countries through trade and capital markets transactions. Second, a group of countries may experience common shocks that

---

\* Pablo Mejía-Reyes, El Colegio Mexiquense, A. C., Ex-Hacienda Sta. Cruz de los Patos, Zinacantepec, México, C. P. 51350. E-mail: [pmejia@cmq.edu.mx](mailto:pmejia@cmq.edu.mx). This paper is a simplified version of Mejía-Reyes (2004).

*Acknowledgement:* The author would like to thank comments from María-Carmen Guisán and research assistance by J. Alonso Martínez Gómez and Wendy L. Rendón Balboa. Remaining errors are responsibility of the author.

affect to all of them in the same manner. Third, shocks to specific sectors may cause co-movement in aggregate output if economic structures of the countries involved are similar (see Loayza, et. al., 2001, and references there in). Indeed, recent research has reported a positive correlation of output across developed countries (see for example Baxter and Kouparitsas, 2003; Christodoulakis, et. al., 1995).

The analysis of international co-movement of economic fluctuations has received substantial attention in the context of the European Union emergence and recent enlargement since the existence of business cycles synchronisation facilitates the implementation of common economic policies and institutions. In particular, if business cycles are synchronised, common international policies can have symmetrical effects on the members of the monetary union<sup>1</sup> (Escaith, 2004; Jacobo, 2000; Christodoulakis, et. al., 1995). Thus, some papers have analysed this subject for two of the most important sub-regions of America, namely, North America (NA) and South America (SA). Yet most papers have used the traditional methodology proposed by Kydland and Prescott (1990) or more sophisticated methodologies that are linear in essence (see below)<sup>2</sup>. The Kydland and Prescott's (1990) methodology has been criticised by Canova (1998) who argues that the nature of business cycle characteristics depend on the filter used to remove the trend. Whilst, several recent papers have criticised the linearity assumption as inconvenient to address turbulent economic episodes, for example. Thus, the last two decades have also witnessed a re-emergence of the Burns and Mitchell's (1946) view of the business cycle in the sense that business cycle regime properties are important

---

<sup>1</sup> In fact, the recent experience of North America has shown that formal monetary integration is not necessary for the US economic policy to affect the other countries' performance since their business cycles have become highly synchronised.

<sup>2</sup> See for example the papers by Michelis (2000) and Murray (1999) for the case of the North American Free Trade Agreement, and Belke, et. al. (2002) and Hochreiter, et. al. (2002) for an analysis of the experience of MERCOSUR.

to be explicitly considered. This literature has emphasised the existence of asymmetries in mean, variance and duration between recessions and expansions. Different approaches have been proposed to characterise and model business cycle regime characteristics, and some of them have been used to address international business cycles synchronisation<sup>3</sup>.

In the Latin American context, several studies analysing business cycles have been published during the last ten years. Although all of them have done important contributions to the understanding of business cycles nature in this region, most of them ignore business cycle regime characteristics<sup>4</sup>. Furthermore, there is no consensus about the nature and magnitude of the links between the economic fluctuations of these economies. For example, Ahmed (2003); Mejía-Reyes (2003); Cerro and Pineda (2002); Loayza, et. al. (2001), and Arnaudo and Jacobo (1997) conclude that national business cycles are largely idiosyncratic and that they mainly respond to country-specific shocks. On the contrary, Hecq (2003) and Engle and Issler (1993) find that major Latin American countries share long and short-run co-movements. It is important to stress that although these papers use different methodologies and sample countries and periods and obtain different conclusions, they all expect that recent increasing international transactions will cause the business cycles to become more synchronized in the future. In this context, we attempt to contribute to the subject of to what extent business cycles are synchronised in America by applying a classical business cycles methodology, which emphasises business cycle regime characteristics<sup>5</sup>. This approach has the advantage of dealing with this issue by measuring synchronisation in the business cycle regimes rather than in the business cycle fluctuations themselves. In particular, we use a classical business cycles approach in the spirit of Burns and Mitchell (1946) due to Artis, Kontolemis and Osborn (1997) to date turning points, analyse asymmetries between

---

<sup>3</sup> See Potter (1999) for an overview.

<sup>4</sup> See Mejía-Reyes (2003) for a review of the literature.

<sup>5</sup> Mejía-Reyes (2003) uses an annual version of this approach for analysing the experience of some Latin American countries for the period 1950-1995.

expansions and recessions -in terms of magnitude, duration, and volatility-, and measure international synchronisation of business cycle regimes. To do so, we apply this methodology to the level of monthly industrial production indexes for seven American countries to identify and characterise classical business cycles.

This paper is organised as follows. In Section 2 we describe the data set and show the general characteristics of the series. In Section 3 we present the methodology, while in Section 4 we use it to analyse the classical business cycles and their synchronisation in the continent. Finally, we state some conclusions in Section 5.

## **2. Basic statistical characteristics**

We consider the experience of seven American countries: Canada, Mexico, the United States (US), Brazil, Chile, Colombia and Peru. Our choice of the countries was mainly based on data availability. Yet, our sample includes countries belonging to two of the most important regions in America, namely, North America and South America, whilst these countries actually have the largest economies in the continent. The analysis is performed for the monthly industrial or manufacturing production index and the largest possible sample period is 1960-2001<sup>6</sup>. Table 1 summarises the data using descriptive statistics and augmented Dickey-Fuller (ADF) unit root tests.

The descriptive statistics show great heterogeneity in the behaviour of output across countries, though output of countries belonging to the same region show closer patterns. In particular, the average growth rates of output of the three countries of North America were greater than those of the South American countries: in the former

---

<sup>6</sup> The data set has been obtained from the *International Financial Statistics* of the International Monetary Fund. For Brazil, the Manufacturing Production Index is used, while for the rest of the countries the Industrial Production Index is employed. The sample periods are as follows: Canada, Chile and the United States, 1960-2001; Mexico, 1970-2001; Brazil, 1975-2001; Peru and Colombia, 1980-1998.

region the growth rates were above 3% per annum, while in SA were between 2 and 3%.

Table 1.Characteristics of Production, 1960-2001 Basic statistics:  
Annualised growth rates

|                      | Canada | Mexico | USA         | Brazil       | Chile      | Colombia | Peru       |
|----------------------|--------|--------|-------------|--------------|------------|----------|------------|
| Mean                 | 3.5    | 3.9    | 3.3         | 2.2          | 2.9        | 2.3      | 0.6        |
| Variance             | 5.1    | 5.9    | 4.8         | 7.5          | 9.4        | 5.3      | 14.5       |
| Skewness             | -0.8   | -0.8   | -0.8        | -0.7         | -1.9       | -0.7     | -0.9       |
| Excess Kurtosis      | 4.1    | 3.5    | 3.6         | 2.9          | 10.9       | 3.9      | 4.0        |
| Median               | 4.1    | 5.0    | 4.2         | 4.0          | 3.6        | 2.7      | 2.2        |
| Minimum              | -16.4  | -13.4  | -13.4       | -20.5        | -52.4      | -17.8    | -50.4      |
| Maximum              | 17.4   | 17.3   | 12.5        | 16.3         | 28.0       | 14.0     | 31.8       |
| p-value              | 0.000  | 0.000  | 0.007       | 0.006        | 0.000      | 0.099    | 0.000      |
| ADF level (log)      | -2.71  | -2.49  | -3.64<br>** | -3.35<br>*** | -1.90      | -0.05    | -2.29      |
| ADF First difference | -5.76* | -6.42* | -7.79<br>*  | -21.4<br>*   | -20.0<br>* | -10.36*  | -5.37<br>* |

The unit root tests on levels were undertaken including a constant and a trend; tests on first differences were carried out including only a constant. The critical values are those of Davidson and Mackinnon (1993, Table 20.2). \*\*\*, \*\* and \* means significant at 10, 5 and 1%, respectively. The number of lags used in the tests in levels and in first differences was as follows: Canada, 12 and 11; Mexico, 7 and 6; United States 5 and 4; Brazil, 2 and 0; Chile, 2 and 1; Colombia, 3 and 2; Peru, 8 and 7.

It is interesting to observe that Mexico has the greatest average growth rate in the whole sample (3.9%), while Peru has the poorest performance regarding growth (0.6% per annum in the average). On the other hand, in general, the variances of the growth rates show a large volatility in Latin American economic growth. We can observe that the Latin American economies have been more volatile<sup>7</sup> (as

<sup>7</sup> It is interesting to observe that the Colombian economy has exhibited a notable stability over a rather turbulent environment for other economies of the region. See Urrutia (1991) for an explanation of the economic performance of this economy.

measured by the variance of the growth rates) than the two developed economies considered in our ample, namely, the US and Canada. Once again, Peru has the poorest performance, exhibiting the largest variance, while the US shows the best performance. Similar conclusions can be drawn from the range of variation of the growth rates: Peru has the worst performance (82 percentage points), while the US has the best one (30 percentage points). Yet, it calls our attention the fact that Chile has a similar range of variation to that of Peru. Analogously, Mexico, Brazil and Colombia have values closer to those of Canada.

On the other hand, it is important to state that asymmetric behaviours had been detected for countries such as the United States and the United Kingdom since the first third of the 20<sup>th</sup> Century. For example, Mitchell (1927) claimed that *“the most violent declines exceed the most considerable advances .... Business contractions appear to be a briefer and more violent process than business expansions”*, while Keynes (1936, p. 314) argued that *“... the substitution of a downward for an upward tendency often takes place suddenly and violently, whereas there is, as a general rule, no such sharp turning point when an upward is substituted for a downward tendency”*.

The claims of Mitchell and Keynes imply that economic downturns are brief and severe, whereas upturns are longer and more gradual. DeLong and Summers (1986) have pointed out that this implies the existence of a significant skewness in a frequency distribution of the growth rates of output (that is, the distribution should have significantly fewer than half its observations below the mean) and the median output growth rate should exceed the mean by an important amount. In addition, they indicate that when the kurtosis is significant there may be important outliers<sup>8</sup>.

---

<sup>8</sup> For a symmetrical distribution about its mean, the skewness is zero and for a symmetrical (unimodal) distribution, the mean, median and mode are equal. A distribution is negatively skewed if the left tail is longer. Then mode > median > mean. A peaked curve is leptokurtic, as opposed to a flat

These statistical properties of asymmetry can be evaluated with the information presented in Table 1: 1) First, we observe that the largest annual downturns are more severe than the largest yearly upturns, which can be inferred from the fact that, except in the cases of Canada and Mexico, the minimum annualised growth rate value is greater than the maximum annualised growth rate value in absolute terms. 2) Second, consistently with the claims of DeLong and Summers, the skewness is negative and the median is greater than the mean for all economies. 3) Third, there is excess of kurtosis in all the cases, especially in the Chilean one, which may reflect the importance of the minimum growth rates (which are twice the absolute value of the maximum growth rates). This information allows us to draw preliminary evidence on the existence of asymmetries in the cyclical fluctuations of these American countries. More formal methods will be used below.

In summary, three important considerations can be drawn from the previous information: 1) First, except in the Peruvian case, these economies have experienced sustained growth, although at not constant rates<sup>9</sup>. The experience of Peru has been quite dramatic given that episodes of sustained recovery have been followed by severe falls in the economic activity. 2) Second, the performances of the output production have shown great volatility. This characteristic can be observed either in the amplitude of the variations of the growth rates and in the huge negative values of the annualised growth rates in specific periods<sup>10</sup>. Once again, the high volatility of the Peruvian

---

one (platykurtic), relative to one that is mesokurtic. The kurtosis for a mesokurtic curve is 3 (see Salvatore, 1982).

<sup>9</sup> See Mejía-Reyes (2004) for further comments and for a graphical representation of the output performance of these countries.

<sup>10</sup> It has been argued that once the crisis started in 1981-1982, business cycles in Latin America might be characterised on the basis of “go” and “stop” policies, which have been closely related to the stabilisation policies and to responses to exogenous shocks (see Hamann and Paredes, 1991). A detailed explanation of the business cycle episodes for each country in our sample is beyond the aims of this paper. See Edwards (1995), Guisán and Aguayo (2001, 2002), San-Millán and Rodríguez (2002) and Mejía-Reyes

economy is evident. 3) Third, the skewness and kurtosis values and the relationship between medians and means suggest the importance of asymmetries in the dynamics of cyclical fluctuations in Latin American countries.

A better knowledge of the nature of the trend of the series aforementioned requires further analysis. Thus, let us say that until the early 1980s it was accepted that economic series could be characterised as the sum of two components: a deterministic trend reflecting a stable long-run growth path and a cyclical component fluctuating around that trend. According to this view, the stochastic component of the series would be associated with the latter. The evidence presented by Nelson and Plosser (1982) changed this belief. They show that most US economic series are characterised by a process with a unit root, or are integrated of order 1,  $I(1)$ , which implies that those series are non-stationary rather than stationary or  $I(0)$  (possibly around a deterministic trend). The break with the previous view was strong: since then it has been accepted that series can have stochastic trends driven by current shocks, either real or monetary and testing for the nature of the trends has become a common preliminary practice in the dynamic empirical analysis.

We apply augmented Dickey-Fuller unit root tests to evaluate whether the levels of the logarithm of the series are stationary around a deterministic trend or whether the first difference of the logarithms are stationary around a constant level. Because under the null hypothesis the asymptotic distribution of the relevant estimated coefficient is not Normal, traditional test statistics are not valid. Then the relevant  $t$ -statistic has to be contrasted with the critical values, corresponding to each model, presented in Davidson and McKinnon (1993). The results for the logarithm and the first difference of real GDP per capita of the countries analysed are shown in Table 1. There is no evidence to reject the null hypothesis of a unit root in most cases (the evidence for Brazil is rather weak, since the null can be

---

(2003) for analyses of the business cycles and economic performance of several Latin American countries over the 20<sup>th</sup> century.



rejected only at 10% of significance). The US output level is the unique variable that appears to be stationary around a deterministic trend. Consequently, it can be concluded that in general the variables in levels are not stationary around a deterministic trend or, equivalently, that they have stochastic trends. In strictly statistical terms, this means that the current shocks experienced by the series accumulate over time, which forces the series to go away from the trend. This implication is especially important because it offers evidence of the permanent nature of the effects of current fluctuations on the long-run behaviour of the economy. Because in most cases there is no evidence to reject the null of a unit root in the levels of the series, we then test whether the first difference is  $I(1)$ . The results are shown in Table 1 as well. The results suggest that this transformation is stationary or, equivalently, that the level of the variables is difference stationary or  $I(1)$ . This result implies that the first difference of logarithm of the variables fluctuates around a constant mean, which can be zero.

### 3. Classical business cycles

In this section we outline the basic concepts of the classical business cycles approach and present the methodology to date the turning points – and the corresponding regimes – of the business cycle as well as the strategy to measure international business cycle regimes synchronisation.

*3.1. Concepts and methodology to date turning points:* In this section we introduce the methodology proposed by Artis, Kontolemis and Osborn (1997, hereafter AKO), which follows the spirit of Burns and Mitchell (1946). The main advantage of the AKO methodology is that it generates turning points very close to those of the National Bureau of Economic Research (NBER) and it is based only on a univariate analysis whereas the NBER's dating process is based on the analysis of different series according to distinct methodologies<sup>11</sup>.

---

<sup>11</sup> The NBER is an organisation with a long tradition in the analysis of US business cycles. See Moore and Zarnowitz (1986) and Boldin (1994) for a

AKO use a classical business cycle approach in which periods of expansion and contraction are represented in the level of activity<sup>12</sup>. From the evidence presented above, we justify this practice on the basis of three considerations. First, after the paper of Nelson and Plosser (1982), increasing evidence has accumulated about the existence of stochastic trends, which implies that the trend reversion property no longer holds. Second, it has been shown that different de-trending methods may yield different growth cycle chronologies, and that commonly used de-trending methods may induce spurious cycles (Canova, 1998). Third, the alternative methodology of growth cycles implies cycles that are more symmetric in duration and amplitude than the approach applied in this paper (see also Mejia-Reyes, 2003).

Given that the regimes of the cycle are inferred primary from the level of economic activity and following to Boldin (1994), we can define the turning points as follows: a *peak* refers to the period immediately preceding a decline in real activity, or *recessions*, while a *trough* refers to the period immediately preceding an upturn, or *expansion*. In turn, the *period* or *duration* of a cycle is the length of time required for the completion of a full cycle and may be measured by the time between two successive peaks or two successive troughs. It is important to emphasise that we will consider a decline as a recession only when an identified peak precedes it and we will consider an upturn as expansion only when it is preceded by a trough. Otherwise, we will talk just about downturns or declines and upturns or revivals, respectively.

The methodology used in this paper, and detailed in Artis, et. al. (1997), can be summarised in the following steps. In step one, extreme values are identified and replaced because we are interested in looking for broad upward and downward movements and we do not want these values to influence the procedure. An extreme value is

---

brief description of the decision procedure to date turning points of this organisation.

<sup>12</sup> This approach contrasts with the alternative growth cycles approach in which periods of “expansion” and “contraction” are represented as cyclical movements around a trend.

defined as that whose (log) change compared with both adjacent observations is greater than 3.5 standard errors of the (log) differenced series; extreme values are replaced by the arithmetic average of the two corresponding adjacent observations. In step two, original values are smoothed by using a centred moving average of seven periods to reduce the importance of short-run erratic fluctuations. Turning points are tentatively defined in this smoothed series by the identification of points higher (peaks) or lower (troughs) than twelve periods on either side, with peaks and troughs required to alternate. In Step three, we return to the unsmoothed series and use similar rules to identify tentative turning points, with the additional requirements that the amplitude of a phase be at least as large as one standard error of the monthly log changes and the duration of a cycle be at least fifteen months. The final stage compares the two sets of tentative turning points: when there is a close correspondence between the two sets of tentative turning points ( $\pm 5$  months), the existence of a turning point is confirmed and dated as that identified in the unsmoothed (original) series.

*3.2. Measuring international synchronisation of business cycle regimes:* An implication of the Burns and Mitchell's definition of business cycle to an international context would imply the existence of co-movements in macroeconomic aggregates across countries "...that organise their work mainly in business enterprises...". In this section we present the methodology due to Artis, et. al. (1997) to measure the *synchronisation between the regimes* of the business cycle. Thus, we adopt a non-parametric procedure that ignores the magnitude of the change in the level of the series and considers only the direction of the underlying movements implied by the turning points chronologies defined according to the methodology outlined above. By doing so, we are able to measure the extent to which the cycles uncovered are contemporaneous international phenomena. The classical business cycle chronologies defined in the previous section are used to create a binary time series variable for each country, denoting periods of expansion by zeros and periods of recessions by ones. For a pair (country  $i$ , country  $j$ ) over the sample period, we obtain a 2x2 contingency table recording expansions/recessions

frequencies. The possible combinations of regimes are shown in Table 2.

Table 2. Contingency table for business cycle regimes

|                  |           | Country <i>j</i> |           |          |
|------------------|-----------|------------------|-----------|----------|
|                  |           | Expansion        | Recession | Subtotal |
| Expansion        |           | $n_{00}$         | $n_{01}$  | $n_{0.}$ |
| Country <i>i</i> | Recession | $n_{10}$         | $n_{11}$  | $n_{1.}$ |
| Subtotal         |           | $n_{.0}$         | $n_{.1}$  | $N$      |

The information of this table will allow us to measure the association between the classical cycle regimes of different pairs of countries by using the a variant of the conventional contingency table statistic named the Pearson’s corrected contingency statistic (expressed as a percentage and ranging between 0 and 100). This coefficient,  $CC_{corr}$  is defined as follows<sup>13</sup>:

$$CC_{corr} = \sqrt{\frac{\hat{c}^2}{N + \hat{c}^2} \frac{100}{\sqrt{0.5}}}$$

where

$$\hat{c}^2 = \sum_{i=0}^1 \sum_{j=0}^1 \frac{[n_{ij} - n_{i.}n_{.j}/N]^2}{n_{i.}n_{.j}/N} \quad (2)$$

where  $n_{ij}$ , for  $i, j = \{0,1\}$ , represents the number of periods at which both countries are in recession, expansion, recession and expansion, or expansion and recession, and  $N$  is the total number of observations. The interpretation of the corrected contingency coefficient is as follows: if the two binary variables are independent and  $n_{ij} = n_{i.}n_{.j}$ , then  $CC_{corr} = 0$ , whilst with complete dependence, that is with  $n_{ij} = n_{i.} = n_{.j}$ , it can be shown that  $CC_{corr} = 100$ . In the context of the business cycle regimes synchronisation, independence implies that there is no contemporaneous relationship between the business

---

<sup>13</sup> Artis, et. al (1997) argue that the maximal attainable value of the Pearson’s contingency coefficient is determined by the dimension of the contingency table. Thus, its maximal value for a 2 x 2 table is  $\sqrt{0.5}$ . Then, they use this corrected version.

cycle regimes (expansion/recession) for the two countries. At the other extreme, complete dependence indicates that the two countries are in the same regime for every time period and hence they have identical business cycle turning point dates.

#### **4. Empirical results**

*4.1. Turning points and business cycle regime characteristics:* The methodology described above was applied to date the turning points of Canada, The United States and Mexico, in North America, and Brazil, Chile, Colombia and Peru in South America. According to the AKO methodology, we looked for extreme values and found none. Given the high volatility of the output series, the smoothing transformation in step two has been very important for the deletion of several potential turning points in the unsmoothed series. When comparing the smoothed with the unsmoothed series, it can be observed its utility for the elimination of short run fluctuations, especially in the cases of Brazil and Peru.

In steps three and four, turning points are identified. The requirement that the amplitude of the phase has to be at least equal to a one standard deviation of the difference (in logs) was applied. The resulting set of turning points was compared with that corresponding to the smoothed series. Turning points in the original series that do not correspond to turning points in the smoothed series were not considered further. Peaks and troughs dates and characteristics of the derived regimes are presented in Tables 3 and 4. As a point of comparison, let us contrast the turning points reported by Artis, et. al. (1997) for the US and Canada with those presented here. It is interesting to observe that in the former case the output series has a declining performance at the beginning of the sample, which actually corresponded to a recession period according to our results. So, in contrast with Artis, et. al. (1997), we date a trough in 1961.02 for the US.

Table 3. Classical Business Cycles Chronologies, 1960-2001

|        | Canada | Mexico | US    | Brazil | Chile | Colombia | Peru  |
|--------|--------|--------|-------|--------|-------|----------|-------|
| Trough |        |        | 61.02 |        |       |          |       |
| Peak   |        |        | 69.10 |        |       |          |       |
| Trough |        |        | 70.11 |        |       |          |       |
| Peak   | 74.05  |        | 73.11 |        | 71.09 |          |       |
| Trough | 75.05  |        | 75.03 |        | 75.08 |          |       |
| Peak   | 79.09  |        | 79.06 |        |       |          |       |
| Trough | 80.06  |        | 80.07 |        |       |          |       |
| Peak   | 81.06  | 81.09  | 81.07 | 80.09  | 80.12 |          | 81.02 |
| Trough | 82.12  | 83.11  | 82.12 | 83.02  | 82.10 | 82.10    | 83.10 |
| Peak   |        |        |       |        | 84.06 |          |       |
| Trough |        |        |       |        | 85.05 |          |       |
| Peak   | 86.01  | 85.07  |       |        |       |          |       |
| Trough | 86.08  | 86.09  |       |        |       |          |       |
| Peak   |        |        |       | 87.02  |       |          | 87.08 |
| Trough |        |        |       | 88.10  |       |          | 88.11 |
| Peak   | 89.04  |        | 89.04 | 89.06  | 89.12 | 90.04    | 89.12 |
| Trough | 91.02  |        | 91.03 | 92.06  | 90.05 | 91.05    | 90.11 |
| Peak   |        |        |       |        |       |          | 91.07 |
| Trough |        |        |       |        |       |          | 92.07 |
| Peak   |        | 94.06  |       | 94.12  |       | 95.11    |       |
| Trough |        | 95.07  |       | 98.12  |       | 96.11    |       |
| Peak   | 00.08  | 00.07  | 00.06 | 01.12  |       | 98.04    | 97.04 |

The other difference is that we date a peak in 1979.06 while the other authors do in 1980.03. The rest of the turning points are exactly the same. In the case of Canada, we missed the cycle these authors identify at the beginning of the sample, which they characterise as a minor recession<sup>14</sup>. The other turning points match very closely with a

---

<sup>14</sup> This is an example of the importance of the smoothing transformation, given that the criterion of the amplitude of a phase to be at least 1 standard error of the monthly log changes was not met.

maximum difference of 2 months in four cases<sup>15</sup>. The last turning point in Table 3 for both countries is not covered by the sample period of these authors.

Then we applied this methodology for the Latin American countries in the sample. It is important to emphasise that there is not an equivalent institution to the NBER in any of these countries, so it is not possible to compare the turning points obtained here. In fact, the turning points reported in this paper could be considered as a contribution to the analysis of the business cycles in this region. The turning point dates for Latin America (LA) are reported in Table 3 also. From these results some general features can be highlighted. First, it can be observed that for the three countries for which the sample period starts in the early 1970s, only Chile experience a business cycle in that decade: we detect peak in September of 1971 and a trough in August of 1975<sup>16</sup>. Second, all Latin American countries experienced a recession that started in the early 1980s and that is associated to the external debt crisis. Although the original causes of this recession differed among countries, most of them were in crisis in 1982-1983<sup>17</sup>. Third, Brazil and, especially, Peru seem to have a different business cycles pattern in the sense that they exhibit more cycles over the sample than the other Latin American countries. In the case of Peru, the economy had a poor performance given that frequent fluctuations coupled with large falls in the economic activity that translated into a non-increasing long-run trend. Fourth, in general, the Latin American economies experience a greater number of fluctuations than the other two developed countries in the sample,

---

<sup>15</sup> The turning points of Artis, et. al. (1997) and ours, respectively, are as follows: 1974.03 and 1974.05, 1979.08 and 1979.09, 1981.04 and 1981.06, and 1982.10 and 1982.12.

<sup>16</sup> This recession has been associated to the uncertainty and economic policies of the government of socialist president Salvador Allende as well as to the restrictive stabilisation policies implemented by the military government of Augusto Pinochet. See Edwards and Cox-Edwards (1991) for a complete analysis of the Chilean economy.

<sup>17</sup> For example, the falls in mineral prices (especially of tin and copper) in the middle and late 1970s affected especially to Bolivia and Chile while the increases in oil prices in the late 1970s benefited Mexico and Venezuela.

especially the US. Finally, some business cycle regimes seem to be particular for some countries, such as the recessions of Chile in 1971-1975 and 1984-1985 and Mexico in 1985-1986.

Table 4. Classical Business Cycles Characteristics, 1960-2001  
(Complete Business Cycles)

|          | Expansions    |          |     | Recessions    |          |     | Cycles |
|----------|---------------|----------|-----|---------------|----------|-----|--------|
|          | Annual Change |          | (3) | Annual Change |          | (6) |        |
|          | Average       | Variance |     | Average       | Variance |     |        |
| Canada   | 0.50          | 0.02     | 49  | -0.66         | 0.02     | 13  | 62     |
| Mexico   | 0.63          | 0.02     | 57  | -0.85         | 0.02     | 18  | 75     |
| US       | 0.53          | 0.01     | 65  | -0.60         | 0.01     | 16  | 81     |
| Brazil   | 1.00          | 0.09     | 27  | -0.59         | 0.10     | 33  | 60     |
| Chile    | 0.91          | 0.11     | 46  | -1.06         | 0.15     | 21  | 67     |
| Colombia | 0.52          | 0.03     | 53  | -0.62         | 0.05     | 13  | 66     |
| Peru     | 1.56          | 0.19     | 31  | -2.08         | 0.23     | 18  | 49     |
| NA       | 0.55          | 0.02     | 57  | -0.70         | 0.02     | 16  | 73     |
| SA       | 1.00          | 0.11     | 39  | -1.09         | 0.13     | 21  | 61     |
| LA       | 0.92          | 0.09     | 43  | -1.04         | 0.11     | 21  | 63     |

Note: Columns (3), (6) and (7) show the corresponding duration in months.

In Table 4 the characteristics of complete regimes are presented<sup>18</sup>. This information allows us to evaluate the claims of Mitchell (1927) and Keynes (1936) regarding regime-dependent characteristics of the business cycle for NA, SA and LA. In particular, it can be observed the type of asymmetries documented in the literature. Both SA and LA exhibit asymmetries in mean, variance and duration: the average annual growth rates in expansions (1 and 0.92%, respectively) are lower than the average annual growth rates in recession in absolute value (-1.09 and -1.04%, respectively), the variance of expansions (0.11 for SA and 0.09 for LA) is lower than that of recessions (0.13 for SA and 0.11 for LA), and the duration of expansions is greater than that of recessions (39 months versus 21 in SA and 43 months

---

<sup>18</sup> The use of complete regimes implies that expansions or recessions in progress at the beginning and end of the sample period are excluded.



versus 21 in LA, respectively). In the case of NA, there are only asymmetries in mean and duration between expansions and recessions. Comparisons across regions suggest that NA has had a better performance than SA since in the former expansions last for longer and are less volatile, while recessions are less deep and volatile and shorter than in the latter region. Notice also that the whole business cycle duration is longer in NA because expansions last for more months than in SA.

With respect to the average growth rates of specific countries, in six out of seven cases, the absolute value of growth during recessions is greater than that during expansions, which makes the Brazilian case a clearly different experience. In turn, in four out of seven countries the variance during recessions is different and greater than the variance during expansions. Yet, notice that variances in all these cases are quite high compare to those of North American countries, in which cases there is not such an asymmetry. On the other hand, the duration of recessions is shorter than expansions in all cases, except once again in the Brazilian case. This information gives us a more complete picture of the Brazilian experience: the average growth rate during expansions is greater than that during recessions, but expansions are shorter than recessions. Even more, the volatilities of both recessions and expansions are very close to each other. These features may help to understand the difficulties of this economy to grow over the last three decades. Regarding Peru, the poor long-run performance may be linked to the large falls experienced during the recessionary episodes. In summary, on the basis of a classical business cycles approach we can conclude that economic dynamics over the business cycle exhibits significant asymmetries, especially in LA, which is consistent with the evidence reported by other authors using alternative methodologies<sup>19</sup>. This is an interesting result because most studies on business cycles in LA have not explicitly considered the properties of recessions and expansions. Thus it is

---

<sup>19</sup> See Mejía-Reyes (2003) for the use of different methodologies for measuring and modelling business cycle asymmetries for a set of Latin American countries, and references there in.

important to have in mind the possibility that these economies might function differently in recessions and expansions.

4.2. *International synchronisation*: Preliminary information about the relationships among American countries is presented in Table 5.

Table 5. Correlation and Pearson's Corrected Contingency Coefficients for the Complete Sample: 1960-2001

|          | Canada | Mexico | US   | Brazil | Chile | Colombia | Peru |
|----------|--------|--------|------|--------|-------|----------|------|
| Canada   | -      | 13.9   | 82.7 | 25.3   | 41.2  | 36.8     | 16.1 |
| Mexico   | 49.1   | -      | 20.1 | -11.4  | -3.4  | 2.7      | 6.6  |
| US       | 80.1   | 28.8   | -    | 15.6   | 49.3  | 37.3     | 10.5 |
| Brazil   | 31.3   | 9.9    | 31.3 | -      | 10.2  | 19.8     | 44.0 |
| Chile    | 36.6   | 5.7    | 28.3 | 16.0   | -     | 38.8     | -3.0 |
| Colombia | 52.5   | 3.8    | 58.3 | 49.3   | 39.4  | -        | 33.0 |
| Peru     | 24.9   | 13.2   | 25.9 | 62.9   | 34.0  | 24.7     | -    |

Conventional sample correlation coefficients for annual growth rates of output over the sample period are shown on the upper block. We observe that correlation coefficients measuring the association between economic fluctuations of Latin American countries are rather moderate – the largest one refers to the relationship between Brazil and Peru (44%) and Colombia and Chile (38.8%) – and range from a negative value of -11.4% (for Mexico and Brazil) to the aforementioned value of 44%. On the contrary, the largest correlation coefficients correspond to the links between the two developed countries in our sample with a correlation coefficient of 82.7%. It is interesting to note that the Chilean economic fluctuations are more correlated to the fluctuations of the two developed countries in the sample (41.2% for Canada and 49.3 for the US) than to those of the Latin American countries (except Brazil). To characterise the associations among the annual growth rates across countries, we define arbitrary ranges for the correlation coefficients. We consider that there exists a “strong” association when the coefficient is greater than 60% and that there exists a “mild” association when the coefficient lies between 40 and 60%. Otherwise we say that there is a “low” association between economic fluctuations. Thus, regarding

geographical areas we can say that in NA there is a strong association only between the US and Canada. In turn, in SA there is only a mild association between Peru and Brazil. Interestingly, Chile maintains mild associations with countries outside SA, the US and Canada. Yet, its links with all the Latin American countries are low. The rest of the countries have only low relationships with the others.

Next we present the Pearson's corrected contingency coefficients for the same group of countries analysed above according to expressions (1) and (2). In the calculations, we do not restrict our analysis to complete cycles. For the period prior to the first observed turning point and for the period subsequent to the last observed turning point, we decide whether each economy was in recession or expansion according to two criteria: first, the inclination of the slope of the production series, and second, the requirements of the AKO methodology about the difference between short run erratic fluctuations and turning points. The results related to the calculations of the Pearson's corrected contingency coefficient based on the regimes defined according to these lines are reported on the lower block in Table 5. By applying the same arbitrary ranges for the Pearson's corrected contingency coefficient, we find strong associations between the business cycle regimes only for a couple of North American countries, namely, the US and Canada (80.1%)<sup>20</sup>, and two South American countries, Brazil and Peru (62.9). These strong links between the business cycle regimes of these countries might be explained by the high value of international transactions they carry out among them. In North America, Mexico has a stronger – although mild – association with Canada than with the US (49.1 versus 28.8%), a rather odd result given that Mexico carries out a very high proportion of trade with the latter<sup>21</sup>. These results imply that Mexican business cycles are highly idiosyncratic over the sample period. However, as some authors have pointed out, business cycles

---

<sup>20</sup> These results are consistent with those reported by Michelis (2000) and Murray (1999).

<sup>21</sup> Michelis (2000) finds similar results.

in NA have become more synchronised since the mid-1990s<sup>22</sup>. In general, the only country that has some association with the rest of countries seems to be Colombia: it exhibits a mild association with Canada (52.5%) and the US (58.3%) in NA and with Brazil (49.3%) and Chile (39.4%) in SA. In turn, it is interesting to observe that the relationships of Chile with the US and Canada that we characterise as mild on the basis of the annual growth rates correlations become low when the business cycle regimes and the Pearson's corrected contingency coefficient are used<sup>23</sup>.

The linkages between the business cycle regimes of the rest of countries are quite weak. In particular, the business cycles of Mexico and Chile appear to be essentially independent from the Latin American perspective. Analogously, it is important to point out that the US and Canadian business cycles do not show important direct association with the business cycles of Latin American countries, except with Colombia. This lack of business cycles synchronisation within this region might be due to differences in shocks experienced by each economy as well as in policy responses to those shocks<sup>24</sup>. Because we are working with countries of different sizes, it would be interesting to know whether there exists some association between smaller and larger economies. To do so, we depict the combination of

---

<sup>22</sup> Kose, et. al. (2003) argue that developing countries business cycles are largely independent in general and that country-specific and idiosyncratic components tend to dominate economic fluctuations in "South America", where they include Mexico. Yet, on the other hand, Cuevas, et. al. (2003) argue that the Mexican economic fluctuations have become more synchronised with those of the US.

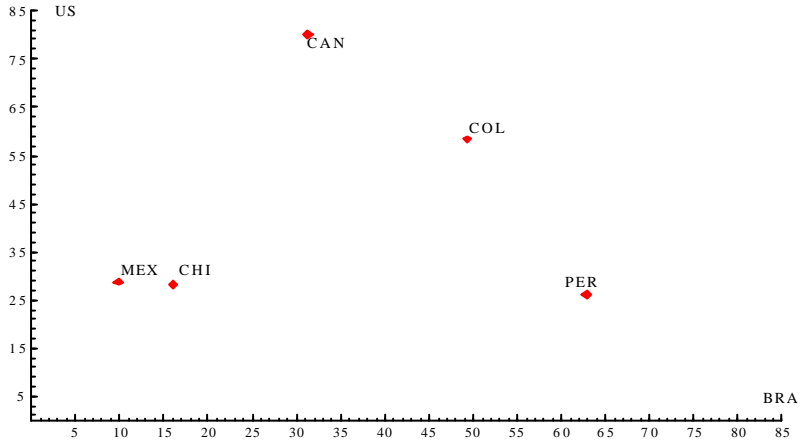
<sup>23</sup> This may indicate the important role that large values can play when measuring relationships between variables rather than between regimes, such as in the case of the recessions that the US and Chile experienced during the mid-1970s.

<sup>24</sup> For example, the earthquake in 1985 and the fall of oil prices in 1985-1986 affected the Mexican economy. In Peru, the natural phenomenon called "El Niño" caused droughts and floods in 1983 while the guerrilla group "Sendero Luminoso" intensified its attacks in the second half of the 1980s. The Asian and Russian financial crisis of 1997 and 1998 had effects mainly on Brazil, Peru and Colombia.

the associations with the largest economies both in NA (the US) and in SA (Brazil) in Graph 1.

Graph 1.

Business cycle regime associations with respect to Brazil and the US



The horizontal and the vertical axes represent the Pearson's corrected contingency coefficient of the countries in the sample with Brazil and the US, respectively. We observe that, except for Colombia, Latin American business cycles have neither mild nor strong association with the US business cycle. The strong association between the US and Canadian business cycle regimes, on the one hand, and the Brazilian and Peruvian ones, on the other, is apparent. It can also be seen that the business cycles of Mexico and Peru are highly idiosyncratic. Our results for the SA countries are qualitatively consistent with those of Arnaudo and Jacobo (1997), who conclude that correlations between economic fluctuations of MERCOSUR countries are low and time-varying. In the same sense, Iguíñez and Aguilar (1998) are not able to find significant correlations among the Andean Group countries over the post-debt crisis period. It is convenient to point out that these two trade agreements are quite recent and that intra-regional trade and investment still keep at low levels, although their importance has

increased rapidly over time<sup>25</sup>. In turn, Kose, et. al. (2003) and Loayza, et. al. (2001) state that cyclical fluctuation in SA are largely idiosyncratic. These findings suggests that the scarce existing synchronisation of international business cycles is not a consequence of international transmission, but a result of common shocks and/or similar economic policies, mainly the restrictive stabilisation policy of the 1980s and 1990s<sup>26</sup>. Engle and Issler (1993), on the other hand, suggest that external shocks have played an important role in Latin American economic performance.

## **5. Conclusions**

We have applied a classical business cycles methodology to date turning points, to analyse asymmetries over the business cycle, and to study international synchronisation of business cycles regimes for some countries in America. An essential feature of this methodology is that distinguishes between short-run declines and recessions and between short-run upturns and expansions. The results suggest the existence of significant asymmetric behaviour over the business cycle for most economies in the sample. In agreement with the considerations of Mitchell (1927), Keynes (1936), and Burns and Mitchell (1946), it is found that economies switch from recessions to expansions and that recessions are characterised by deeper change and less persistence than expansions. In addition, the results are consistent with the findings of Blanchard and Watson (1986) and Kähler and Monet (1992) with respect to the volatility being asymmetric over the business cycle. The implication of these findings is that these economies might function differently in

---

<sup>25</sup> Mejía-Reyes (2002) analyses the flows of goods, services and capitals within Latin America and concludes that these flows have stayed at rather low levels during the last four decades. Similar conclusions are stated by Primo-Braga, et. al. (1994), although they claim that international trade intensity has increased substantially during the last two decades.

<sup>26</sup> Some examples of common shocks are the external debt crisis of 1982, the tequila effect that affected to some countries in 1995, and the slowdown of the US growth in 2000.

expansions and recessions, and these characteristics should be considered in the design of economic policies.

On the other hand, we have found only weak evidence about the existence of an American business cycle, in general, and a Latin American business cycle, in particular. However, we have presented evidence about strong associations between business cycles regimes of Brazil and Peru and the US and Canada, and Colombia and the US and Canada. Yet, existing evidence about intra-regional trade and foreign investment suggests that, for the Latin American countries, these associations might be explained by similar economic policies and common external shocks rather than by international transmission of country specific shocks. For the two developed countries in the sample, international transmission mechanisms seem to have played an important role in the transmission of cycles. Thus, regarding the title of this paper, we conclude that from the business cycle synchronisation point of view, America as a whole does not meet this criterion for further formal economic integration yet. However, it is reasonable to think that after recent free trade agreements and liberalisation of capital markets both in North America and South America factual economic integration will increase, and that transmission mechanisms will play a more important role in the future – recent evidence about an increasing integration of the Mexican economy to the US one provides some support for this view –, which will set the basis for future formal coordination policies and further monetary integration.

## **References**

Ahmed, S. (2003) “Sources of economic fluctuations in Latin America and implications for choice of exchange rate regimes”, *Journal of Development Economics*, Vol. 72, pp. 181-202.

Arnaudo, A. and A. D. Jacobo (1997). “Macroeconomic homogeneity within MERCOSUR: an overview”, *Estudios Económicos*, Vol. 12, Num. 1, pp. 37-51.

Artis, M. J., Z. G. Kontolemis and D. R. Osborn (1997). "Business cycles for G7 European Countries", *The Journal of Business*, Vol. 70, Num. 2, pp. 249-279.

Baxter, M. and M. A. Kouparitzas (2003). "Trade Structure, Industrial Structure, and international Business Cycles", *The American Economic Review*, Vol. 93, Num. 2, pp. 267-272.

Belke, A., D. Gros and K. Geisslreithe (2002). "Monetary Integration in the Southern Cone: Mercosur Is Not Like the EU?", University of Hohenheim / Centre for European Policy Studies / manuscript.

Blanchard, O. and M. W. Watson (1986). "Are business cycles all alike?", in Gordon, R. J. (ed.), *The American Business Cycle*, Chicago: Chicago University Press, pp. 123-156.

Boldin, M. D. (1994). "Dating turning points in the business cycle", *The Journal of Business*, Vol. 67, Num. 1, pp. 97-131.

Burns, A. F. and W. C. Mitchel (1946). *Measuring Business cycles*, Studies in Business cycles, No. 2, New York: NBER.

Canova, F. (1998). "Detrending and business cycles facts", *Journal of Monetary Economics*, Vol. 41, Num. 3, pp. 475-512.

Cerro, A. M. and J. Pineda (2002). "Latin American growth cycles. Empirical evidence 1960-2000", *Estudios de Economía*, Vol. 29, Num. 1, pp. 89-109.

Christodoulakis, N., Dimelis, S. P. and Kollintzas, T. (1995). "Comparison of business cycles in the EC: Idiosyncrasies y regularities", *Economica*, Vol. 62, pp. 1-27.

Cuevas, A., M. Messmacher and A. Werner (2003). "Sincronización macroeconómica entre México y sus socios comerciales del TLCAN", Banco de México, Documento No. 2003-1.



Davidson, R. and J. G. MacKinnon (1993). *Estimation and Inference in Econometrics*, Oxford University Press, Oxford.

DeLong, J. B. and L. H. Summers (1986). “Are business cycles symmetrical?”, en Gordon, R. J. (ed.), *The American Business Cycle*, Chicago University Press, Chicago, pp. 166-179.

Edwards, S. and A. Cox-Edwards (1991). *Monetarism and liberalization. The Chilean experiment*. Chicago University Press.

Edwards, S. (1995). *Crisis and Reform in Latin America*, Oxford and New York: The World Bank, Oxford University Press.

Engle, R. and J. V. Issler (1993). “Common trends and common cycles in Latin America”, *Revista Brasileira do Economia*, Vol. 47, Num. 2, pp. 149-176.

Escaith, H. (2004). “La integración regional y la coordinación macroeconómica en América Latina”, *Revista de la CEPAL*, No. 82, pp. 55-74.

Guisan, M. C. and E. Aguayo (2002). “Economic growth and cycles in Latin American countries in 20<sup>th</sup> century”, *Review on Economic Cycles*, Vol. 4, Issue 1, pp. 1-14.

Guisan, M. C. and E. Aguayo (2001). “Economic development of American and European areas in 1951-99”, *Applied Econometrics and International Development*, Vol. 1, No. 1, pp. 1-10.

Hamann, A. J. and C. E. Paredes (1991). “Economic characteristics and trends”, in Paredes, C. E. and J. D. Sachs (eds.), *Perú's Path to recovery. A Plan for Economic Stabilisation and Growth*, Washington: The Brookings Institution, pp. 41-79.

Hecq, A. (2003). “Common Cycles and Common Trends in Latin America”, University of Maastricht, manuscript.

Hochreiter, E., K. Schmidt-Hebbel and G. Winckler (2002). "Monetary Union: European Lessons, Latin American Prospects", Oesterreichische Nationalbank / Banco Central de Chile / University of Vienna, manuscript.

Iguñiz, J. and G. Aguilar (1997). "Ciclos peruanos, andinos y de Estados Unidos", *Revista Economía*, Vol. XX, No.39-40, pp.165-206.

Jacobo, A. (2000). "Some Empirical Evidence On The Macroeconomic Behavior Of MERCOSUR Countries", in *Supranational Cooperation and Integration. Goods and Services vs Information*, Berlin: P. Lang Publishers, pp. 127-152.

Kähler, J. and V. Marnet (1992). "International business cycles and long-run growth: an analysis with Markov-switching and cointegration models", *Recherches Economiques de Louvain*, Vol. 58, Num. 3-4, pp. 399-417.

Keynes, J. M. (1936). *The General Theory of Employment, Interest, and Money*, London: Macmillan.

Kose, A., C. Otrok and C. Whiteman (2003). "International business cycles: world, region, and country specific factors", *The American Economic Review*, Vol. 93, Num. 4, pp. 1216-1239.

Kydland, F. E. and E. C. Prescott (1990). "Business cycles: real facts and monetary myth", *Federal Reserve Bank of Minneapolis Quarterly Review*, Vol. 14, Num. 2, pp. 3-18.

Levy-Yeyati, E. and F. Sturzenegger (2000). "Is EMU a blueprint for MERCOSUR?", *Cuadernos de Economía*, Vol. 110, pp. 63-99.

Loayza, N. H. López and A. Ubide (2001). "Comovement and sectoral interdependence: evidence for Latin America, East Asia, and Europe", *IMF Staff Papers*, Vol. 48, No. 2, pp. 367-396.

Mejía-Reyes, P. (2002). "Why national business cycles are largely independent in Latin America? Evidence from intra-regional trade and investment", *Ciencia Ergo Sum*, Vol. 9, Núm. 1, pp. 10-20.

Mejía-Reyes, P. (2003). *No linealidades y ciclos económicos en América Latina*, Zinacantepec: El Colegio Mexiquense, Universidad Autónoma del Estado de México.

Mejía-Reyes, P. (2004). "Classical business cycles in America: are national business cycles synchronised?", El Colegio Mexiquense, Documento de Investigación, Num. 96.

Michelis, L. (2000). "Prospects of a monetary union in North America: and empirical investigation", Ryerson University, manuscript.

Mitchell, W. C. (1927). *Business cycles: The problems and its setting*, New York: National Bureau of Economic Research.

Moore, G. H. and V. Zarnowitz (1986). "The development and role of the National Bureau of Economic Research's business cycle chronologies", in Gordon, R. J. (ed.), *The American Business Cycle*, Chicago: Chicago University Press, pp. 735-779.

Murray, J. (1999). "Why Canada needs a flexible exchange rate", Bank of Canada, Working Paper 99-12, Canada.

Nelson, C. R. and C. I. Plosser (1982). "Trends and random walks in macroeconomic time series: some evidence and implications", *Journal of Monetary Economics*, Vol. 10, Num. 9, pp. 139-162.

Potter, S. M. (1999). "Nonlinear time series modelling: an introduction", *Journal of Economic Surveys*, Vol. 13-5, pp. 505-528.

Primo-Braga, C. A., R. Safadi and A. Yeats (1994). "Regional Integration in the Americas". *The World Economy*, Vol. 17-4, pp. 577-601.

Salvatore, D. (1982). *Statistics and Econometrics*, McGraw-Hill.

San-Millán, A. and X. A. Rodríguez (2002). “Liberalización comercial y crecimiento económico en MERCOSUR (1994-2000)”, *Estudios Económicos de Desarrollo Internacional*, AEEADE, Vol. 2, No. 1, 51-68.

Urrutia, M. (1991). “Acerca de la ausencia de populismo económico en Colombia”, en Dornbusch, R. & S. Edwards (eds.), *Macroeconomía del Populismo en América Latina*, Lecturas de El Trimestre Económico, No. 75, Fondo de Cultura Económica, Mexico, pp. 421-444.

Zarnowitz, V. and G. H. Moore (1986). “Major changes in cyclical behavior”, in Gordon, R. J. (ed.), *The American Business Cycle. Continuity and Change*, Chicago and London: The University of Chicago Press, pp. 519-582.