Mexico's business cycles: determination and synchronization between the stock market and the business cycle

Ciclos económicos de México: determinación y sincronización entre el bursátil y el económico

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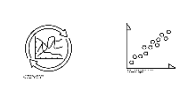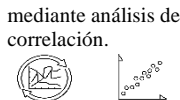
Abstract

The objective of this study was to determine the synchronization between Mexico's stock market cycle and business cycle. The business and stock market cycles were identified using the General Indicator of Economic Activity (IGAE) and the Mexican Stock Exchange's Price and Quotation Index (IPC). Turning points were detected following the Bry and Boschan procedure. Classical cycles were determined according to the Burns and Mitchell definition and aligned with the criteria of the Mexican Business Cycle Dating Committee. For each cycle, the chronology, duration, frequency, mean, minimum, maximum, and correlations between both cycles were calculated. The results reveal that the IPC shows more frequent turning points compared to the IGAE. Furthermore, the stock market cycle was identified as a leading indicator of the business cycle, with a lead time of three months.

Resumen

El objetivo de este trabajo fue determinar la sincronización entre el ciclo bursátil y el ciclo económico de México. Se determinaron los ciclos económicos y bursátiles, a través las variables Índice General de la Actividad Económica (IGAE) y el Índice de Precios y Cotizaciones (IPC) de la Bolsa Mexicana de Valores. Se identificaron puntos de giro con base al procedimiento de Bry y Boschan. Se determinaron los ciclos clásicos con base a la definición de Burns y Mitchell y siguiendo los criterios del Comité de Fechado de Ciclos de la Economía de México. Se calcularon por cada ciclo: duración cronología, veces, promedio, mínimo y máximo y correlación (entre ambos). En los resultados destacan que El IPC presenta puntos de giro más frecuentes en comparación con el IGAE; además se identificó al ciclo bursátil como un indicador adelantado, por tres meses, del ciclo económico.

Mexico's business cycles: determination and synchronization between the stock market and the business cycle		
Objective	Methodology	Contribution
Determine the synchronization between Mexico's stock market cycle and business cycle.	Classical cycles were determined according to the Burns and Mitchell definition. Synchronization was determined by correlation analysis.	The stock market cycle was identified as a leading indicator of the business cycle, with a lead time of three months.

Ciclos económicos de México: determinación y sincronización entre el bursátil y el económico		
Objetivo	Método	Contribución
Determinar la sincronización entre el ciclo bursátil y el ciclo económico de México.	Se determinaron los ciclos clásicos con base a la definición de Burns y Mitchell. Se determinó la sincronización mediante análisis de correlación.	Se identificó al ciclo bursátil como un indicador adelantado, por tres meses, del ciclo económico.

Cycles, Chronology, Synchronization

Ciclos, Cronología, Sincronización

Introduction

The Mexican Stock Exchange (BMV) index (Índice de Precios y Cotizaciones, IPC) is one of the indicators of the Mexican Stock Exchange (BMV). Like the IPC, there are other relevant indices in international financial markets, such as the Dow Jones, the Nasdaq 100 and the S&P500 (Román, et al., 2019). In general terms, stock market indices group a representative sample of companies listed on a stock exchange.

Most countries have a benchmark index, and the positive or negative performance of the companies included in them directly impacts the value of the index, either upwards or downwards (Mireles, 2012).

Some stock indices measure the overall performance of a market, while others focus on specific sectors. For example, the Nasdaq 100 specialises in technology companies, including those in hardware, software, telecommunications, biotechnology, and retail or wholesale. These companies, both domestic and international, are listed on the Nasdaq Stock Market and the New York Stock Exchange (NYSE) (Martinez and Devesa, 2021).

Several studies have analysed the importance of stock market indices, Ladrón de Guevara (2004) highlighted the relevance of the IPC in the BMV. Although some question its representativeness because it includes only the largest companies in Mexico and leaves out many others that are not listed, these large companies are fundamental for the national economy. Their growth generates a positive spillover effect on other companies linked to their activity, thus promoting economic reactivation in different sectors of the country.

The analysis of business cycles began in the last century. Kuznets (1926) identified common patterns between the business cycles of different countries, Mitchell (1927) pointed out the existence of specific phases in the cycles, and Mills (1936) discovered associations between prices and quantities during the stages of economic expansion and contraction. Currently, business cycle theory has two main objectives: to develop general equilibrium models that explain the causes and propagation of economic fluctuations, and to determine the empirical facts of cycles (Arango-Thomas and Castillo, 1999; Cuadra, 2008; Orellana, 2011). This research focuses on the second objective.

Business cycles reflect fluctuations in aggregate economic activity, their peaks and valleys are essential to identify growth and contraction phases, they are recurrent, they do not follow an exact periodicity, and their duration can vary from one year to more than a decade. Understanding these cycles allows an assessment of the economic situation and facilitates decision-making in economic policy and in the private sector (INEGI, n.d.).

In addition to the analysis of business cycles, it is also crucial to study financial cycles. Román, et al. (2019). investigated the synchronised movements between the Mexican CPI and the Dow Jones in the United States, as well as their relationship with the economic cycles of both countries. Using concepts such as trend, turning points and synchrony, they concluded that stock market indices tend to anticipate economic cycles, with a margin of at least four months.

In Argentina, Lanteri (2014) explored the long-run relationships between major stock market indices and economic activity using Granger causality tests and VEC (vector error correction) models. The analysis, based on monthly data from 1993 to 2010, found that the MERVAL25 and BURCAP indices cause, in a Granger sense, the economic activity estimator (EMAE). He concludes that both indicators could be used to anticipate changes in Argentina's monthly indicator of economic activity.

Similarly, Pinilla (2014) studied the impact of the stock market on the business cycle in Colombia. Using a VAR model and causality tests, he showed that the General Index of the Colombian Stock Exchange (IGBC) has a positive effect on GDP, and that the stock market anticipates changes in the business cycle.

In terms of synchronisation studies, Calvia (2024) analysed the fluctuations in carbon emissions of sixteen major developed and developing economies over the period 1946-2021, under the classical business cycle approach, identified expansionary and recessionary phases, establishing their durations and amplitudes; he also assessed the synchronisation of emissions between pairs and groups of countries to measure their degree of integration in terms of carbon.

He found that developed economies exhibit a common carbon emissions cycle, while the results are more heterogeneous in developing economies, with only a fraction of the latter showing the presence of a common carbon emissions cycle.

Elayan (2024) formulated a global sourcing model that considers the comparative advantage favoured by geographical location and varying levels of exposure to regional shocks, defined by the timing of these shocks across firms' sourcing locations. The author found that firms with more dispersed supply chains derive significant benefits from exploiting the specialisation and comparative advantages of the various regions. However, dispersion makes them more fragile to supply chain disruptions due to out-of-sync business cycles; as a result of covid-19 confinements and constraints, firms reacted by decreasing their geographical dispersion to lessen impending risks.

Another study of cycle synchronisation was by Magubane (2024) who analysed the degree of synchronisation of the financial cycle. degree of synchronisation of the Aggregate Financial Cycle and the Credit and Real Estate Cycle in South Africa using the Dynamic Conditional Correlation model and the Vector Error Correction Mechanism; his results showed a higher level of homogeneity in the stability, size and movement of financial cycles versus their relationship with business cycles, indicating greater synchronisation of financial cycles.

In the same vein, Papaioannou (2024) studied the impact of the euro on the synchronisation of business cycles in EMU countries. He found that monetary union had a negative effect on the synchronisation of business cycles, after examining a large set of variables, antecedent trends and post-euro entry relationships.

The proposal of Bybee, et al. (2024) contemplates the formulation of a thematic model, using a vector autoregressive model extended with text, which, based on the text of 800,000 articles published (between 1984 and 2017) in the *Wall Street Journal*, which synthesises the news into interpretable topics, measures the proportion of attention given to the topic over time.

They found that narratives drawn from news text complement existing numerical measures and provide additional space for understanding economic and financial market variations, giving them the potential to increase understanding of business cycles and improve decision making based on textual data.

According to Galván-Corral, et al. (2023), since Kydland and Prescott established the empirical regularities of the US business cycle, multiple researchers have used this methodology to identify them in countries such as Chile, Colombia, Peru, Ecuador and Mexico, among others in Latin America.

However, the literature analysing the synchronisation of the stock market cycle and the business cycle for Mexico seems to be scarce; consequently, the following research question is formulated: Are the stock market cycle and the business cycle synchronised in Mexico? The objective of this study was to determine the synchronisation between the stock market cycle and the business cycle in Mexico, using the classical cycle methodology.

The synchronisation of the stock market cycle and the business cycle in Mexico, under the classical cycles approach, is of strategic relevance in order to identify patterns that enable the use of the stock market cycle as a predictor of the business cycle. The volatility of stock markets, together with their capacity to show future expectations, suggests that the behaviour of the stock market could anticipate changes in the real economy. In a context where the Mexican economy is susceptible to both internal and external factors, the identification of these turning points provides decision-makers with useful tools to anticipate recessions or expansions, designing more effective public policies aligned with economic cycles.

This approach not only contributes to the theoretical understanding of the relationship between financial and economic variations, but also provides a practical contribution to improve risk management and economic planning. The synchronisation between the two cycles is crucial for defining whether the stock market operates ahead of the business cycle or whether it has a time lag that limits its predictive ability.

The findings of this work will have relevant implications for the design of financial strategies, both from a public and private perspective, by facilitating decision making based on early information from the financial market that anticipates phases of economic expansion or contraction.

The use of the Mexican Stock Exchange (BMV) Price and Quotations Index (IPC) and the Mexican General Index of Economic Activity (IGAE) is fundamental to determine stock market and business cycles, respectively, due to the complementary nature of both indicators.

The IPC reflects the aggregate behaviour of the stock market, capturing investors' expectations about future economic performance, making it a key thermometer of financial confidence. The IGAE provides a broad and timely measure of the level of economic activity in key sectors, making it possible to identify the expansion and recession phases of the business cycle.

The joint analysis of both indices not only facilitates the accurate determination of stock market and business cycles, but also allows their synchronisation to be assessed, thus providing a valuable tool for anticipating changes in the economy and making strategic decisions for both the public and private sectors.

In addition, using the IGAE to identify business cycles in Mexico has benefits, as it is highly correlated with gross domestic product (GDP), which is generally used to identify business cycles, and is therefore valued as an excellent indicator of output (Heat, 2012).

The document is composed of six parts: the first is the introduction section, including, among other aspects, the research question and objective; the second corresponds to the methodology, which includes the type of research, the variables used, the period of analysis and the description of the methodology for the identification of classical economic cycles and the synchronisation between the financial and economic cycles; the third part corresponds to the results, the fourth part is devoted to the acknowledgements, the fifth to the source of funding, in the sixth part the conclusions of the research are presented.

Methodology

The study was quantitative, with a business cycle econometric approach. The classical economic and stock market cycles were determined, through the variables IGAE and IPC, respectively; both are seasonally adjusted time series [Instituto Nacional de Geografía e Informática, (INEGI, 2018)] with monthly periodicity and unit of measurement index base 2018=100, the sample comprised from January 1993 to August 2022, which are available for consultation and download in the Economic Information Bank of INEGI.

The analysis of the data is described below: the variables under study (CPI and IGAE) were transformed to natural logarithms, as it is a usual and recommended practice; the identification of turning points was determined based on the procedure of Bry and Boschan (1971) using the Bry-Boschan-Pagan-Harding algorithm, available as a complement of the Eviews v10 program and following the criteria established by the Committee for the Dating of Cycles of the Mexican Economy (2022); the classical cycles were obtained according to the definition of Burns and Mitchell (1946), each cycle was set from initial peak-valley-final peak; the two phases of each cycle were recorded, descending (Initial Peak to Valley) and ascending (Valley to Final Peak); regarding the stages of the cycle, the most common style of identifying the stages of recession, contraction, recovery and expansion was followed (Heat, 2012).

Some facts or regularities of the CPI and IGAE cycles were calculated: duration and correlation (Kydland and Prescott, 1990); also reported, by stage or phase of each cycle: timing, times, average, minimum and maximum (Erquizio Espinal, 2007, Heat, 2011, 2012; and Erquizio Espinal, et al., 2020).

Results

This section presents the results of the study, firstly, the analysis of the economic cycles, then the analysis of the stock market cycles, and finally the analysis of the synchronisation between the two.

Box 1

Table 1

IGAE pivot points

Peaks	Valleys
1994M10	1995M05
2000M09	2002M01
2008M06	2009M05
2018M08	2020M05
2021M03	2021M10

Source: Own elaboration

The table refers to peaks and troughs in economic activity measured by the IGAE between 1994 and 2021. Highlights include peaks in October 1994, September 2000, June 2008, and August 2018. The most significant valleys occurred in May 1995, May 2009, and May 2020, reflecting critical moments of economic contraction and recovery. Figure 1 shows the business cycles based on the IGAE turning points.

Box 2

Figure 1

Business cycles (based on IGAE)
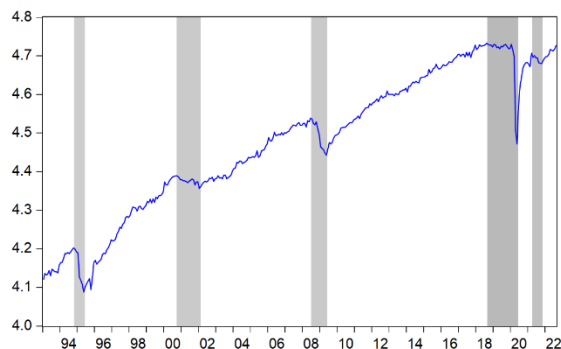
Source: Own elaboration, the grey part represents the downward phase of the cycle

The IGAE turning points show the dates when peaks and troughs in Mexican economic activity were recorded from 1994 to 2021. Peaks are identified in October 1994, September 2000, June 2008 and August 2018, among others. The most notable valleys occurred in May 1995, related to the so-called Tequila effect, May 2009, related to the US housing crisis, and May 2020, related to the economic impact of the COVID-19 pandemic.

Table 2 describes the different stages and phases of the business cycle. The longest expansions occurred between November 2003 and June 2008 (56 months), and from February 2011 to August 2018 (91 months).

The longest recessions occurred between August 2018 and May 2020 (22 months). Recovery phases are also notable, such as between May 2009 and February 2011 (22 months), following the 2008 recession. As for expansions, the one observed between February 2011 and August 2018 (91 months), also following the 2008 recession, stands out.

The stages of the business cycle show phases of recession, recovery and expansion. The most notable are prolonged expansions, such as the one from November 2003 to June 2008, which lasted 56 months, and the one from February 2011 to August 2018, which lasted 91 months. As for recessions, they vary in length, the shortest in 1994-1995 and 2021, both lasting 8 months, and the longest between August 2018 and May 2020, which lasted 22 months. It is noteworthy that there were no business cycle downturns in the period under analysis. Recovery phases tend to last more than one year, as in 1995-1996 (17 months) and 2009-2011 (22 months), while expansions tend to last more than four years.

Typically, the IGAE business cycle phase analysis shows complex patterns of expansion, recession and recovery. Expansions, such as from 2003 to 2008, were relatively long (56 months), aligned with periods of global growth. However, recessions in 2008-2009 and 2018-2020 reveal vulnerability to external shocks. The longest phase was the expansion between 2011 and 2018 (91 months), reflecting stability after the 2008 financial crisis. These results highlight how international economic shocks significantly affect national economic performance.

Box 3

Table 2

Summary of the stages of the business cycle (based on IGAE)

Peaks	Valleys	Phase	Etapa	Duration (months)
Oct-1994	May-1995	Descending	Recession	8
May-1995	Sep-1996	Ascending	Recovery	17
Sep-1996	Sep-2000	Ascending	Expansion	49
Sep-2000	Ene-2002	Descending	Recession	17
Ene-2002	Nov-2003	Ascending	Recovery	23
Nov-2003	Jun-2008	Ascending	Expansion	56
Jun-2008	May-2009	Descending	Recession	12
May-2009	Feb-2011	Ascending	Recovery	22
Feb-2011	Ago-2018	Ascending	Expansion	91
Ago-2018	May-2020	Descending	Recession	22
May-2020	Mar-2021	Ascending	Recovery	11
Mar-2021	Oct-2021	Descending	Recession	8

Source: Own elaboration

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Table 3 summarises the phases of the business cycles. On average, recessions lasted 13.4 months, with a minimum of 8 months and a maximum of 22 months. Recessions and expansions were longer, with an average of 18.3 and 65.3 months, respectively, reaching a maximum of 23 and 91 months. The ascending phases lasted an average of 67.3 months, with a minimum of 11 months and a maximum of 113 months, while the descending phases had an average duration of 13.4 months, with a minimum of 8 months and a maximum of 22 months.

In terms of business cycle characteristics or stylised facts, the average duration of recessions was 13.4 months, with a minimum of 8 months and a maximum of 22 months, but some, such as the one in 2008-2009, were deeper. Expansions have a considerably longer duration, averaging 65.3 months, with the shortest being 49 months and the longest 91 months, highlighting that periods of economic growth are longer than periods of recession, which could be interpreted as a trend towards long-term recovery. Upturns averaged 67.3 months, while downturns were shorter, averaging 13.4 months, suggesting that the economy takes time to regain momentum after recessions.

This is in line with Kydland and Prescott (1990), Heath (2012) and the Mexican Economic Cycle Dating Committee (2022).

Box 4

Table 3

Characteristics of Mexico's business cycles (based on IGAE))

Stages/Phase	Times	Number of months		
		Average	Minimum	Maximum
Recession	5	13.4	8	22
Recovery	4	18.3	11	23
Expansion	3	65.3	49	91
Upswing	4	67.3	11	113
Downturn	5	13.4	8	22

Source: Own elaboration

The analysis of the stock market cycles is presented below. Table 4 shows the peaks and troughs of the stock market cycle as measured by the CPI between 1994 and 2020. Highlights include peaks in January 1994, May 2008 and August 2017, as well as troughs in February 2009 and March 2020. These turning points reflect boom and bust periods in the Mexican stock market. Figure 2 shows the stock market cycles, based on the IPC turning points.

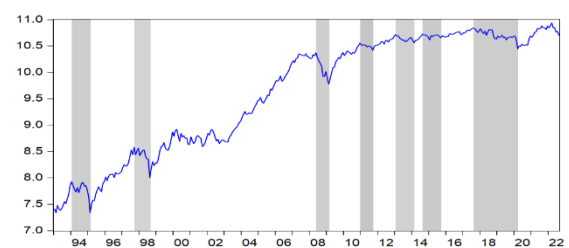**Box 5**

Table 4

CPI turning points

Peaks	Valleys
1994M01	1995M02
1997M09	1998M08
2008M05	2009M02
2010M12	2011M09
2013M01	2014M02
2014M08	2015M09
2017M08	2020M03

Source: Own elaboration

Box 6

Figure 2

Stock market cycles (CPI-based)

Source: Own elaboration, the grey part represents the downward phase of the cycle

The longest stock market expansion was between April 1999 and May 2008 (110 months). Recessions, although more frequent, had shorter durations, notably from January 1994 to February 1995 with a duration of 14 months, from May 2008 to February 2009 with a duration of 10 months, as well as from August 2017 to November 2018 with a duration of 14 months, prior to the only contractionary phase that occurred between November 2018 and March 2020, with 17 months (table 5).

Box 7

Table 5

Summary of the stages of the stock market cycle (based on the CPI)

Peaks	Valleys	Phase	Stage	Duration (months)
Ene-1994	Feb-1995	Descending	Recession	14
Feb-1995	Dic-1995	Ascending	Recovery	11
Dic-1995	Sep-1997	Ascending	Expansion	22
Sep-1997	Ago-1998	Descending	Recession	12
Ago-1998	Abr-1999	Ascending	Recovery	9
Abr-1999	Mayo-2008	Ascending	Expansion	110
May-2008	Feb-2009	Descending	Recession	10
Feb-2009	May-2010	Ascending	Recovery	16
May-2010	Dic-2010	Ascending	Expansion	8
Dic-2010	Sep-2011	Descending	Recession	10
Sep-2011	Mar-2012	Ascending	Recovery	7
Mar-2011	Ene-2013	Ascending	Expansion	23
Ene-2013	Feb-2014	Descending	Recession	13
Feb-2014	Ago-2014	Ascending	Recovery	7
Ago-2014	Sep-2015	Descending	Recession	14
Sep-2015	Jun-2016	Ascending	Recovery	10
Jun-2016	Ago-2017	Ascending	Expansion	11
Ago-2017	Nov-2018	Descending	Recession	14
Nov-2018	Mar-2020	Descending	Contraction	17

Source: Own elaboration

Stock market recessions occurred 7 times, with an average duration of 12.4 months. Recessions averaged 10 months, reaching a maximum of 16 months. Expansion phases were more varied, with an average of 34.8 months and a maximum of 110 months. Rising phases lasted an average of 39 months, while falling phases averaged 14.9 months, with a maximum of 31 months (Table 6).

Box 8

Table 6

Characteristics of the Mexican stock market cycles (based on the IPC

Stages/Phase	Times	Number of months		
		Average	Minimum	Maximum
Recession	7	12.4	10	14
Contraction	1	17	17	17
Recovery	6	10	7	16
Expansion	5	34.8	8	110
Upswing	6	39	7	119
Downturn	7	14.9	10	31

Source: Own elaboration

The IPC has more frequent turning points compared to the IGAE, indicating greater volatility in the stock market. Moments such as 2008-2009 and 2017-2020 reflect the impact of global crises, including the pandemic. The higher number of peaks and valleys indicates that stock markets, which have higher volatility, tend to react faster than the real economy, can provide useful clues for anticipating business cycles.

Conversely, the expansion phases of the CPI turned out to be shorter than those of the IGAE. The longest expansion was from April 1999 to May 2008, lasting 110 months. Recessions occurred more frequently, averaging 12.4 months, with the shortest being 10 months and the longest 14 months. Recessions tend to be faster, as in 1995 (11 months) and 1999 (9 months).

The CPI stock market cycle reveals shorter recovery phases than economic ones, with notable expansions such as that of 1999-2008, which lasted 110 months. However, the frequency of recessions suggests that the stock market is more prone to fluctuations. Recession phases, such as those of 2017-2020, show how financial markets respond quickly to economic and political events, both internal and external.

Stock market cycles have a higher frequency of recessions (7 times) and a shorter average duration (12.4 months) compared to business cycles. Expansions are shorter, averaging 34.8 months, although the phase from 1999 to 2008 stands out as one of the longest. This suggests that the stock market is more sensitive to short-term changes, while the real economy has more stable and longer cycles.

The stock market, as measured by the CPI, has more frequent turning points than the economic market, as measured by the IGAE, suggesting that financial markets react more quickly to economic changes. This can be seen, for example, in the 2008 and 2020 crises, where the CPI recorded troughs before the impact was fully reflected in the IGAE.

Economic expansions tend to be longer than stock market expansions, reflecting how stock markets can anticipate or decouple from the real economy. Stock market recessions are shorter but more frequent, indicating greater financial market volatility.

Stock market cycles show a higher frequency of downturns and shorter duration of expansions compared to business cycles. This implies that, while the Mexican economy can sustain more stable and prolonged growth phases, the financial market experiences more dynamic fluctuations in response to short-term changes.

Generally speaking, cycles are recurrent rather than periodic, which is consistent with Mitchell (1927) and Burns and Mitchell (1946).

As for the synchronisation results between the Mexican stock market and business cycles, they are presented in table 7. The correlation between the CPI and IGAE cycles shows a strong positive relationship, especially in the 3- to 4-month lags, where the coefficient reaches its maximum point, with a value of 0.964394. This indicates that the stock market cycle tends to anticipate changes in the real economy by three months. As the lag increases beyond 6 months, the correlation progressively decreases, indicating that the impact of the stock market on the economy is more immediate and that it is diluted over time.

The correlation between the CPI and the IGAE shows a significant positive relationship, especially at the 3-month lag.

This indicates that movements in the CPI tend to anticipate, by three months, the business cycles of the IGAE. In other words, changes in the stock market can be used as a three-month leading indicator to predict the direction of the real economy. These results are consistent with those of Pinilla (2014); Lanteri (2014), Román, et al., (2019) and INEGI (n.d.).

Box 9

Table 7

Co-movements between the stock market and the business cycle

Variable	IGAE
IPC (-6)	0.963698
IPC (-5)	0.964069
IPC (-4)	0.964335
IPC (-3)	**0.964394**
IPC (-2)	0.964249
IPC (-1)	0.963452
IPC	0.961672
IPC (1)	0.959487
IPC (2)	0.957171
IPC (3)	0.954925
IPC (4)	0.952671
IPC (5)	0.950614
IPC (6)	0.948321

Conclusions

The results indicate that the Mexican economy, as measured by the IGAE, exhibits more stable and longer cycles than the stock market, which shows a higher frequency of fluctuations and shorter duration of expansion phases. The strong correlation between the two cycles, especially at closer lags, suggests that the stock market is an effective predictor of economic performance. Thus, monitoring the CPI can provide early signals to anticipate changes in the real economy, which is valuable for decision-makers and investors alike.

In terms of economic policy, it is recommended to use stock market movements as a leading indicator to formulate counter-cyclical policies to mitigate the negative effects of economic downturns. Stock market volatility also implies the need to strengthen financial regulation to prevent excessive market fluctuations from affecting economic stability.

At the corporate level, companies could benefit from strategies that take stock market cycles into account when planning their investments and expansion, especially during recovery and boom phases.

Finally, the study suggests that the joint analysis of stock market and business cycles is fundamental to understanding the dynamics of the Mexican economy. The stock market, by reacting more quickly, can provide key information for designing timely and effective policies to foster sustained growth and reduce the impact of future crises.

This study fulfilled the research objective by determining the synchronisation between the stock market cycle and the business cycle in Mexico, using the classical cycle methodology, which allowed us to identify the stock market cycle as a three-month leading indicator of the business cycle.

The study has some limitations, one of which is that the dating of the business cycles obtained in this study was not analysed in comparison with the business cycles determined by the Mexican Economic Cycle Dating Committee, which was set up relatively recently in Mexico; given this situation, the dating of one or the other may have some differences in terms of the start or end of some of the phases of the cycles; another aspect that may be considered a limitation is that while the Committee only identifies two stages or phases: recession and expansion, this study identified four stages: recession, contraction, recovery and expansion, as well as two phases: downward and upward, which could be comparable to those identified by the Committee.

Another limitation to consider is that, generally, in the determination of economic cycles, not only one variable is taken into account (as was the case in this research) but a series of economic indicators or variables based on which the phases and dates of the economic cycle are determined, leaving the decision on the dates and phases of the cycle to the discretion of the responsible authority, while in this research only one variable (IGAE) was used to determine the dating, stages and phases of the economic cycles, in addition to resorting to an algorithm through the application of software for this purpose. As for future research, it may be advisable to use, for the determination of business cycles, the gross domestic product of Mexico, which is published on a quarterly basis, however, it is available since the first quarter of 1980, so that the cycles could be identified with a relatively larger sample than the one used in this research.

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Another route is to analyse the synchronisation of the economic cycle with cycles of other indicators that could be leading indicators, such as employment variables, remunerations, company inventories, among others, or to determine the economic cycles, whether of growth or acceleration, as well as the synchronisation of national or international cycles.

Declarations

Conflict of interest

The authors declare that they have no conflicts of interest. They have no known competing financial interests or personal relationships that might have appeared to influence the article reported in this paper.

Authors' contribution

Galván-Corral, *Alberto*: Project idea, literature review, resources, writing, editing, proofreading, data analysis, formulation of results.

Murillo-Félix, *Cecilia Aurora*: project idea, writing, editing, proofreading, literature review.

Hinojosa-Rodríguez, *Carlos Jesús*: literature review, data collection, writing, proofreading.

López-Castro, *Jesús Alberto*: literature review, data collection, writing, formulation of results.

Availability of data and materials

The IGAE series is available from INEGI's Economic Information Bank, while the CPI series is available from Banxico's Economic Information System, however, the database used in this research can be requested from alberto.galvan@itson.edu.mx.

Abbreviations

Banxico	Bank of Mexico
BMV	Mexican Stock Exchange
EMAE	Economic activity estimator
IGAE	General Index of Economic Activity
IGBC	General Index of the Colombian Stock Exchange
INEGI	National Institute of Statistics and Geography
IPC	Index of Prices and Quotations
NYSE	New York Stock Exchange
S&P500	Standard & Poor's 500 Index
VEC	Error correction vector

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