Latin American cycles: Has anything changed after the Great Recession?*

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ABSTRACT

This paper analyzes the evolution of growth cycles and business cycles in Latin America from 1980 to 2013 by using monthly industrial production. Focusing on both synchronization and other cyclical features, we find evidence of significant cyclical links between the countries of the region, which seem to be highly integrated in this period. Notably, we find that the Great Recession did not lead to any significant impact on the pre-existing Latin American cyclical linkages.

Key words: economic cycle, growth cycle, business cycle, cyclical synchronization.

Classification JEL: C22, E32, F15.

INTRODUCTION

Some economic integration areas have emerged in Latin America, such as the Southern Common Market (Mercosur) and the Andean Community of Nations. As pointed out by Christodoulakis et al. (1995), examining the degree of cyclical similarities across their members become of great interest since it could affect the success of these integration processes because it may significantly raise the costs for countries with idiosyncratic cycles. In addition, new challenges may emerge in case of substantial changes in the interdependences across their economic cycles.

Although the analysis of international cyclical features on industrialized economies has been the source of a large literature (see de Haan, Inklaar and Jong-A-Pin, 2008), the Latin American cycles are still relatively unexplored. Not being exhaustive, some exceptions are the empirical studies conducted by Iguíñiz and Aguilar (1998), Mejía-Reyes (1999, 2004), Aiolfi, Timmermann, and Catao (2006), Carrasco and Reis (2006), Calderón and Fuentes (2010), and Hurtado-Rendón and Builes-Vásquez (2010). However, these contributions are incomplete in at least one of the following ways: (i) they focus exclusively either on growth cycles or business cycles; (ii) they focus only on synchronization omitting the analysis of other important characteristics of the economic cycles; and (iii) they do not account for the impact of the Great Recession on the cyclical linkages, which has recently been identified as a potential source of changes in the distribution of bilateral business cycle linkages (Imbs, 2010; Fidrmuc and Korhonen, 2010; Gächter, 2012).

The objective of this paper is to fill this gap in the literature by providing an exhaustive and complete analysis of the Latin American cyclical situation by using industrial productions of Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Mexico, Peru, Uruguay and Venezuela from 1980 to 2013. For this purpose, we focus on two complementary approaches: growth cycles and business cycles. This dual approach represents a significant contribution to the literature since they are usually focused in separate studies and applied to different samples. With the aim of completeness, we examine not only synchronization but also other features of the economic cycles that describe and measure the cycle such as duration, amplitude, excess, deepness and steepness.

By means of statistical techniques, such as nonparametric density estimation and bootstrap multimodality tests, the number of modes in the distributions of pairwise economic cycle dissimilarities is tested. This approach is useful to uncover distinct economic cycle characteristics for different population subgroups of countries. Also, multi-dimensional scaling techniques are used to understand the formation of these potential subgroups.

In the empirical analysis, we find evidence of significant links across the cycles of the Latin American countries. However, our empirical analysis suggests that Bolivia, Costa Rica and Ecuador exhibit the most idiosyncratic cycles. Remarkably, we find that the Great Recession did not lead to any significant impact on the pre-existing Latin American cyclical linkages.

This paper is structured as follows. Section 2 describes the methodological issues of our analysis. Section 3 examines the empirical results. Section 4 reviews our most significant conclusions.

2. METHODOLOGICAL ISSUES

2.1. Growth cycles

The so-called growth cycles are defined on the detrended time series, which are usually referred to as the cycle components. Positive cycles (deviations above the trend) are identified with expansionary phases while negative cycles (deviations below the trend) refer to recessions. As a way of detrending the series, we focus on the band-pass filter proposed by Hodrick and Prescott (1997).

Using the cycle components, pairwise growth-cycle synchronizations are measured through their correlation coefficients. Following Camacho, Perez Quiros and Saiz (2006), the corresponding pairwise distances on growth-cycle synchronizations are obtained as one minus the correlation coefficients.

The pairwise distances on other growth-cycle features are computed as the square root of the sum of the squares of the differences between the corresponding country-specific features. For this purpose, the first feature used in this context is duration, which is defined as the average number of months spent in each phase. Therefore, the duration of expansions (recessions) corresponds to the averaged number of months in which industrial production is above (below) long-term trend. The second feature is the amplitude of the growth-cycle phase, which is computed as the maximum ascent (descent) of the cycle occurred in expansions (recessions).

In line with Sichel (1993), the third growth-cycle feature is deepness, which measures whether the amplitude of troughs exceeds (or is shallower than) that of peaks. This characteristics can be obtained as the skweness of the cycle components. If C_t is the cycle component of industrial production, $\bar{C}$ is its sample average and S_C its standard deviation, the deepness coefficient is

$$Ds(c) = \frac{1}{T\, S_C^3} \sum_{t=1}^{T} \left(C_t - \bar{C} \right)^3. \quad (1)$$

Following Sichel (1993), the last growth-cycle feature is steepness, which relates to whether contractions are steeper (or less steep) than expansions. This characteristics can be obtained as the skweness of the first difference of the cycle components, ΔCt. By analogy, steepness is defined as follows:

$$St(c) = \frac{1}{T\, S_{\Delta c}^3} \sum_{t=1}^{T} \left(\Delta Ct - \Delta\overline{Ct} \right)^3 . \quad (2)$$

2.2. Business Cycles

The business cycle view of economic cycles focuses on the features that appear in the spirit of the National Bureau of Economic Research Business Cycle Dating Committee. In this context, the analysis of the economic cycles relies on the set of turning points that are located in the series of industrial production, thereby defining specific cycles. Although there are several ways to identify turning points, we employ the Bry-Boschan algorithm (Bry and Boschan, 1971).[i] This method detects local maxima (peaks) and minima (troughs) in the series of industrial production subject to certain censoring rules. Then, expansions are defined as the periods from troughs to peaks and recession are defined as the periods from peaks to troughs.

Based on the information provided by this algorithm, we construct country-specific binary variables, R_{it}, that take the value of one whenever country i is in recession. Using these variables, Harding and Pagan (2002) measure the business cycle synchronization between countries i and j by using the concordance index

$$IC_{ij} = \frac{1}{T}\sum_{t=1}^{T}\{ R_{it} R_{jt} + (1 - R_{it})(1 - R_{jt}) \}. \tag{3}$$

This index represents the proportion of time in which two nations experience the same state of the economy. Values equal to one indicate that both economies experience the same phase during the whole period; while values equal to zero have the opposite meaning. Therefore, pairwise distances on business-cycle synchronization are obtained as one minus concordance indexes.

For the sake of completeness, we also compute pairwise distances on other business cycle features as the Euclidean distances between the corresponding country-specific features. In this context, for each of the two phases of the business cycle, we consider duration, amplitude and excess. Duration reflects the average number of months between turning points. Amplitude measures the average increase in industrial production during expansionary periods or the corresponding drop during recessions.

Excess (Harding and Pagan, 2002) is a relative measure of the shape of expansions and recessions and represents the actual path of time series between turning points against a linear path. In other words, as was noted in Camacho, Pérez Quirós and Saiz (2008), convex actual paths match with positive values of excess, while concave paths refer to negative values of excess. For country i, the excess of recessions ER_i is defined as the average of the excess of each recession h

$$ER_{ih} = A_{ih} - T_{ih} + 0.5\, M_{ih}, \tag{4}$$

where T_{ih} is the cumulative gain or loss of recession h, which is obtained by the sum of all the amplitudes of each phase; M_{ih} represents the amplitude; and A_{ih} is the triangle approximation $0.5\, D_{ih}\, M_{ih}$, where D_{ih} matches with duration. For country i, the excess of expansions, EE_i, can be defined analogously

2.3. Global Structure and Cycle Dynamics

Although trying to draw conclusions from these pairwise distances is appealing, a difficulty with it is that there are many such measures and it is a challenge to organize and present the results in a coherent way. To overcome this drawback, we take nonparametric density estimation approaches to examine the distribution of the pairwise distances. For a given bandwidth h and N countries, the kernel distribution of distances that is obtained from the empirical distances between two countries i and j, d_{ij}, is

$$f_h(d) = \frac{1}{nh} \sum_{i=1}^{N} \sum_{j>i}^{N} K(\frac{d-d_{ij}}{h}), \tag{5}$$

where n is the number of different distances and K is the Gaussian kernel.

The nonparametric density estimation approach has the additional advantage of enabling us to explicitly test for the number of modes of the underlying distribution of economic cycle distances. If confirmed, multimodality would point to population heterogeneity, implying the existence of separate population groups. Unimodality would imply that Latin American countries exhibit similar cycles. To test for multimodality, we follow the lines suggested by Silverman (1981), who proposed a simple way to assess the *p*-value that a density is at most *m*-modal against the alternative that it has more than *m* modes.

Since the number of modes in a normal kernel density estimate does not increase as h increases, let h_m be the minimum bandwidth for which the kernel density estimate is at most *m*-modal. Let d^* be a resample drawn from the estimated economic cycle distances

$$d_{ij}^* = (1 + h_m^2/s^2)^{\frac{-1}{2}} \left(d_{ij} + h_m \omega_{ij}\right). \tag{6}$$

where s^2 is the sample variance of the data, and ω_{ij} is an independent sequence of standard normal random variables. Let h_m^* be the smallest possible h producing at most *m* modes in the bootstrap density estimate

$$f_h^*(d) = \frac{1}{nh} \sum_{i=1}^{N} \sum_{j>i}^{N} K(\frac{d-d_{ij}^*}{h}). \tag{7}$$

Repeated many times, the probability that the resulting critical bandwidths h_m^* are larger than h_m can be used as the p-value of the test.

Although useful, the kernel density estimation approach does not allow us to understand the economic cycle affiliations detected across the set of countries. To address this deficiency, we also employ classical Multi-Dimensional Scaling (MDS) to project the pairwise economic cycle distances in a map in such a way that the distances among the countries plotted in the plane approximate the economic cycle dissimilarities.[ii] In the resulting map, countries which present high economic cycle dissimilarities have representations in the plane that are far away from each other. Therefore, the goals of this analysis are to examine the extent to which our set of countries appear in distinct groups with similar cycles or to explore if some Latin American countries exhibit idiosyncratic cycles.

3. EMPIRICAL RESULTS

Our primary interest is on the industrial production of Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Mexico, Peru, Uruguay and Venezuela. Although we understand that industrial production indexes are measures that focus on one sector, more comprehensive measures of activity using aggregates such as Gross Domestic Product are not exempt of problems. The frequency of these series is quarterly, the available samples are shorter and they are not usually calculated from national accounts on a quarterly basis but constructed from annual series that are converted to quarterly using indicators.[iii]

Table 1 shows the variables used in the analysis and the effective sample periods per country.[iv] Data were extracted from the OECD database and from National Ministries of Economy and Industry databases. The time series were filtered with TRAMO-SEATS and the seasonally adjusted series were analyzed by using the two alternative approaches: growth cycles and business cycles.

3.1. Results from the growth-cycle analysis

In line with the related literature, the analysis of HP correlations (Table 2) evidences the existence of significant cyclical links among Latin American countries (77.8% of the coefficients have statistical significance). In Brazil and Mexico, the largest economies of the region in terms of GDP, all of the correlation coefficients are statistically significant. Other distinguished cases are Argentina (80% of significant correlations), Peru (90%) and Colombia (80%). By contrast, the most desynchronized nations are Uruguay and Costa Rica, which show relatively lower proportions of significant coefficients (40% and 50% respectively), and Ecuador and Bolivia, which show low average ratios (0.13 and -0.16 respectively).

By pairs of countries, there is remarkably variety of important associations. The most important coefficients are those existing between Argentina and Mexico (0.5), Brazil and Argentina (0.45), Peru and Brazil (0.45), Mexico and Peru (0.40) and Argentina and Colombia (0.41). Some of these figures can be connected with other results in the related literature: Mejía-Reyes (1999) detect associations between Argentina and Brazil and Peru and Brazil, Hurtado-Rendón and Builes-Vásquez (2010) find similarities between Brazil-Peru, and Aiolfi et al. (2006) obtain significant linkages between Argentina and Mexico.

Figure 1 shows the MDS map of growth-cycle synchronization distances over the sample.[v] This map clearly reflects the information contained in Table 2. Countries with the highest degree of growth-cycle synchronization as Brazil, Mexico and Argentina are represented by points that are closer together in the map. By contrast, countries with less synchronized cycles as Ecuador (Hurtado-Rendón and Builes-Vásquez, 2010), Bolivia and Costa Rica are further apart.

Does it mean that this result agrees with a core-periphery interpretation (Artis and Zhang, 2001) of the growth-cycle synchronization across the Latin American countries? To evaluate this fact, we examine the number of modes on the distribution of the pairwise distances on growth-cycle synchronization that appear in Figure 5. The kernel density plots of this figure seems to have two modes. The main one is placed around 0.14, indicating that these countries are highly synchronized. In addition, there is a smaller bump around 0.23 formed by the countries with more idiosyncratic cycles.

By testing for the number of modes in the density probability distribution of the data (Table 6), we fail to reject the null hypothesis of unimodality. This indicates that, in spite of the presence of the small bump in the right-hand tail of the distribution, we do not find different groups of countries in the data in terms of their growth-cycle synchronization, which does not agree with the core-periphery story.

To complete our growth-cycle analysis, we also compute the distance on other growth-cycle characteristics (amplitude, duration, deepness and steepness). The results, which are displayed in Table 3, show that the average duration is about 16 months in both phases of the growth cycle. However, Venezuela and Costa Rica show cycles that become much longer than the average while Ecuador and Uruguay face the shortest cycles. There is a small variability in terms of phase durations across countries.

Venezuela experienced the longest expansions (21 months) while Uruguay faced the shortest (11.5 months). Regarding to contractions, Peru present the longest (20 months) and the shortest belong to Ecuador and Uruguay (13 months).

Amplitude in expansions and recessions is also relatively symmetric. On average, the maximum ascent of the cycle occurred in expansions is 9, while the maximum descent in recessions is 8.49. With the exception of three countries (Uruguay, Venezuela and Mexico), average amplitudes are greater in expansionary phases. Ecuador, Costa Rica and Venezuela are the countries with the most volatile cycles. Mexico, Chile, Peru and Bolivia (as in Hurtado-Rendón and Builes-Vásquez, 2010) experienced the less volatiles cycles during the considered period.

On average, deepness and steepness reach a value of -0.49. This implies that recessions are deeper than expansions and that the cycle falls rapidly in recessions and only recovers slowly over time. Chile and Venezuela have the deepest recessions and Bolivia has the deepest expansion. Bolivia has the steepest expansions and Venezuela the steepest recessions.

The MDS map of growth-cycle features is reported in Figure 2, which provides a visual inspection of the relative dissimilarities on the growth-cycle features of Latin American countries. Notably, the largest countries stick together in the map, reflecting that these countries form a cluster that shows growth-cycle features that are similar among them. In addition, some countries are plotted further away from the cluster formed by the largest countries, which reflects the differences between their cycles and those of the cluster. These countries also appear separate from each other, which indicates that their growth-cycle characteristics are idiosyncratic. This group of countries with idiosyncratic growth cycles is mainly formed by Ecuador, Venezuela, Costa Rica, Uruguay and, to lesser extent, Bolivia.

Figure 6 shows that bimodality is a visual feature of the kernel estimate of the distribution of distances on growth-cycle features, measured as the Euclidean distance across all of the features examined below. It shows that the countries of the cluster exhibit an average distance on their growth-cycle features of about 0.005 while the average distance for the countries with idiosyncratic growth-cycles grows up to about 0.05. This bimodal characterization is statistically confirmed by the Silverman test displayed in Table 6.

3.2. Results from the business-cycle analysis

The business cycle synchronization is examined in Table 4. Typically, the pairwise concordance indexes range between 0.6 and 0.7, which implies that most of the pairs of Latin American countries crossed through identical business cycle phases between 60% and 70% of the time elapsed between 1980 and 2013.[vi] This evidences their significant business cycle synchronicity. At the country level, Peru, Chile and Uruguay show the highest average rates (0.76, 0.75 and 0.73 respectively); while Bolivia (0.61) and Ecuador (0.62) represent the less synchronized countries.

By pairs of countries, the most important cyclical comovements in terms of concordance indexes are: Bolivia-Costa Rica (0.81), Chile-Costa Rica (0.81), Chile-Uruguay (0.80), Colombia-Venezuela (0.80), Peru-Uruguay (0.83) and Chile-Peru (0.91). In addition, we also find significant comovements in the following pairs of countries: Uruguay-Argentina (0.79), Bolivia-Peru (0.75), Brazil-Peru (0.78), Brazil-Uruguay (0.77), Chile-Venezuela (0.78), Colombia-Uruguay (0.76), Peru-Costa Rica (0.78), as well as Uruguay-Venezuela (0.76). Some of these high values of pairwise comovements were already found in the literature: Uruguay-Argentina and Uruguay-Venezuela by Hurtado-Rendón and Builes-Vásquez (2010); Brazil-Uruguay by Carrasco and Reis (2006); and Brazil-Peru by Hurtado-Rendón and Builes-Vásquez (2010) and Mejía-Reyes (1999).

Figure 3 shows a graphical representation of the MDS technique, which has been derived only from the distances on business cycle synchronization. All countries appear tightly clustered forming only one group. This reveals that the sample of countries is rather homogeneous in terms of business cycle synchronization.

In line with these uniformly distributed high values of the pairwise concordance indexes, the kernel representation of the distances on business cycle synchronization plotted in Figure 7 suggests that the underlying distribution of distances is unimodal. This suggests that Latin American business cycle cohere. The fact that we fail to find different sub-populations of Latin American countries is corroborated by the result of the Silverman test displayed in the third row of Table 6. The *p*-value of the null of unimodality is 0.41, which implies that this null cannot be rejected at standard confidence intervals.

As in the case of growth cycles, we complete our business-cycle analysis by examining the distance on other business-cycle characteristics in Table 5. In line with Mejía-Reyes (1999, 2004), we find a large asymmetric behaviour over the business cycle for most economies in the sample. On average, the duration of the business cycles implies that expansions last much longer than recessions (duration of 32.7 and 12.6 months, respectively). This asymmetry is remarkable in Peru (53.25 versus 10 months), Chile (47.8 versus 13.5 months), Costa Rica (43.8 versus 11.5 months) and Uruguay (29.25 versus 8 months). We also observe a great variability of the full cycle across countries, something already mentioned by Mejía-Reyes (1999). The duration of expansions exhibit a huge variability across countries (53.3 months in Peru vs 12.2 months in Ecuador). Moreover, the duration of recessions is relatively similar across nations (18.7 months in Venezuela vs 8 months in Bolivia, Ecuador and Uruguay). These findings also appear in Calderón and Fuentes (2010).

On average, the gains in expansions are about 18.7% while the losses in recessions are of 10.2%. Again, the well-known high volatility of the Latin American cycles is remarkable (see, among others, Aiolfi et al., 2006, and Mejía-Reyes 1999 and 2004). Moreover, the variability in the amplitude of the Latin American business cycles is noticeable, in line with the findings of Calderón and Fuentes (2010). Costa Rica is the nation with the highest increase of its industrial production in times of economic growth (31.8%), followed by Peru (29.6 %), Venezuela (27.6 %) and Uruguay (22.1 %). By contrast, Venezuela (-32.8 %) and Uruguay (-18.5 %) are the countries with the largest falls of industrial product during economic downturns. This singularity places these countries as those with the most volatile cycles. In contrast to these countries, Bolivia show the less volatile business cycle.

Overall, Latin American countries exhibit negative excess in expansions and positive excess in recessions. Therefore, industrial production increases in expansions intensively after the troughs (Bolivia, Ecuador and Colombia are the only exceptions). By contrast, industrial production falls quickly after the peaks during recessions (Chile, México, Uruguay and Venezuela are the exceptions).

The MDS map displayed in Figure 4 greatly helps in the comparison of all the distances in business-cycle features. According with this representation, the countries are grouped in two concentric circles, whose radius lengths reflect the business cycle dissimilarities from the centre to the periphery. The core of countries with more similar business cycles are Argentina, Mexico, Brazil, Uruguay Colombia and C. Rica. Ecuador, Bolivia Venezuela, Peru and Chile are located in the periphery

The kernel approximation to the density distribution of distances in business-cycle features is plotted in Figure 8. The density estimation suggests that the countries with more homogeneous business cycles belong to the mass of the distribution. The smaller bump placed in the right-hand-side tail of the distribution refer to those countries with more heterogeneous business cycles. In spite of this comment, the Silverman test displayed in Table 6 fails to find two different modes in the distribution of distances in business-cycle features since the p-value of the null of one mode is 0.62.

3.3. Economic cycle structures and dynamic evolution

In the previous sections we show that regardless of the approach used to compute the cycle features, we find evidence of significant linkages in this region. With the exception of the growth cycle features, the Latin American countries exhibited pretty similar cycles during this sample period. This result is of significant importance for the economic integrations that are currently being implemented in the region.

In this context, some results in the recent literature point out that part of the cyclical linkages may rely on presence of the Great Recession. Imbs (2010) argues that world synchronization has greatly increased due to the Great Recession, mainly due to the linkages observed among developed countries. In addition, Fidrmuc and Korhonen (2010) finds that the rises in synchronization have been particularly important between the largest Asian emerging economies (China and India) and the industrialized countries. However, Gächter et al. (2012) show a pronounced desynchronization of business cycles in Economic and Monetary Union during the crisis period, both with respect to dispersion and to the correlation of business cycles.

Although there are some studies (for example, Hurtado-Rendón and Builes-Vásquez, 2010) that focus on the reinforcements of the cyclical links in the region in periods of instability (in the “lost decade” and the last years of the previous century), they do not cover the Great Recession, or only the initial years of the same. The purpose of this section is to examine the extent to which the economic cycle linkages in Latin American countries documented above were affected by the Great Recession.

For this purpose, we examine the dynamic of the density distributions of pairwise economic cycle distances by repeating the analysis with sample that ends before the Great Recession. According to Figure 5 to Figure 8, the modes slightly shifts to the left when the data of the Great Recession are included in the sample, especially in the case of growth cycle and business cycle synchronization. This agrees with the view that the business cycles of individual countries may have become more closely synchronized because the Latin American countries experienced the effects of this recession roughly at the same time.

The last two column of Table 6 show the *p*-values of the null of testing for the number of modes in the density probability distribution of the data when the sample ends in 2007. The table shows that we have virtually identical results regardless of whether the data of the Great Recession are included in the sample. As in the case of the entire sample, the unimodality hypothesis is not rejected in the case of growth-cycle synchronization, business-cycle synchronization and business-cycle features. In addition, the distribution of growth-cycle features seems to have two modes. Therefore, it seems that the Great Recession did not have significant effects on the pre-existing Latin American cyclical linkages.[vii]

4. CONCLUDING REMARKS

The main conclusions about the situation of Latin American cycles during the last thirty years can be summarized as follows. First, regardless of the approach used to compute the cycle features, we find evidence of significant linkages in this region. Second, the growth-cycle features tend to be more symmetric across the cycle than the business cycle features. Third, the Great Recession did not lead to any significant impact on the Latin American distribution of distances on economic cycles. Moreover, except for the growth cycle features for which we find two modes in the distribution of distances, Latin America countries had pretty uniform cycles in this period. In spite of this comment, we find that the countries with more idiosyncratic cycles are Bolivia, Ecuador and Costa Rica.

These results are of significant importance for the economic integrations that are currently being implemented in the region. With few exceptions, we find that Latin American countries exhibit similar cycles during the sample period. Therefore, we think that the cyclical synchronization and the similarities on other cycle characteristics would not be an obstacle to follow with the economic integrations already initiated among some of these countries.

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NOTES

[i] In particular, we implement the Bry-Boschan Gauss code created for Stock and Watson (2014).

[ii] A good reference on MDS techniques is Timm (2002).

[iii] Following the suggestion of the reviewers, we repeated all the analyses developed in the paper using GDP. Although the results are omitted to save space (they are available upon request) they are qualitatively similar to those that we obtained with IP.

[iv] Due to data availability problems, we use the index of economic activity for Bolivia and Ecuador and the non-primary added value index for Peru.

[v] In these maps, the axes are meaningless and the orientation of the picture is arbitrary.

[vi] All the indexes in the table are statistically significant.

[vii] Following the suggestion of a reviewer, we repeated all the analyses developed in the paper using the year 2000 as the breakpoint. Although the results are omitted to save space (they are available upon request) they are qualitatively similar to those that using 2008 as the breakpoint.

Table 1. Data description.

Country	Indicator	Period
Argentina	Industrial production index	January 1994-January 2013
Bolivia	Index of economic activity	January 2008-December 2012
Brazil	Industrial production index	January 1980-January 2013
Chile	Industrial production index	January 2001-February 2013
Colombia	Industrial production index	January 1990-January 2013
Costa Rica	Industrial production index	January 1991-February 2013
Ecuador	Index of economic activity	January 2001-February 2013
Mexico	Industrial production index	January 1980-January 2013
Peru	Index of the non-primary gross added value	January 1992-January 2013
Venezuela	Industrial production index	January 1997-December 2012
Uruguay	Industrial production index	January 2002-February 2013
USA	Industrial production index	January 1980-March 2013

Notes. Data were extracted from the OECD database and from National Ministries of Economy and Industry databases.

Table 2. Growth cycle synchronization: 1980-2013.

	PERU	RICA	URU	VEN	MEX	CHIL	ARG	BRA	COL	ECU	BOL	USA
PERU	1											
C. RICA	0.06	1										
URUGUAY	0.23**	-0.14	1									
VENEZUELA	0.13 **	-0.22***	0.39**	1								
MEXICO	0.40**	0.24***	0.15*	0.25***	1							
CHILE	0.36**	-0.01	0.11	0.22***	0.27***	1						
ARGENTINA	0.32**	0.05	-0.02	0.16**	0.5 ***	0.30***	1					
BRAZIL	0.45**	0.13**	0.23**	0.26***	0.29***	0.19***	0.45***	1				
COLOMBIA	0.37**	-0.06	0.03	0.39***	0.38***	0.32***	0.41***	0.29***	1			
ECUADOR	0.22**	0.19***	0.05	0.11	0.23***	-0.01	0.19***	0.19 **	0.35***	1		
BOLIVIA	-0,37**	0.37***	0.04	-0.28**	0.26 **	-0.02	-0,48***	-0,23*	-0,23*	-0.20	1	
USA	0.64***	0.36***	0.12	0.21***	0.62***	0.38***	0.46***	0.37***	0.51***	0.29***	-0.32**	1

Notes. The entries show the pairwise correlations of the Hodrick-Prescott cycles. (*) significant at 10 %; (**) significant at 5 %; (***) significant at 1 %.

Table 3. Growth cycle features: 1980-2013

	Amplitude		Duration		Asymmetry	
	Expansion	Recession	Expansion	Recession	Deepness	Steepness
ARGENTINA	6.32	-5.45	18.3	14.6	-0.42	-0.80
BOLIVIA	5.06	-2.83	13.0	17.0	0.88	1.68
BRAZIL	5.74	-4.73	15.6	17.5	-0.88	-1.28
CHILE	4.31	-3.70	16.3	17.0	-2.22	-0.79
COLOMBIA	5.92	-5.55	15.3	19.4	0.04	-0.22
C. RICA	18.73	-18.11	19.9	18.1	0.27	-0.49
ECUADOR	34.17	-32.32	13.5	13.0	0.42	-0.06
MEXICO	2.65	-3.09	18.6	16.0	-0.65 **	-0.14
PERU	4.31	-4.10	14.3	19.9	0.10	0.00
URUGUAY	8.94	-11.99	11.5	13.0	-1.00 **	-0.43
VENEZUELA	10.05	-12.80	21.0	17.4	-1.88	-2.87
REGIONAL AVERAGE	9.00	-8.49	16.4	16.8	-0.49	-0.49
USA	1.57	-2.11	17.5	18.7	-0.84	-1.49

Notes. Duration is the number of months in the cycle phase, amplitude is maximum ascent in expansions or descent in recessions and deepness and steepness measure the skewness of the cycle components and their first differences. (**) Significant at 5% level.

Table 4. Business cycle synchronization: 1980-2013.

	ARG	BOL	BRA	CHIL	COL	ECU	PERU	MEX	RICA	URU	VEN	USA
ARGENTINA	1											
BOLIVIA	0.63***	1										
BRAZIL	0.69***	0.58***	1									
CHILE	0.69***	0.64***	0.74***	1								
COLOMBIA	0.65***	0.31***	0.69***	0.72***	1							
ECUADOR	0.67***	0.61***	0.54***	0.64***	0.61***	1						
PERU	0.74***	0.75***	0.78***	0.91***	0.70***	0.65***	1					
MEXICO	0.73***	0.61***	0.61***	0.72***	0.63***	0.63***	0.67***	1				
C. RICA	0.68***	0.81***	0.65***	0.81***	0.66***	0.65***	0.78***	0.74***	1			
URUGUAY	0.79***	0.58***	0.77***	0.80***	0.76***	0.54***	0.83***	0.71***	0.72***	1		
VENEZUELA	0.70***	0.54***	0.65***	0.78***	0.80***	0.61***	0.74***	0.73***	0.62***	0.76***	1	
USA	0.67***	0.58***	0.69***	0.86***	0.76***	0.71***	0.79***	0.79***	0.82***	0.75***	0.82***	1

Notes*:* The entries show the pairwise concordance indexes of Harding and Pagan (2006). (***) Significant at the 10% level.

Table 5. Business cycle features: 1980-2013..

	Amplitude		Duration		Excess	
	Expansion	Recession	Expansion	Recession	Expansion	Recession
ARGENTINA	20%	-11%	31.8	14	-0.0221	0.007
BOLIVIA	5.90%	-0.40%	19.7	8	0.0015	0.0124
BRAZIL	14.10%	-9.80%	25.8	15.4	-0.0011	0.0095
CHILE	17.40%	-6%	47.8	13.5	-0.015	-0.0092
COLOMBIA	12.20%	-9.20%	28.7	15.2	0.0012	0.0031
C. RICA	31.80%	-9.20%	43.8	11.5	-0.004	0.0105
ECUADOR	10.90%	-2.70%	12.2	8	0.0006	0.0114
MEXICO	14.30%	-9%	33.6	15.8	-0.0135	-0.0009
PERU	29.60%	-3%	53.25	10	-0.0043	0.002
URUGUAY	22.10%	-18.50%	29.25	8	-0.0374	-0.0347
VENEZUELA	27.60%	-32.80%	33.8	18.7	-0.064	-0.0614
REGIONAL AVERAGE	18.70%	-10.20%	32.7	12.6	-0.0144	-0.0046
USA	21.24%	-8.20%	67.4	12.4	-0.0176	-0.0012

Notes*:* Duration is the number of months in each phase, amplitude is maximum gain in expansions or loss in recessions and excess is the deviation of actual industrial production from a linear path

Table 6. Silverman Test.

		1980-2013		1980-2008	
		1 mode	2 modes	1 mode	2 modes
Growth cycle	Synchronization	0.34	0.60	0.37	0.15
	Other features	0.00	0.49	0.03	0.30
Business cycle	Synchronization	0.41	0.75	0.39	0.23
	Other features	0.62	0.39	0.20	0.54

Notes: The entries show the *p*-values of the Silverman test of 1 and 2 modes on the distributions of economic cycle characteristics.

Figure 1. Growth-cycle synchronization. 1980-2013.

Figure 2. Growth-cycle features. 1980-2013.

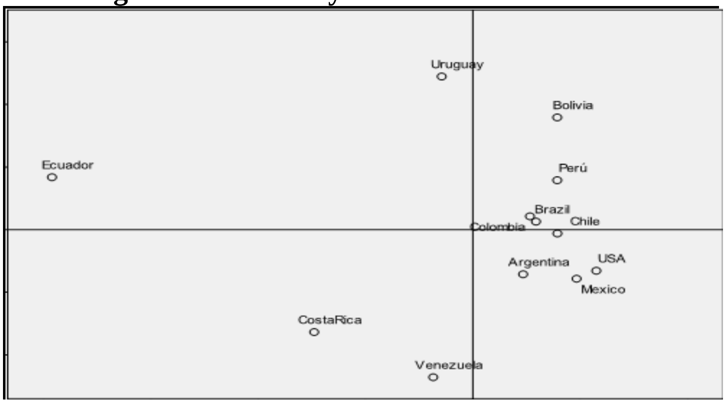

Figure 3. Business-cycle synchronization. 1980-2013.

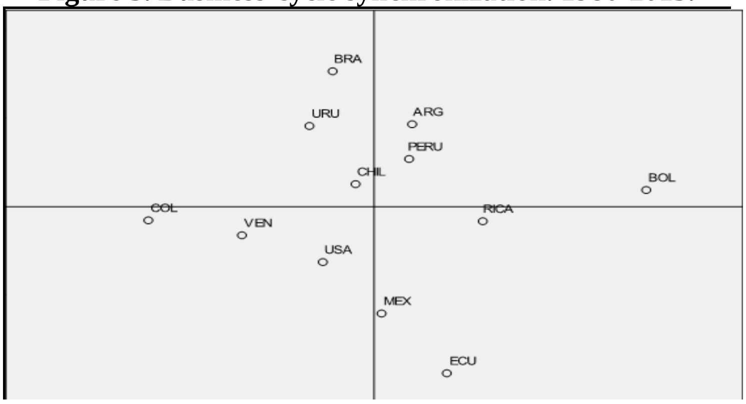

Figure 4. Business-cycle features. 1980-2013.

Figure 5. Kernel density function of distances on growth-cycle synchronization.

A) Period 1980-2013. **B) Period 1980-2008.**

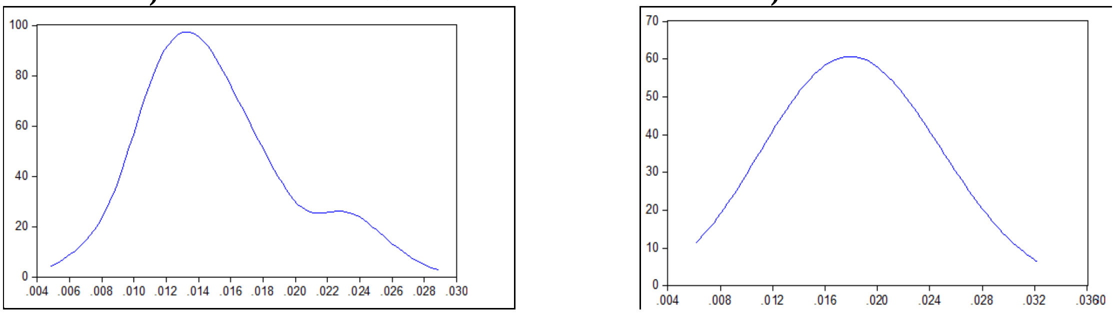

Figure 6. Kernel density function of distances on growth-cycle features.

A) Period 1980-2013. **B) Period 1980-2008.**

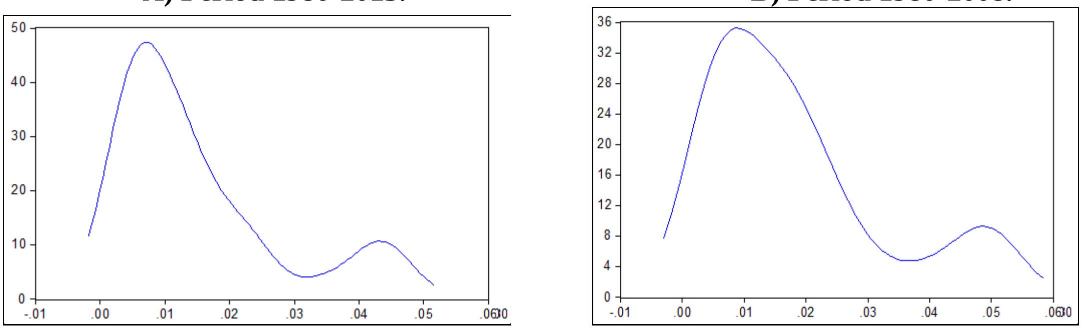

Figure 7. Kernel density function of distances on business-cycle synchronization.

A) Period 1980-2013. **B) Period 1980-2008.**

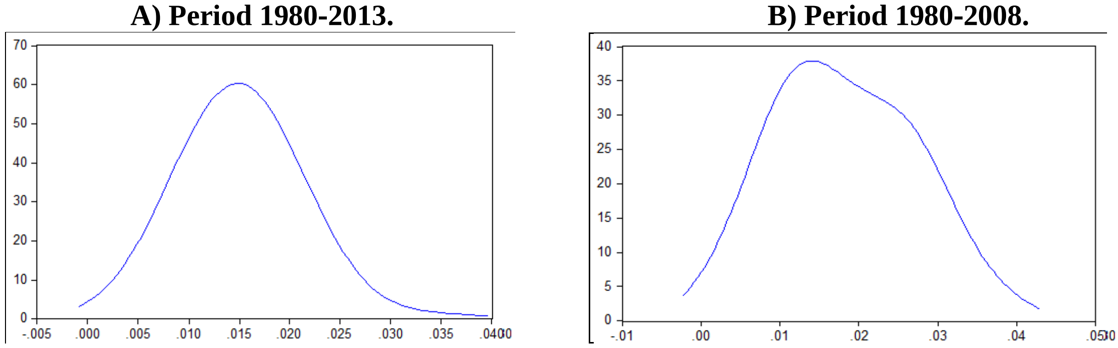

Figure 8. Kernel density function of distances on business-cycle features.

A) Period 1980-2013. **B) Period 1980-2008.**