Business Cycle Synchronization in Latin American. A Critical Survey of Empirical Research

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Abstract

This paper develops a systematic literature review to show the state of the art in business cycle research in Latin America by analyzing articles that use a variety of data and approaches to measure the business cycle and convergence. Thus, this research focuses on two questions: whether business cycles become more similar over time and what factors drive business cycle synchronization.

We conclude that business cycles in the Latin American region have gone through periods of both convergence and divergence, but that in general, evidence of a common business cycle in the region is limited. The level of synchronization varies across countries and sub-regions, and there are significant differences in the behavior of economies during recessions and expansions. Trade plays a crucial role in the propagation of the cycle, but the strength of synchronization between individual countries and the United States is unclear. In addition, the region's dependence on external events, particularly since the 2008 global recession, and the dominance of trade flows over financial flows are highlighted as determinants of business cycle comovements in the short term. Studies also suggest that Latin America's disconnection from advanced economies may be influenced by increased trade with China and the low degree of financial integration with its main partners.

1. Introduction

Since the beginning of economic science, economists have studied the recurrent phenomena of boom and bust of economic activity, starting with Juglar (1862) who was a pioneer in studying economic crises and their relationship with business cycles, followed by his Soviet counterpart Kondratieff (1935), who had made analyses of long business cycles. analyses taken up by Schumpeter (1939). In the United Kingdom, Kitchin in 1923 found evidence of the existence of a short business cycle.

Since then, the approaches and depth of research have varied. Thus, the phases as well as the co-movements and the common characteristics of the cycles have been studied by economists of all currents of thought. Regarding the phases of the business cycle, Mitchell (1913, 1927) highlighted the existence of expansions, recessions, contractions and recoveries throughout the cycle, while Kuznets (1926, 1930) observed the existence

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of some similarities between some economies throughout the business cycle. In relation to the co-movements (contemporary, lagging or advanced) between some economic variables, Mills (1936) pointed out the existence of correlations between prices and quantities during economic expansions and contractions: positive correlations between these variables were indicative of cycles induced by demand phenomena, while negative correlations were indicative of supply-induced cycles.

After the emergence of the Keynesian current, with which the determination of income gained the greatest importance, discussions about the business cycle took a back seat and it was only until Lucas (1972, 1975) that the characterization of fluctuations, as well as the explanation of their causes, was taken up with special interest . However, it has been during the last two decades that there has been a greater development in the systematic study and measurement of economic fluctuations, which has provoked considerable macroeconomic debate. Some of this research has been assembled into a body of theory known as the Real Business Cycle (RBC) approach, initially proposed by Kydland and Prescott (1982) and Long and Plosser (1983).

Real Business Cycle models were originally designed to determine how much of the recurrent fluctuations in economic activity , measured in deviations from the logarithm of variables around a permanent trend or component, could be attributed to real factors and, more specifically, to productivity shocks. So, we can say that business cycles are positions of GDP above and below potential GDP, i.e., they are non-periodic recurring sequences of expansions and recessions. Since Kydland and Prescott's (1982) "time to build", the use of Hodrick and Prescott's filter to separate the permanent and transient components of a stochastic realization has become widespread (despite the multiple reactions that such a filter has aroused). Other types of decompositions such as the first differences, the subtraction of a deterministic tendency, whether linear or quadratic, or frequency domain techniques are also used to remove the permanent component of a variable .

Thus, the description of the business cycle implies the measurement of the volatility of real output, employment, consumption, investment, prices, interest rates and monetary aggregates or, what is the same, of the movements of these variables around their respective trend, the persistence of their cyclical component, and the persistence of the cyclical component of the variables. as well as the co-movements of the cyclical component of all variables with that of the real product. These three properties of the economic variables are observed in the transitory component of the variables and are estimated, respectively, by the standard deviation, the autocorrelation coefficient and the cross-correlation of the variables with the real output. Accordingly, a variable is procyclical if its contemporaneous correlation with real output is positive; it is countercyclical if its correlation is negative; and it is acyclic if it is not contemporaneously correlated with the actual product, in a meaningful way. Thus, for example, while countries in the downward phase of the cycle would prefer a more expansionary monetary policy, countries in the ascending phase of the cycle would prefer a more restrictive monetary policy.

A variable leads (lags) output if its cross-correlation with future real output (laggard) is greater than the contemporary correlation. Estimated indicators are used to identify the "regularities" or "stylized facts" associated with the business cycle, which, since Lucas (1977), constitute the underlying reference point of Real Business Cycle models. These regularities, common to all decentralized market economies, are, first, price

procyclicality, short- and long-term interest rates, monetary aggregates, measures of velocity of circulation, and business profits; second, greater volatility of the production of durables (for both consumption and production) relative to that of non-durables; third, harmonious movements of the product across the different sectors (conformity); and, finally, less harmonious movements in the production and prices of agricultural goods and natural resources.

It is for all these reasons that the analysis of economic cycles is a useful tool for the design and evaluation of public policy. For this purpose, a systematic review of the vast literature developed under the approach of Economic Cycles in Latin America was carried out, thus, the results that have been obtained for different countries, periods, etc. presented by different authors are reviewed in order to address the central theme of this research: Can we speak of a process of convergence in Latin American countries? Are they synchronizing or is there a more pronounced asymmetry over the years?

Within the literature on business cycles, two points of view have been presented on this question. In what we call the "optimistic view," greater economic (and monetary) integration will lead to less divergence. This view is quite popular among policymakers in the European Union, for example. However, Krugman (1991) argues that if similar concentration of industries occur in particular regions, because of economies of scale and scope, sector-specific shocks can become regional shocks, thereby increasing the likelihood of asymmetric shocks and divergent business cycles. Therefore, the "pessimistic view" holds that euro area business cycles may become more divergent in the future.

In the debate on the synchronization of business cycles in Latin America, two questions are worth asking. First, have the region's business cycles become more similar, and second, what factors drive business cycle synchronization? Regarding the first issue, the literature has not yet reached a consensus on whether the economic cycles of the countries of the region are converging. The differences between various studies can be explained in part by the use of different data. However, other reasons include the use of divergent methods to identify business cycles and assess convergence. Competitive methods for calculating a business cycle have been suggested. There is also no consensus on how convergence between business cycles should be measured. Regarding the second issue, various factors have been raised that can affect the synchronization of the business cycle, ranging from trade relations (Frankel and Rose, 1998), specialization (Imbs, 2004), monetary integration (Fata's, 1997), and financial relations. (Imbs, 2006) and fiscal policy (Clark and van Wincoop, 2001). However, despite the theoretical and empirical analyses to date, it seems fair to say that there is no consensus on the important determinants of business cycle co-movement. The difficulty is that there are many possible possible explanations.

This article analyzes the empirical literature dealing with these issues, focusing on Latin American countries. This implies that articles on business cycle asymmetries among G7 countries (such as Kiani and Bidirkota, 2004) or on international business cycles (such as Ambler et al., 2004) are not discussed, unless they contain interesting results from the point of view of this paper. The rest of the article is organized as follows. Section 2 describes the methodology used to select the articles. Section 3 reviews methods for identifying business cycles and business cycle timing. Section 4 assesses the degree of synchronization of the business cycle in the region, as well as discusses the factors driving synchronization. The last section offers some final comments.

2.   Description of the methodology for selecting articles.

The transfer of knowledge through scientific publications is considered a fundamental element for the advancement of any science (Pérez-Anaya, 2017). This breakthrough requires researchers to know the state of the art in the subjects studied. In this context, it is valuable to carry out a qualitative analysis, requiring a quantitative study of the academic literature on a topic (Fernández, 1998). Building on the research questions, which are: have the region's business cycles become more similar, and second, what factors drive the synchronization of the business cycle?

The search strategy included search terms, literary devices, and the search process, which took place in November 2020. The main concepts in Spanish and English referred to in the research questions were used. These are synchronization, economic cycles, Latin America was also included because the focus of the research is this region. It's important to identify different ways to spell terms, including abbreviations and synonyms. Specifically, the sources for the literature review were the databases Web of Science, Scopus, Directory of Open Access Journals, JSTOR and SciElo. In addition, additional potential articles were identified by searching the Google Scholar search engine. This search procedure is widely accepted and has been used by (David & Han, 2004; Hohenstein et al., 2014; Kitchenham et al., 2010; Turner et al., 2010).

In order to select the interesting works in this study, the inclusion and exclusion criteria were applied, and then the quality evaluation was carried out through the quality criteria, as already done by authors such as Kitchenham et al. (2010). Once the keywords were included and the articles that would form the basis of the work for this study were obtained, the studies were continued to be refined by applying inclusion and exclusion criteria. Specifically, and following Echeverri and Cruz (2014) and Ramírez Correa and García Cruz (2005), all those scientific articles (1) with a publication date after the year 2000, (2) published in Spanish and English, (3) articles published in scientific journals, (4) primary studies were searched and (5) with methodology of economic cycles in Latin America. In the same way, the main exclusion criteria were established that led to the rejection of all those works (1) of less than four pages, (2) those published as theses and books, and (3) those duplicates. The papers were classified according to the type of study and a generic set of questions was used to evaluate their rigor, credibility and relevance, and thus be able to make the final screening to obtain the final sample. This quality tool was developed by Dybå and Dingsøyr (2008) in their systematic review of software engineering, and is applicable to most studies.

3.   Measuring the synchronization of the business cycle.

Studies examining the synchronization of business cycles in the Latin American region tend to come to very different conclusions. Part of these differences may be related to the selection of variables used, divergent methodologies for constructing business cycles, and alternative ways of assessing timing. Therefore, we start from a description of the methodology used to collect the information to be analyzed in this paper in the previous section, and then discuss the economic variables that have been considered, alternative ways of measuring the cycle, and different indicators of synchronization of the business cycle.

Data Used.

The two most important variables used are annual real GDP data and monthly industrial production index (IPI) data. In addition, GDP per capita, adjusted as purchasing power parity to U.S. dollars, is sometimes used. From the perspective of this document, studies on the synchronization of the business cycle should focus on the broadest possible production variable, i.e., GDP at a quarterly frequency and in general, annual data would be avoided in order to capture more high-frequency fluctuations, however, unfortunately in the Latin American case the absence of long-term databases at shorter frequencies does not exist in the long term.

IP data has the advantage that it is available for many countries on a monthly basis. However, the conceptual reasoning behind the use of IP is less convincing. First, manufacturing activity is less representative in Latin America compared to Europe or the United States, so a priori it would not seem to be representative of total production . Second, manufacturing output is much more volatile than aggregate output .

Measurement of business cycles.

A first distinction to be made is between classical business cycles and deviation (or growth) cycles, i.e. the difference between the cyclical and trend components of a time series. Burns and Mitchell (1946) define (classical) business cycles in terms of absolute expansions and contractions of economic activity. More recent business cycle studies, however, look at deviation cycles, i.e., the deviation of economic activity from a "trend." This is also true for most of the studies discussed here. A practical reason why most researchers focus on deflection cycles is that most (parametric) measures used to describe the cycle need stationary series as input. Moreover, since most economies are growing over time, classic recessions occur much less frequently than growth-cycle recessions.

The studies discussed in this paper use a variety of filtering techniques to break down output into trend and cycle. The simplest filtering technique is to calculate the first differences . This is usually enough to make the series of interest stationary. However, as Baxter and King (1999) point out, the first differentiation removes a trend from a series, but potentially at the cost of a change in the peaks and troughs of the differentiated series and increased volatility. The phase change may not be too important when comparing cycles between countries, as this phase change is the same for both countries. However, the greater weight in the higher frequencies of the series emphasizes the irregular "noise" over the cyclic movements.

Most of the studies under review apply non-parametric filters, especially the Hodrick-Prescott filter (1997), the Baxter-King bandpass filter (1999) and the average phase trend (PAT, Boschan and Ebanks, 1978) using the Bry-Boschan algorithm. Probably the most commonly used filter in this type of research is the Hodrick-Prescott (HP) filter. This filter estimates the trend component by minimizing trend deviations, subject to a predetermined smoothness of the resulting trend. The HP filter can be interpreted as a high-pass filter that removes fluctuations with a frequency of more than 32 quarters or eight years and puts those fluctuations in the trend .

Baxter and King (1999) argue that the combination of a high-pass filter on the one hand and a low-pass filter (which removes high frequencies) on the other hand is better since the HP filter still leaves much of the high-frequency noise as part of the cycle. If such a

bandpass (BP) filter is applied, the resulting cyclic component does not contain any fluctuation at high or low frequencies beyond the predetermined cut-off points. Both Baxter and King (1999) and Christiano and Fitzgerald (2003) derive an approximate BP filter, using somewhat different assumptions.

Finally, the TAP is closely related to the method used to calculate the turning points of the business cycle. The PAT filter, originally proposed by Boschan and Ebanks (1978), begins by estimating a 25-quarter moving average. The inflection points of the deviations from this trend are dated using the algorithm of Bry and Boschan (1971), which generates inflection points of the classical cycle that are very close to those selected by the NBER Business Cycle Committee. Finally, the trend is estimated by connecting the average values between each cyclical peak. Zarnowitz and Ozyildirim (2002) show that the PAT filter gives similar tipping points to other filters such as the HP filter and the Baxter–King BP filter.

To what extent does the selection of a particular way of modeling the business cycle affect conclusions about business cycle timing?

Unfortunately, only a few studies prove how sensitive their results are in this regard. Within this research, Fiess, N. (2007) and Ávila et al. (2015) conclude that the use of the various filtering techniques in their research did not lead to differences in the final results. In the same way, Artis and Zhang (1997) and Calderón et al. (2007) carried out analyses using various filtering techniques (PAT, HP, linear trend, quadratic trend, first differences, BP) for OECD countries and 147 countries around the world respectively; They both conclude that the choice of a particular filtering method is not crucial to their conclusions. Like Massmann and Mitchell (2004, p. 303), who considered a large number of measures of the business cycle, they concluded that "there are substantial similarities between alternative measures of the business cycle."

This finding is notable since Canova (1998) concluded that different filtering methods lead to divergent conclusions regarding the U.S. business cycle. However, these findings are not mutually exclusive, as Canova compares the results of applying different filters to a country's output, while Massmann and Mitchell et al. compare the results using different filters across countries. So, although the various filters can "extract different types of information" (Canova 1998, p. 475), the findings are similar when comparing this information across countries.

In summary, studies using standard filters such as HP, Baxter-King, and Christiano-Fitzgerald filters are likely to yield similar results. These three filters also work reasonably well for isolating fluctuations in data from certain frequencies, which after all is the most important goal of filtering. Using early differences is likely to lead to bigger problems, as it puts too much weight on high-frequency fluctuations .

Synchronization Measurement.

Given a certain measure of the business cycle, one has to determine the extent to which these cycles move together between countries. Most studies use simple (Pearson's) correlation coefficients of the cyclical portion of GDP for this purpose, but others have suggested alternative measures in the literature, such as Harding and Pagan's (2002) concordance index and Bernard and Durlauf's stochastic definitions of convergence.

The concordance index proposed by Harding and Pagan (2002) is a non-parametric measure of comotion that uses a binary indicator variable of recessions and expansions. This index measures the percentage of time in which the two series are in the same phase of the business cycle. The index is somewhat more flexible than the correlation coefficient, as any method can be chosen to distinguish between recessions and expansions. Therefore, while calculating the correlation between GDP series, the levels will generally not be very informative because of the strong trend in those series, classic recessions can be dated from these series of levels and the concordance index can be calculated. One drawback, however, is that the analysis of a binary variable yields potentially useful information.

On the other hand, Bernard and Durlauf's (1995) definitions of convergence imply that, if the output series are stationary, the time trends must be the same between countries i and j. This option is taken into account when evaluating convergence as the absence of unit root unity. In particular, stochastic definitions of convergence and common trends in production, which can be tested naturally using cointegration techniques, are based on Bernard and Durlauf (1995). Unlike the classic tests (β- and - □convergence) that only tell us whether convergence has occurred in a given period, this approach also confirms whether convergence is a continuous process. This additional advantage is important for the embryonic case of South America examined by Bolaños, A. (2017) because convergence is still in process. According to Bernard and Durlauf (1995), for countries to converge, the long-term forecast of their output differences must tend to zero. Thus, if the standard of living of two (or more) countries converge, the output gap between them will tend to disappear in the long run.

Most measures of comovement are judged by their characteristics and not so much by economic reasoning. An exception is the work of Kalemli-Ozcan et al. (2001), who argue that a natural measure of asymmetry quantifies the potential loss of welfare due to asymmetric fluctuations in GDP in the absence of risk-sharing mechanisms.

The last issue to be discussed is how to judge the change in co-movement between cycles over time. The simplest solution is to compare correlations in two periods, e.g., before and after the establishment of the Exchange Rate Mechanism (ERM) (Artis and Zhang, 1997, 1999), or for multiple periods as in Inklaar and De Haan (2001) and De Haan (2002, 2008). A more general and less arbitrary approach is to use movable windows as in Massmann and Mitchell (2004). The use of a correlation coefficient as a dependent variable in models examining the determinants of business cycle synchronization leads to some complications. Since the dependent variable is between 1 and 1, it is likely that error terms in a regression model of the determinants of business cycle synchronization will not be normally distributed. In fact, the evidence presented by Inklaar et al. (2007) suggests that it is necessary to transform the dependent variable.

Measuring Timing: "Accounting for Shocks"

All of the measures discussed so far take business cycles for granted. A different variety of literature seeks to directly classify fluctuations as originating, for example, from common shocks or country-specific shocks, as Caporale et al (2015) do. Clark and Shin (2000) review the literature that uses vector autoregression (VAR) models or factorial models to identify sources of fluctuations.

Thus, the authors state that shocks in industry i of country c can be broken down into common shocks (a), country-specific shocks (b), industry-specific shocks (c) and

idiosyncratic shocks (u). Alternatively, studies estimate models using data on industries within regions of a country (e.g., Norrbin and Schlagenhauf, 1996; Clark & Shin, 2000).

The most common identification assumption in these models is that the various shocks are uncorrelated. This means that an industry-specific shock at time t is a shock to that industry in all countries, but not to other industries. Clark and Shin (2000) argue that, although this is restrictive, it can be seen as providing a lower bound on the significance of industry- or country-specific shocks. A more conceptual problem with this type of model is that economic theory is relatively silent about the sources of the identified shocks. For example, it seems plausible to attribute industry-specific shocks to changes in product demand and productivity shocks, but no more definitive statements can be made in the absence of an economic model.

This method appears to be a complement to the methods described above for observing common cyclical movements between countries. In a way, the correlation between cycles is a "raw" measure of comotion, capturing all commonalities, regardless of the source of the shock, as well as the policy reaction to the shocks. The shock accounting literature attempts to take this a step further by deriving a "net" measure of comotion. This measure includes only shocks that occur in all countries and industries, and excludes the contribution of industry-specific shocks. From a policy point of view, the gross measure is probably more interesting, as it gives an indication of how appropriate a common monetary policy will be. However, the literature on crash accounting provides additional information.

4.   Synchronization of the economic cycle in Latin America.

Studies on the synchronization of business cycles in Latin America use different data sets and approaches to measure the business cycle and convergence, the main aspects and results of which are summarized in Table 1 and broken down and deepened below:

Data Used.

As for the data used, time series of macroeconomic variables such as real Gross Domestic Product (GDP), Industrial Production Index (IPI) and GDP per capita are mainly used. This data is collected on a quarterly or annual basis and covers different periods, from the 1950s to the present day. The studies also consider data on international trade and capital flows to analyze the influence of economic integration on the synchronization of cycles.

Measurement of cycle and convergence.

Among the approaches used to measure the business cycle, different methods are employed, such as the Hodrick-Prescott filter, the Bry-Boschan algorithm, and the Harding-Pagan algorithm. These approaches make it possible to identify cyclical movements of economic variables and to determine the duration and amplitude of cycles. Finally, different techniques are used to measure convergence, such as Pearson's corrected contingency coefficient, correlation coefficient, and generalized variance error estimation (GFEV). These measures make it possible to assess the convergence of business cycles between countries and to determine whether there is a trend towards synchronization or divergence.

Trade as a convergence mechanism.

Trade plays a crucial role in the propagation of business cycles in Latin America. Greater trade integration between countries can lead to the transmission of shocks and the synchronization of business cycles.

In this sense, a study by Caporale and Girardi (2015) found that trade is a mechanism for propagating the cycle between Latin American countries. The study suggests that trade flows between countries can transmit shocks and contribute to the synchronization of business cycles. Similarly, a study by Fiess (2007) on Central America concluded that trade integration within the region has the potential to synchronize business cycles. The study underlines the importance of trade linkages in transmitting shocks and influencing the overall movement of economic activity. In addition, a study by Gong and Kim (2018) on emerging and developing countries, including several Latin American countries, also emphasizes the role of trade integration in synchronizing business cycles. The study suggests that regional or global integration, particularly through trade, may lead to a greater degree of synchronization of business cycles. Taken together, these studies highlight the important influence of trade on the propagation of business cycles in Latin America, and increased trade integration contributes to the synchronization of business cycles among countries in the region.

Has there been convergence in Latin American business cycles?

Studies generally conclude that there is not a high synchronization of economic cycles among the countries of the region. However, greater synchronization is observed in subregions such as Mercosur, and trade plays a role in the propagation of business cycles. It also highlights the importance of financial and trade linkages with countries outside the region in synchronizing business cycles.

Thus, the studies conclude that there is limited evidence of a high level of synchronization of business cycles among Latin American countries. Among the most representative findings, we can highlight Fiess's (2007) study on Central America, which found limited evidence of a common business cycle in the region. Another study by Salamanca Lugo (2012) on Colombia, Ecuador, and Venezuela also found little evidence of a common business cycle. In addition, a study by Caporale and Girardi (2015) on Argentina, Brazil, Chile, Mexico, Peru, and Venezuela concluded that while trade plays a crucial role in propagating the cycle, the strength of synchronization between the various countries and the United States is unclear.

Overall, studies suggest that while there may be some synchronization of business cycles in Latin America, it is not strong or consistent across the region.

Table 1. Studies on Synchronization of Business Cycles in Latin America

I am a student	Data Used	Business Cycle Measurement	Convergence Measurement	Conclusions
Ávila-Vélez, J., & Pinzón-Giraldo, Á. J. (2015). Are Latin America's business cycles in sync?	Real Gross Domestic Product (GDP), Quarterly Series. Industrial Production Index (IPI), Monthly Series. 1980-2014 Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Venezuela	Hodrick-Prescott Filter Bry-Boschan algorithm	Cross-correlations Harding-Pagan Algorithm	It is possible to identify a joint cycle for the group of Latin American countries in the sample, supported by four major recessions (1982, 1998, 2000, 2008) that occurred in a generalized manner, in addition to those of an idiosyncratic nature. When analysing the combinations of country pairs separately, there is no high synchronization between them, there is, in addition, a drop in the significance of cross-correlations between country pairs since the end of 2012, except for Chile-Mexico and Chile-Colombia. Trade is a mechanism for propagating the cycle for these countries; however, it is not clear that there is a strong synchronization between the countries (individually) and the United States.
Bolaños, Andrea Gabriela Bonilla (2017). Are South American countries really converging? the influence of the region's integration projects	Gross Domestic Product per capita (GDPpc). Dollar-adjusted PPP. Annual series. 1951-2011 UNASUR (Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Peru, Uruguay, Paraguay, Venezuela)	Hodrick-Prescott Filter	Bernard and Durlauf's Stochastic Definitions of Convergence	The evidence presented supports the existence of several long-term trends driving production in South America, which means that the region is engaged in a dynamic process of convergence of living standards, but not of its economic cycles. The existence of this long-term trend suggests that economic growth responds to idiosyncratic factors in each country.
Caporale, G. M., & Girardi, A. (2015). Business cycles, international trade and capital flows evidence from Latin America.	Real Gross Domestic Product (GDP). Quarterly series. 1980-2011. Argentina, Brazil, Chile, Mexico, Peru, Venezuela. The four largest economies in the world (USA, European Union, Japan, China)	VAR model	Decomposition of Generalized Variance Error Estimation (GFEV)	The Latin American region as a whole is highly dependent on external development, especially since the Great Recession of 2008. There is a clear dominance of trade flows over financial flows as determinants of the co-movements of the trade cycle in the short term. Latin America's decoupling from the more advanced economies appears to have been determined not only by increased trade flows to China, but also by a low degree of financial integration with its main economic partners.

Fiess, N. (2007). Business Cycle Synchronization and Regional Integration: A Case Study for Central America	Real Gross Domestic Product (GDP). Annual series, 1965-2002 Industrial Production Index (IPI). Economic activity. Monthly, 1995-2002 CAFTA (United States, Costa Rica, El Salvador, Honduras, Guatemala, Nicaragua, Panama)	First Differences Baxter-King Filter	Correlations between the cyclical component of economic activity	The synchronization of business cycles in Central America is quite low compared to the synchronization in NAFTA and the European Union, but not compared to Mercosur. The USA is the most important partner. The synchronization of the business cycle in Central America is greatest between Costa Rica and El Salvador, El Salvador and Guatemala, El Salvador and Nicaragua, and Honduras and Nicaragua. The relationship between trade and the business cycle is the most important aspect of synchronization.
Gong, C., & Kim, S. (2018). Regional business cycle synchronization in emerging and developing countries Regional or global integration Trade or financial integration	Real Gross Domestic Product (GDP). Annual series. 1990-2009 Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Uruguay, Venezuela	Hodrick-Prescott Filter	Bilateral correlation coefficient	There are similar and strong common linkages with major industrial countries outside the region, particularly in Latin America. Regional trade integration has a positive effect on the synchronization of regional trade cycles, and regional financial integration has a negative effect.
González, G. H., Rendón, A. H., & Restrepo, A. M. P. (2012). Synchronization of Cycles and Latin American Integration: New Hypotheses After Another Empirical Exercise.	Gross Domestic Product per capita (GDPpc). Annual series. 1960-2008 Mercosur (Argentina, Brazil, Paraguay, Uruguay). CAN (Bolivia, Colombia, Ecuador, Peru). CACM (El Salvador, Guatemala, Honduras, Nicaragua, Costa Rica). Chile, Haiti, Mexico, Panama, Dominican Republic, Venezuela.	Hodrick-Prescott Filter	Bilateral correlation coefficient	There is a high volatility that is related to the crises that arise. No evidence is found in favor of the existence of a common cycle, although relevant correlations between pairs of countries are observed. This would lead us to think that there is a greater correlation of economic cycles between these countries, including subregional synchronization, as shown by the results obtained.

Martínez Roldán, L. E., Hurtado Rendón, Á. A., Builes, F., Calle Marín, N., & Vásquez Bedoya, F. A. (2012). Business cycles in LAAFA OR ALADI, CAN, CAFTA, MCCA: 1960-2008.	Real Gross Domestic Product (GDP), Annual Series. 1960-2008 ALADI, CAN, CAFTA, MCCA. Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela	Hodrick-Prescott Filter	Harding-Pagan Algorithm	The links are not strong enough to speak of a common cycle, for this reason it can be said that there are no indications of economic synchronization in the treaties analysed.
Mora-Mora, J. U. (2016). The Pacific Alliance and Mercosur are evidence of economic convergence.	Economic Convergence Index (ECI). 1980-2014 Pacific Alliance (Chile, Colombia, Peru, Mexico). Mercosur (Argentina, Brazil, Paraguay, Uruguay, Venezuela)	Hodrick-Prescott Filter	Correlation coefficient.	The results are not conclusive, it is not possible to determine the course to be followed by these two agreements for expansion and greater economic integration, although the patterns observed in the decisions of the member countries for this objective suggest that this could be quite feasible in the medium term and the economic convergence index reflects this trend.
Rendón, Á. H., & Vásquez, F. B. (2010). Synchronization of economic cycles in Mercosur 1960-2008	Real Gross Domestic Product (GDP). Annual series. 1960-2008 Argentina, Brazil, Paraguay, Uruguay, Chile, Colombia, Ecuador, Peru, Venezuela, Bolivia	Hodrick-Prescott Filter	Cross-correlations	Important relationships were found between some country pairs, but there is no evidence to suggest the existence of a common cycle in the region.

Reyes, P. M. (1999). Classic Economic Cycles in Latin America: Inflection Points, Asymmetries and International Synchronization.	Gross Domestic Product per capita (GDPpc). Annual series. 1950-1995 Argentina, Bolivia, Brazil, Chile, Colombia, Mexico, Peru, Venezuela	Bry-Boschan algorithm	Pearson's corrected contingency coefficient	The economies studied function differently in recessions and expansions. Little evidence was found of a common business cycle for Latin America.
Salamanca Lugo, A. (2012). Synchronization of economic cycles: the case of Colombia, Ecuador and Venezuela	Real Gross Domestic Product (GDP). Annual series. 1961-2007. Colombia, Ecuador, Venezuela	Multivariate autoregressive Markov switching model	Harding-Pagan Algorithm	There is strong statistical evidence to corroborate the existence of a common Markovian state in which the fluctuations of each economy are characterized by similar co-movements of productive activity in each country

5.   Conclusions.

The studies analyzed on the synchronization of business cycles in Latin America use a variety of data and approaches to measure the business cycle and convergence. These approaches make it possible to analyse the influence of trade and economic integration on the propagation of cycles and to determine whether there is strong or limited synchronization among countries in the region.

Studies on the synchronization of business cycles in Latin America conclude, in general, that evidence of a common business cycle in the region is limited. The level of synchronization varies across countries and subregions, and there are significant differences in the behavior of economies during recessions and expansions. Trade plays a crucial role in propagating the cycle, but the strength of synchronization between countries and the United States is unclear. In addition, the region's dependence on external events, particularly since the global recession of 2008, and the predominance of trade flows over financial flows as determinants of short-term business cycle co-movements are highlighted. Studies also suggest that Latin America's disconnection from advanced economies may be influenced by increased trade with China and low degrees of financial integration with its major partners.

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