www.cya.unam.mx/index.php/cya

Contaduría y Administración 66 (3), 2021, 1-22

Stock market development and economic growth in Mexico: An examination using ARDL and non-causality approaches

Desarrollo del mercado accionario y crecimiento económico en México: un examen mediante los enfoques ARDL y no causalidad

Jesús Dacio Villarreal-Samaniego*

Instituto Tecnológico de Parral, México

Received October 23, 2018; accepted September 23, 2020
Available online January 10, 2020

Abstract

This research paper examines the interaction between the development of the stock market and economic growth in Mexico. Unit root tests with structural breaks show that of all crises registered between 1993 and the first quarter of 2018, the so-called Tequila Crisis of the mid-1990s was the most relevant since it affected all the variables examined. When applying the ARDL model with bounds tests, the study found cointegration between the dynamics of economic indicators and several variables of the stock market, but not with the Price and Quotations Index. The results of the Granger non-causality test through the Toda & Yamamoto methodology suggest that market capitalization caused economic growth in Mexico and indicate a two-way causality between economic growth and the market capitalization index.

JEL Code: G10, O10, O47
Keywords: economic growth; stock market; ARDL; causality

* Corresponding author.
E-mail address: jesusdacio@yahoo.com (J. D. Villarreal-Samaniego).
Peer Review under the responsibility of Universidad Nacional Autónoma de México.

http://dx.doi.org/10.22201/fca.24488410e.2021.2259

Resumen

Este trabajo de investigación examina la interacción entre el desarrollo del mercado de valores y el crecimiento económico en México. Las pruebas de raíz unitaria con cambios estructurales muestran que de todas las crisis registradas entre 1993 y el primer trimestre de 2018, la llamada Crisis del Tequila de mediados de la década de 1990 fue la más relevante ya que afectó a todas las variables examinadas. Al aplicar el modelo ARDL con pruebas de límites, el estudio encontró cointegración entre la dinámica de los indicadores económicos y varias variables del mercado de valores, pero no con el Índice de Precios y Cotizaciones. Los resultados de la prueba de no causalidad de Granger a través de la metodología Toda & Yamamoto sugieren que la capitalización de mercado provocó el crecimiento económico en México e indican una causalidad bidireccional entre el crecimiento económico y el índice de capitalización de mercado.

Código JEL: G10, O10, O47
Palabras clave: crecimiento económico; mercado accionario; ARDL; causalidad

---

Introduction

A country's economic growth, defined as the increase in production value in real terms over a given period, is closely related to the well-being of its citizens and the decision-making prospects of producers, consumers, investors, and other economic agents. For these reasons, economic growth, and the ways to boost it, have been a constant topic of study in economic science and possibly the most examined aspect of this discipline.

The literature has argued that financial markets serve an important function by allowing resources to move from those economic units that lack productive investment opportunities to those that do (Levine & Zervos, 1998; Mishkin & Eakins, 2015). In other words, a well-organized financial market makes it possible to direct resources toward productive and profitable investment projects, which ultimately promotes economic activity, helps mobilize household savings, favors risk diversification, and facilitates the exchange of goods and services (Caporale, Howells, & Soliman, 2004).

Beginning with the work of Schumpeter (1911) and continuing with those of Goldsmith (1959) and McKinnon (1973), among others, multiple empirical studies have explored the causal relation between economic growth and the development of financial markets. However, the debate regarding their findings is still ongoing. While some research points to a positive causal relation between financial market development and economic growth (Boubakari & Jin, 2010; Caporale et al., 2004; King & Levine, 1993; Pradhan, 2018), others conclude that financial market development negatively influences economic growth (Bhatt, 1995; Lucas, 1988). Also, while it is argued that the financial sector helps mobilize savings to create growth in the real sector of the economy, it is argued that the surpluses generated by economic growth cause the development of financial markets (Pan & Mishra, 2018).

Nevertheless, considering the complexity and diversity of financial markets, several studies have specifically focused on examining the causal relationship between stock market development and economic growth (Adebayo, Awosusi, & Eminer, 2020; Boubakari & Jin, 2010; Lahura & Vega, 2017; Levine & Zervos, 1998; Pan & Mishra, 2018). This research aims to examine the relation between economic growth and stock market development in Mexico, a country for which the literature on the subject is relatively scarce.

Specifically, after testing for the presence of unit root with structural breaks according to Perron's (1989) proposal and identifying the moments of such changes with Bai and Perron's (2003) method to generate the corresponding binary variables, the study applies the autoregressive distributed lags model (ARDL) with bounds testing (Pesaran, Shin, & Smith, 2001) to examine the short and long-run dynamics of stock market variables and those of the real economy.

In addition, given the debate in this regard, the existence of non-causality in the Granger sense was tested with the method proposed by Toda and Yamamoto (1995), which determines the relation and direction of causality regardless of the order of integration of the variables (Inusah, 2018). Both the ARDL model with bounds testing and Toda and Yamamoto's non-causality model are powerful methods that, as far as could be determined, have not been applied in previous studies conducted in Mexico on this topic.

The rest of the paper is organized as follows: section 2 presents the review of the literature, part 3 describes the data, section 4 explains the methodology used in the research, part 5 presents the empirical results, and the discussion and conclusions are presented in section 6.

Review of the literature

Various views have been proposed in the literature regarding the relationship between financial market development and economic growth (Blum, Federmair, Fink, & Haiss, 2002; Graff, 2001). (1) The approach that there is no relation between these variables. (2) The supply anticipation theory, in which financial development anticipates and determines economic growth (Cole & Shaw, 1974; McKinnon, 1973). (3) The demand-pull theory, which holds that financial development follows economic growth (Robinson, 1952). (4) The approach that there is an interdependent relation between the real and financial sectors (Patrick, 1966). (5) The view that financial development hinders economic growth (Bhatt, 1995; Lucas, 1988).

Several studies indicate a positive relation between the dynamics of the economy and that of the stock market. Pradhan (2018) examined the relationship between stock market development and economic growth in G-20 countries between 1980 and 2015. Granger causality tests using vector autoregressive (VAR) models indicate unidirectional causality between stock market development and per capita economic growth. Similarly, the results obtained by Caporale et al. (2004), in their analysis of seven countries[1] for the period 1977-1998, indicate that a well-developed stock market promotes long-term economic growth. The authors also conclude that well-functioning stock markets can foster economic development, supporting economic growth through faster capital accumulation and adjusting it through a better allocation of resources.

Likewise, the results of the ARDL models used by Adebayo et al. (2020) for the Nigerian economy for the period 1989-2017 indicate that market capitalization of listed companies, total value of traded shares, and market turnover have positive effects on economic growth, measured through GDP per capita.

Despite the empirical evidence supporting the positive relation between stock market development and economic growth, several studies report contrary findings. In their analysis of nine European Union candidate countries[2], Fink et al. (2009) found no evidence that stock markets were an important factor in the economic growth of these nations in the period from 1996 to 2000. Through the ARDL approach with bounds testing, Pan and Mishra (2018) examined the relationship between economic growth, measured through the industrial production index as a proxy for GDP, and stock market development in China. The study, which considered the period from January 1991 to November 2015, concluded that, over the long term, the Shanghai A market had a very small but negative relationship with the real economy. The same research found no relationship between the real economy and the stock market in the short term. On the other hand, Men and Li (2006) found no long-term or Granger causality relation between the Chinese economy and the Shanghai and Shenzhen stock market indices between 1995 and 2005.

Conflicting findings have also been reported in studies conducted in several emerging countries. Aali-Bujari, Venegas-Martínez, and Pérez-Lechuga (2017) examined the impact of bank spread and stock market capitalization on per capita economic growth in the seven largest Latin American[3] economies, a variable they used as a proxy for economic development. This research, which covered the period 1994-2012 and used the generalized method of moments, concluded that there is a positive relationship between stock market capitalization with per capita income and, therefore, with the economic development of these countries in the region.

Tinoco et al. (2011) examined the influence of stock market development and financial development in general on the growth rate in four Southeast Asian and three Latin American[4] countries

[1] Argentina, Chile, Korea, Philippines, Greece, Malaysia and Portugal.
[2] Bulgaria, Slovakia, Slovenia, Hungary, Malta, Poland, Czech Republic, Romania, and Turkey.
[3] Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela.
[4] The Southeast Asian countries were the Philippines, Indonesia, Malaysia, and Thailand and the Latin American countries were Chile, Mexico, and Venezuela.

between 1980 and 2009 through nonparametric panel regression. The authors concluded that the stock market's development has negatively affected Latin American countries' economic growth, while such effects have been favorable for Southeast Asian countries. Lahura and Vega (2017) applied VAR models with long-run restrictions to examine the relationship between real economic activity and stock market development in Peru from 1965 to 2013. This research indicates that stock market shocks had a positive short-term causal effect on real GDP per capita growth dynamics. Nevertheless, this occurred only from the early 1990s onwards and with a low level of impact.

In the particular case of Mexico, empirical studies on the relationship between stock market development and economic growth also report mixed results. Using a multivariate time series method, Kassimatis and Spyrou (2001) investigated the relationship between the development of the banking sector, the stock market, and the economic development of five of the most important[5] emerging economies between 1977 and 1997. This research concluded that the stock market plays a role in Mexico's economic development. More specifically, the study results indicate that the Mexican stock market is exogenous, according to the Boyd and Smith (1996) model, which the authors attribute to the country's high level of economic openness.

Ron Delgado (2001) examined the long-run and causal relationship between stock market activity and economic growth in Mexico between 1980 and 2001, using VAR models and the Granger non-causality method. This research showed that the effect of the stock market development indicator was significant for GDP between 1987 and 2001. The study also concluded that the Mexican Stock Exchange Price and Quotations Index (IPC, Spanish acronym for this index) and the value of industrial production had a long-term equilibrium relation, and that the IPC has an effect in the Granger sense on the value of industrial production.

Research by Castillo-Ponce, Rodríguez-Espinosa, and Gaytán-Alfaro (2015) examined the relationship between economic growth, measured through the dynamics of GDP and industrial production, and various stock market indicators in Mexico between 1993 and the first quarter of 2011. By applying Johansen's (1991) cointegration test and Vahid and Engle's (1993) common cycle test, the authors found a positive long-run association between stock market variables and economic growth, thus concluding that stock market development is conducive to economic growth in Mexico.

The results of these three studies, nevertheless, contrast with the findings reported by Tinoco et al. (2011), who concluded that the development of the Mexican stock market has negative effects on the country's economic growth.

[5] Chile, South Korea, India, Mexico, and Taiwan.

Description of the data

The study period was from the first quarter of 1993 to the second quarter of 2018 for data with quarterly frequency and from January 1993 to February 2018 for data with monthly frequency. During this period, several important economic and financial events in the domestic environment, such as the Tequila Crisis, and the international environment, such as the Great Recession of 2008-2009, suggest the possible presence of structural breaks in the variables.

In their research, Beck, Demirgüç-Kunt, and Levine (2010) refer to the variables associated with stock market development most frequently used in the literature. Among such variables are market size indicators, which include the ratio of stock market capitalization as a percentage of GDP; activity indicators, the ratio of the total traded value of the stock market as a percentage of GDP; and efficiency indicators, which include stock market turnover, calculated as the volume of transactions per period divided by the total market capitalization.

Cuche and Hess (1999) state that, although GDP is undoubtedly a key indicator of the economy's growth, it is useful to use a variable related to it, but with a higher frequency of measurement, to avoid the disadvantage of quarterly observations. In a seminal paper on auto-regressive vectors, Sims (1992) used the industrial production index as a proxy for GDP. This indicator of economic growth has also been used in various subsequent research (see, for example, Castillo-Ponce et al., 2015; Kajurová, 2017; Pan & Mishra, 2018; Paramati & Gupta, 2013; Ron Delgado, 2001). Thus, this study used quarterly data of the gross domestic product in real terms at 2013 prices and monthly data of the Index of Industrial Production (IP) with base 100 as of 2015 as variables related to economic growth.

Furthermore, indicators of stock market development were selected in line with what has been previously put forward in the literature (see, for example, Adebayo et al., 2020; Beck et al., 2010; Ghimire & Giorgioni, 2013; Ho & Iyke, 2017; Pradhan, 2018). Several researchers consider stock indexes as a proxy for market size, so the IPC and the main stock index of the Mexican Stock Exchange were included, as has been done in previous studies (Castillo-Ponce et al., 2015; Ron Delgado, 2001). Nevertheless, it has been pointed out that stock indices are not necessarily a good proxy for market size due to the component selection process involving committees. Moreover, given the method used for their calculation, the value of the indices is strongly influenced by movements in the share prices of the largest companies, which are often multinationals (Pan & Mishra, 2018).

This research also considers other variables related to the size and other aspects of the Mexican stock market. Market capitalization (K) is the total number of outstanding shares of each issuer multiplied by the respective price, while trading volume (O) is the average monetary value of shares traded in a particular period. These variables, measured in real terms, relate to market size and liquidity respectively. In addition, these same indicators are considered in relative terms concerning economic growth variables. The market capitalization ratios (K/GDP and K/IP) and traded volume (O/GDP and O/PI) are related to the size and relative activity of the market, respectively. Market turnover, i.e., volume traded relative to capitalization (O/K), is used as a measure of liquidity.

Quarterly GDP data were obtained from the National Institute of Statistics and Geography (INEGI), while monthly IP data were obtained from the Organization for Economic Cooperation and Development (OECD) database. The observations of the variables related to the stock market were obtained from the database published by Banco de México.

Methodological aspects

The Dickey-Fuller t-statistic minimization test was applied to determine the presence of unit roots with structural breaks in the series. Then, the times such changes occurred were identified using the L vs. L+1 sequentially determined changes model of Bai and Perron (2003), considering the number of lags suggested by the Schwarz information criterion (SIC).

Table 1
Unit root tests with structural breaks of the variables in levels

Panel A: Monthly frequency (M)									
	Levels				First Differences				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variable	Statistic t	Value-p	Unitary Root?	Date of Change	Statistic t	Value-p	Unitary Root?	Date of Change	I(d)
IP	-4.0155	0.152	Yes	---	-18.9504	< 0.01	No*	1994M02	I(1)
IPC	-2.5244	0.896	Yes	---	-18.4688	< 0.01	No*	2008M10	I(1)
K	-2.4582	0.913	Yes	---	-18.0945	< 0.01	No*	2008M10	I(1)
K/IP	-2.4625	0.912	Yes	---	-24.9541	< 0.01	No*	2008M10	I(1)
O	-4.5441	0.038	No**	2009M01	---	---	---	---	I(0)
O/IP	-4.5866	0.034	No**	1994M05	---	---	---	---	I(0)
O/K	-21.6415	< 0.01	No*	2001M08	---	---	---	---	I(0)
Panel B: Quarterly Frequency (Q)									

http://dx.doi.org/10.22201/fca.24488410e.2021.2259

	Levels				First Differences				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variable	Statistic t	Value-p	Unitary Root?	Date of Change	Statistic t	Value-p	Unitary Root?	Date of Change	I(d)
GDP	-0.1074	>0.99	Yes	---	-18.2901	< 0.01	No*	1995Q1	I(1)
IPC	-2.5062	0.902	Yes	---	-8.7800	< 0.01	No*	2008Q3	I(1)
K	-2.3727	0.933	Yes	---	-8.8692	< 0.01	No*	2008Q3	I(1)
K/GDP	-3.1389	0.604	Yes	---	-10.0745	< 0.01	No*	1995Q1	I(1)
O	-7.1681	< 0.01	No*	2009Q2	---	---	---	---	I(0)
O/GDP	-6.0187	< 0.01	No*	2009Q2	---	---	---	---	I(0)
O/K	-8.6749	< 0.01	No*	2013Q2	---	---	---	---	I(0)

* Significant at 1% ** Significant at 5% *** Significant at 10%

Source: created by the author

The results of the unit root tests are shown in Table 1. Panel A shows the variables measured monthly, and panel B shows those observed quarterly. These results indicate that, regardless of the measurement frequency, the series involving trading volume or market ratios related to that variable were stationary in levels, while the rest were stationary in first differences. Furthermore, these results prove that the identified structural breaks coincided with the crises between the mid-1990s and 2013.

The results of the unit root tests of the logarithms of IP, GDP, K and O are shown in Table 2. Most of the structural breaks in the logarithms of practically all variables coincide with the Tequila Crisis originating in Mexico, which is evidence of the considerable influence of that event. It is also observed that some variables are stationary in levels, while others are stationary in first differences.

Table 2

Unit root tests with structural breaks of the logarithms of the variables

Panel A: Monthly frequency (M)									
	Levels				First Differences				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variable	Statistic t	Value-p	Unitary Root?	Date of Change	Statistic t	Value-p	Unitary Root?	Date of Change	I(d)
ln(PI)	-4.3162	0.072	No***	1995M10	---	---	---	---	I(0)
ln(IPC)	-3.5081	0.383	Yes	---	-18.7658	< 0.01	No*	1995M02	I(1)
ln(K)	-3.5444	0.363	Yes	---	-16.8508	< 0.01	No*	1998M08	I(1)
ln(O)	-4.8538	0.015	No**	2005M07	---	---	---	---	I(0)
Panel B: Quarterly Frequency (Q)									
	Levels				First Differences				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

http://dx.doi.org/10.22201/fca.24488410e.2021.2259

Variable	Statistic t	Value-p	Unitary Root?	Date of Change	Statistic t	Value-p	Unitary Root?	Date of Change	I(d)
ln(GDP)	-5.4246	< 0.01	No*	1994Q3	---	---	---	---	I(0)
ln(IPC)	-3.5670	0.349	Yes	---	-9.6071	< 0.01	No*	1995Q1	I(1)
ln(K)	-3.5842	0.340	Yes	---	-9.4632	< 0.01	No*	1995Q1	I(1)
ln(O)	-4.1369	0.115	Yes	---	-15.1583	< 0.01	No*	1996Q3	I(1)

* Significant at 1% ** Significant at 5% *** Significant at 10%
Source: created by the author

In the literature on the relation between economic growth and stock market development, several cointegration tests have been used, such as the maximum likelihood test (Johansen, 1988), the residuals test (Engle & Granger, 1987), the regime shifts test (Hatemi-J, 2008), and the autoregressive distributed lagged regression (ARDL) model with proposed bounds test (Pesaran et al., 2001). Nonetheless, the latter offers some advantageous features over other cointegration tests. The ARDL method simplifies the analysis of the relation of the response and the input variables through ordinary least squares regressions, in addition to taking into account a sufficient number of lags to consider the data-generating process in a context ranging from general to specific (Hoque & Yakob, 2017; Laurencenson & Chai, 2003). Nevertheless, based on the results of the unit root tests in Tables 1 and 2, for this research, the main advantage offered by the ARDL method is that it applies to variables with different orders of integration, as long as the order of integration is not greater than I(1) (Menegaki, 2019; Shestha & Chowdury, 2005).

The general ARDL specification used in the study is the following unrestricted error correction model (ECM) that includes binary variables for structural breaks:

$$\Delta Y_{n,t} = \alpha_0 + \sum_{i=1}^{p} \alpha_j \Delta Y_{n,i} + \sum_{i=0}^{q_1} \beta_j \Delta X_{m,i} + \delta_Y Y_{n,t-1} + \delta_X X_{m,t-1} + \delta_D D_{k,t} + \varepsilon_t \tag{1}$$

In Equation (1), α_0 is the constant, Y is the value of the n-th economic response variable (GDP or IP), X_m is the m-th stock market variable, D_k is a binary variable taking the value of 1 in the k-th regime and zero in any other case. The coefficients α_j and β_j are the short-run relationships, the coefficients δ_i represent the long-run parameters, and ε_t is the random error, i.i.d. When the bounds test rejected the null hypothesis that there is no cointegrating relationship, the following ECM was used within the ARDL modeling framework:

$$\Delta Y_{n,t} = \alpha_0 + \sum_{i=1}^{p} \alpha_j \Delta Y_{n,i} + \sum_{i=0}^{q_1} \beta_j \Delta X_{m,i} + \varphi ECT_{t-1} + \delta_D D_{k,t} + \varepsilon_t \tag{2}$$

In Equation (2), the speed of adjustment, φ, of the error correction term, ECT_{t-1}, must be negative and statistically significant to validate the long-term relationship between the variables. The number of model lags was determined using the Akaike information criterion (AIC). In most cases, standard errors consistent with heteroscedasticity and autocorrelation (HAC) were used (Newey & West, 1987), except for the one for the relation between GDP and IPC and the one for the relation between GDP and the K/GDP ratio, where the presence of homoscedasticity could not be rejected.

Following the model of Pesaran and Pesaran (1997), the control tests of cumulative sums of recursive residuals (CUSUM) and cumulative sums of squares of recursive residuals (CUSUMSQ) were applied to evaluate the consistency of the parameters (Brown, Durbin & Evans, 1975). All models were stable according to both tests at a significance level of 5%[6].

In order to test Granger non-causality, vector autoregressive processes (VAR) were used according to the procedure proposed by Toda and Yamamoto (1995). Once the maximum lag size, r, was determined, the (r + d_{max})-i-th order of the VAR was estimated, with d_{max} being the maximum order of integration assumed to occur. The Wald test was then applied, considering the coefficients of the additional lags (r + d_{max}) as exogenous variables. The general VAR model used to test for Granger non-causality was:

$$Y_{n,t} = \alpha_0 + \sum_{i=1}^{p} \alpha_i Y_{n,t-i} + \sum_{i=p+1}^{dmax} \alpha_i Y_{n,t-i} + \sum_{j=1}^{p} \beta_j X_{m,t-j} + \sum_{j=p+1}^{dmax} \beta_j X_{m,t-j} + \upsilon_t \tag{3}$$

$$X_{m,t} = \gamma_0 + \sum_{i=1}^{p} \gamma_i X_{m,t-i} + \sum_{i=p+1}^{dmax} \gamma_i X_{m,t-i} + \sum_{j=1}^{p} \delta_j Y_{n,t-j} + \sum_{j=p+1}^{dmax} \delta_j Y_{n,t-j} + \nu_t \tag{4}$$

In Equations (3) and (4), α_i, β_j, γ_i, and δ_j are the unknown parameters of the models, while υ and ν are the i.i.d. perturbations. For Equation (3) H_0: $\beta_1 = \beta_2 = ... = \beta_p = 0$ and H_1: $\beta_1 \neq \beta_2 \neq ... \neq \beta_p \neq 0$, and for (4) H_0: $\delta_1 = \delta_2 = ... = ... = \delta_p = 0$ and H_1: $\delta_1 \neq \delta_2 \neq ... \neq \delta_p \neq 0$.

[6]In some models there were short periods of instability according to the CUSUMSQ test, which lasted from 1 to 14 periods for data with monthly frequency and one period for data with quarterly frequency, although with a return to stability in all cases.

Results

Graphical analysis

As a first approximation to the analysis of the time series considered in the study, Figure 1 presents a graph with the economic growth variables and those of the stock market with quarterly frequency. Panel A shows the dynamics of the IPC and GDP in real terms, and a close relationship can be observed in the behavior of both variables.

Panel B shows the performance of the IPC and market capitalization, while panel C shows the dynamics of the IPC and trading volume. In both cases, there is a considerable relation between the variables representative of stock market activity, and they also reflect the crises that occurred in the period under study. Considerable increases in trading volume related to the Great Recession of 2008 and, most notably, the Gradual Taper Tantrum of 2013 became evident, although such increases were short-lived.

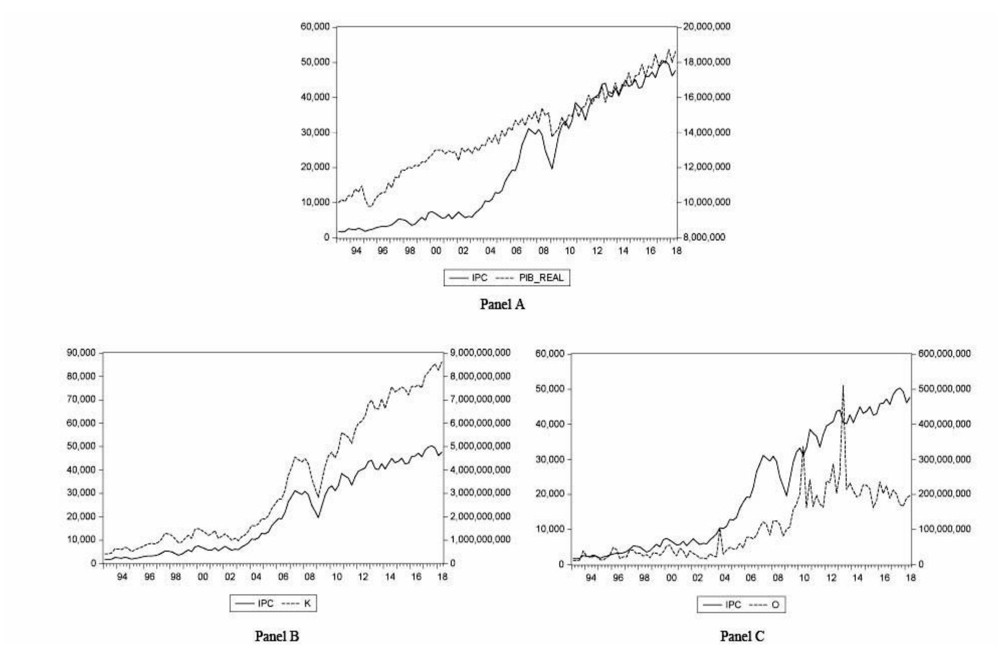

Figure 1. Stock market and economic growth indicators (1993 - 2018)
Source: Created by the author with data from INEGI and Banco de México

Specification of the moments of structural breaks

Bivariate linear models with the following form were used to determine the moments in which structural breaks occurred:

$$Y_{n,t} = \alpha + \beta X_{m,t} + \varepsilon_t \tag{5}$$

In these specifications, Y_n and X_m are, respectively, the variables related to economic growth and the market as defined above, α and β are unknown parameters, and εt is the disturbance, as usually defined.

Table 3
Dates of structural breaks in the bivariate equations

Panel A. Response Variable: IP
Monthly Frequency (M)

Independent Variable	Dates of Changes			
IPC	1998M05	2005M05	2009M03	2014M02
K	1998M07	2002M07	2006M10	2014M04
O	1998M01	2004M03	2008M03	2011M12
K/IP	1998M02	2002M07	2006M11	2014M02
O/K	1997M04	2004M02	2011M07	---
O/IP	1997M11	2004M03	2008M03	2011M12

Panel B. Response Variable: ln(IP)
Monthly Frequency (M)

Independent Variable	Dates of Changes			
ln(IPC)	1998M02	2009M04	2014M02	---
ln(K)	1998M02	2002M07	2009M03	2014M04
ln(O)	1997M11	2003M12	2008M03	2011M12

Panel C. Response Variable: GDP
Quarterly Frequency (Q)

Independent Variable	Dates of Changes			
IPC	1998Q2	2002Q2	2009Q2	2014Q4
K	1998Q2	2002Q2	2011Q1	2014Q4
O	1997Q4	2001Q3	2005Q2	2013Q3
K/GDP	2000Q1	2003Q2	2012Q4	---
O/K	1997Q4	2002Q2	2006Q2	2013Q3
O/GDP	1997Q4	2001Q3	2005Q4	2013Q3

Panel D. Response Variable: ln(GDP)
Quarterly Frequency (Q)

Independent Variable	Dates of Changes			
ln(IPC)	1998Q2	2002Q2	2008Q2	2013Q2
ln(K)	1998Q2	2002Q2	2010Q4	2014Q3
ln(O)	1999Q3	2004Q2	2013Q3	---

Method: L+1 vs. L sequentially determined structural breaks (Bai - Perron, 2003)

Source: created by the author

Using the L+1 vs. L method, the moments of regime changes established sequentially determined structural breaks (Bai & Perron, 2003), the results of which were used to generate the corresponding binary variables. Table 3 shows the findings of such tests, both for the monthly data, in panels A and B, and for the quarterly data shown in panels C and D.

Bounds test

The ARDL model bounds test results are shown in Tables 4 and 5. Panels A and B of Table 4 show, respectively, the results of the models that included IP and GDP as response variables. Panels A and B of Table 5 show the results corresponding to the logarithms of these two variables, respectively.

Table 4
Limit test results: Variables in levels

Panel A. Response Variable: IP Monthly Data					
	ARDL Results				
(1)	(2)	(3)	(4)	(5)	(6)
Independent Variable	Case	Statistic F	Decision H_0	Error Correction Coefficient (EC)	Long-term p-value Coefficient
IPC	III	3.86	Accept H_0	---	---
K/IP	III	9.63	Reject H_0*	-0.0838*	0.00
O/K	IV	6.67	Reject H_0**	-0.0975*	0.52
O/IP	IV	6.16	Reject H_0**	-0.0926*	0.21
K	III	7.34	Reject H_0**	-0.0674*	0.00
O	IV	6.73	Reject H_0**	-0.0960*	0.15
Panel B. Response Variable: GDP Quarterly Data					
	ARDL Results				
(1)	(2)	(3)	(4)	(5)	(6)
Independent Variable	Case	Statistic F	Decision H_0	Error Correction Coefficient (EC)	Long-term p-value Coefficient
IPC	IV	4.06	Accept H_0	---	---
K/GDP	IV	3.10	Accept H_0	---	---
O/K	IV	6.43	Reject H_0***	-0.4586*	0.040
O/GDP	IV	5.65	Reject H_0***	-0.4442*	0.031
K	III	4.53	Accept H_0	---	---
O	IV	5.82	Reject H_0***	-0.4371*	0.024

H0: There is no long-term relation between the variables.
* Significant at 1% ** Significant at 2.5%
*** Significant at 5% **** Significant at 10%
Source: created by the author

According to the findings in Table 4, it is not possible to reject the hypothesis that there is no cointegration between the IPC and the two indicators of economic growth, IP and GDP. Nor can this hypothesis be rejected in the case of GDP and indicators involving market capitalization. The results shown in Table 5 indicate that there is also no cointegration between the logarithms of market capitalization and trading volume with the logarithm of GDP.

Table 5
Results of limit tests: Logarithms of variables

Panel A. Response Variable: ln(IP) Monthly Data					
	ARDL Results				
(1) Independent Variable	(2) Case	(3) Statistic F	(4) Decision H_0	(5) Error Correction Coefficient	(6) Long-term p-value Coefficient
ln(IPC)	IV	9.66	Reject H_0*	-0.1266	0.000
ln(K)	III	14.30	Reject H_0*	-0.1407	0.000
ln(O)	III	8.10	Reject H_0*	-0.1102	0.003
Panel B. Response Variable: ln(GDP) Quarterly Data					
	ARDL Results				
(1) Independent Variable	(2) Case	(3) Statistic F	(4) Decision H_0	(5) Error Correction Coefficient	(6) Long-term p-value Coefficient
ln(IPC)	IV	6.01	Reject H_0**	-0.4333	0.066
ln(K)	IV	4.27	Accept H_0	---	---
ln(O)	III	0.99	Accept H_0	---	---

H0: There is no long-term relation between the variables.
* Significant at 1% ** Significant at 2.5%
*** Significant at 5% **** Significant at 10%
Source: created by the author

The findings on the absence of a long-term relationship between IPC and economic growth indicators are unexpected since previous studies in Mexico found a long-term relationship between IPC and IP and GDP. Furthermore, although GDP, IP and GDP are stationary in first differences, no combination generates a new stationary process between IPC and any two variables associated with economic growth. This finding means it is impossible to cross-check causality as suggested, for example, by interdependence, demand-pull or supply-anticipation theories[7].

Table 6
Results of the Granger non-causality tests: Variables in levels

Panel A: Response Variable (Y): IP Monthly Data					
(1)	(2)	(3)	(4)	(5)	(6)
	X Does Not Cause Y		Y Does Not Cause X		
Explanatory Variable (X)	Value p	Decision H_0	Value p	Decision H_0	Direction of Causality
IPC	0.060	Reject H_0 ***	0.376	Accept H_0	IP ← IPC
K/IP	0.009	Reject H_0 *	0.057	Reject H_0 **	IP ↔ K/IP
O/K	0.175	Accept H_0	0.465	Accept H_0	None
O/IP	0.615	Accept H_0	0.777	Accept H_0	None
K	0.019	Reject H_0 **	0.365	Accept H_0	IP ← K
O	0.636	Accept H_0	0.802	Accept H_0	None

Panel B: Response Variable (Y): GDP

[7]According to Castillo-Ponce et al. (2015), this result could also be interpreted as evidence against the Efficient Markets Hypothesis.

http://dx.doi.org/10.22201/fca.24488410e.2021.2259

Quarterly Data

(1)	(2)	(3)	(4)	(5)	(6)
	X Does Not Cause Y		Y Does Not Cause X		
Explanatory Variable (X)	Value p	Decision H_0	Value p	Decision H_0	Direction of Causality
IPC	0.011	Reject H_0 **	0.385	Accept H_0	GDP ← IPC
O/K	0.418	Accept H_0	0.046	Reject H_0 **	GDP → O/K

H0: No causal relation exists.
* Significant at 1% *** Significant at 10%
** Significant at 5%
Source: created by the author

In the models where the hypothesis of no cointegration was rejected, the error correction term (ECT) coefficients were negative and highly significant, thus confirming the long-run relationship between the variables. Furthermore, according to these results, between 8 and 10% of the imbalance between IP and other variables is corrected in one month, except in the case of the relationship between IP and market capitalization, where the correction is slower. Specifically, seven to ten months are needed to correct half of the imbalance. For models involving ln(IP), between 11 and 14% of the imbalance is corrected over one month. In the case of models involving GDP, it is stated that half of the imbalance persists for only a little more than a quarter, which is also the case when considering the relationship between ln(GDP) and ln(IPC).

Granger's non-causality tests

Tables 6 and 7 show the results of the non-causality tests in the Granger sense using the procedure of Toda and Yamamoto (1995)[8]. As shown in Panel A of Table 6, both IPC and market capitalization cause IP, although the relationship was significant only at 10% in the former case. It is also observed that there is a significant bidirectional causality between the IP and the K/IP ratio. Nevertheless, no evidence of causality was found between the IP and any of the indicators involving the volume of operations. The results in panel B also indicate significant causality from IPC to GDP and from GDP to the market turnover ratio.

Panel A of Table 7 shows a bidirectional causality between the percentage changes of the IP, those of the IPC, and those of the market capitalization. A highly significant causal relationship was also found between the percentage change in IP and the percentage change in the volume of market transactions. The results reported in panel B indicate that percentage changes in IPC, market capitalization, and trading volume cause percentage changes in GDP, although only at a 10% significance

[8]In results not reported for reasons of brevity, it was found that the inverse roots of the characteristic equation showed dynamic stability by staying within the unit circle, so that the VAR models were stationary in almost all cases. Nonetheless, the models relating GDP to O and K, as well as to O/GDP and K/GDP ratios were dynamically unstable and were therefore not considered for subsequent analyses.

http://dx.doi.org/10.22201/fca.24488410e.2021.2259

level in the latter case. Overall, the results favor the supply anticipation theory viewpoint. Nevertheless, there is also some evidence favoring the interdependence and demand-pull views.

Conclusions

This study contributes to the analysis of the long-term and causal relation between stock market development and economic growth, focusing specifically on the case of Mexico, the second most important emerging country in Latin America in terms of gross domestic product. In addition to incorporating structural breaks through binary variables, its contribution consists in applying efficient methods, which have not been used in studies previously carried out for the Mexican economy. Specifically, to determine the long-term relation of the variables, this study uses the ARDL model with a bounds test proposed by Pesaran et al. (2001), while the Toda and Yamamoto (1995) model is used to test for non-causality in the Granger sense.

Table 7
Results of Granger non-causality tests: Logarithms of variables

Panel A: Response Variable (Y): ln(IP) Monthly Data					
(1)	(2)	(3)	(4)	(5)	(6)
	X Does Not Cause Y		Y Does Not Cause X		
Explanatory Variable (X)	Value p	Decision H_0	Value p	Decision H_0	Direction of Causality
ln(IPC)	0.000	Reject H_0 *	0.027	Reject H_0 **	ln(IP) ↔ ln(IPC)
ln(K)	0.001	Reject H_0 *	0.063	Reject H_0 ***	ln(IP) ↔ ln(K)
ln(O)	0.400	Accept H_0	0.004	Reject H_0 *	ln(IP) → ln(O)
Panel B: Response Variable (Y): GDP Quarterly Data					
(1)	(2)	(3)	(4)	(5)	(6)
	X Does Not Cause Y		Y Does Not Cause X		
Explanatory Variable (X)	Value p	Decision H_0	Value p	Decision H_0	Direction of Causality
ln(IPC)	0.000	Reject H_0 *	0.776	Accept H_0	ln(GDP) ← ln(IPC)
ln(K)	0.000	Reject H_0 *	0.921	Accept H_0	ln(GDP) ← ln(K)
ln(O)	0.088	Reject H_0 ***	0.330	Accept H_0	ln(GDP) ← ln(O)

H0: No causal relation exists.
* Significant at 1% *** Significant at 10%
** Significant at 5%
Source: created by the author

The results of the unit root tests with structural breaks highlight the influence of the main episodes of financial stress that occurred from the mid-1990s to 2013 on the variables under analysis. Nevertheless, according to the results of the sequentially determined structural change tests of Bai and Perron (2003), the shock of the Mexican crisis of the mid-1990s was the most significant, as it impacted all the variables examined. On the other hand, according to the results, the shock of the Great Recession of 2008-2009 was relatively limited in Mexico since it only involved the IPC and the monetary volume of stock market operations. This is most likely because the Mexican economy had solid foundations that allowed it to mitigate the impact of that crisis.

The so-called Taper Tantrum of 2013 had significant effects on stock market turnover. It is very likely that, given the possible increase in interest rates in the United States, there will be a flight to quality, considerably increasing the volume of operations and reducing, albeit relatively less, the market capitalization in Mexico. These conditions were absent during the 2008-2009 financial crisis, so market turnover was comparatively less affected by that episode.

The results of the ARDL models with bounds test indicate a long-run relation between the economic growth variables and most of the variables related to the development of the stock market. In addition, the results of the error correction term coefficients confirmed the variables' cointegration. These findings generally coincide with those reported by Castillo-Ponce et al. (2015) and Ron Delgado (2001) for the Mexican economy and stock market. However, an important discrepancy regarding the results of these studies is that this study found no evidence of a long-term relationship between the dynamics of the IPC and economic growth indicators. It is considered that this divergence may be due to the methods used, the incorporation of structural breaks within the models carried out in this study, and the differences in the periods examined.

Several of the findings of the Granger non-causality tests favor the supply-anticipation theory viewpoint since a significant causal relation of stock market variables to economic growth variables was found. These results are in line with those of other studies conducted in various countries (Adebayo et al., 2020; Caporale et al., 2004; Pradhan, 2018), although they contrast with those reported by Pan and Mishra (2018), who found a causal relationship from the economy to the stock market in China.

Specifically, a causal relationship was identified from market capitalization to the industrial production index and from IPC to both IP and GDP. These results may be related to Mexico's trade and financial openness since the mid-1990s. It should be noted, nonetheless, that the finding that there is no long-run relation between the IPC and economic growth variables does not allow these causality results to be cross-checked, which opens the possibility for future research on this aspect. On the other hand, the results indicate that market capitalization causes economic growth measured through IP in Granger's sense.

A bidirectional causal relationship between IP and market consolidation measured through the K/PI ratio was also identified, which is particularly relevant for an emerging country according to the point of view of the interdependence between economic growth and stock market development. Finally, it was found that there is a causal relationship between GDP and market liquidity, measured by the ratio of trading volume to total market capitalization. This leads to the conclusion that economic growth influences the efficiency of stock market operations.

The results of this research have several implications for policymakers. Firstly, based on the causal relation of the stock market to the Mexican economy, this market's stability, liquidity, and transparency should be promoted, and the investors who participate in it should be protected. Secondly, policies should be implemented within a regulatory framework that considers the abovementioned elements and facilitates companies' access to the resources that can be obtained through the stock market. Finally, mechanisms must be established to facilitate the entry of a broader base of investors into this market to channel their resources efficiently to the real economy and promote its growth.

One issue that remains open for future research is the acceptance of the non-causality hypothesis despite the long-term relation identified between the industrial production index and the volume of operations. One avenue to explore would be the possibility that this result is related to omitted variables that could affect the trading volume and IP (Lütkepohl, 1982). Specifically, the models evaluated here, which consider these variables, could simultaneously incorporate other variables such as, for example, market capitalization. An aspect that could also be addressed in subsequent studies is related to the influence of the bond market or the banking system on the economy's growth. Finally, a topic worth considering for further study is the development of the Mexican stock market and its contribution to the reduction of financing costs for companies, as well as th

References

Aali-Bujari, A., Venegas-Martínez, F., & Pérez-Lechuga, G. (2017). Impact of the Stock Market Capitalization and the Banking Spread in Growth and Development in Latin America: A Panel Data Estimation with System GMM. Contaduría y Administración, 62(5), 1427–1441. https://doi.org/10.1016/J.CYA.2017.09.005

Adebayo, T. S., Awosusi, A. A., & Eminer, F. (2020). Stock Market-Growth Relationship in an Emerging Economy: Empirical Finding from ARDL-Based Bounds and Causality Approaches. Journal of Economics and Business, 3(2), 903–916. https://doi.org/10.31014/aior.1992.03.02.247

Bai, J., & Perron, P. (2003). Computation and Analysis of Multiple Structural Change Models. Journal of Applied Econometrics, 18(1), 1–22. https://doi.org/10.1002/jae.659

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2010). Financial Institutions and Markets Across Countries and Over Time: The Updated Financial Development and Structure Database. The World Bank Economic Review, 24(1), 77–92. https://doi.org/10.1093/wber/lhp016

Bhatt, V. V. (1995). Financial Systems, Innovation, and Development. New Delhi: Sage.

Blum, D., Federmair, K., Fink, G., & Haiss, P. (2002). The Financial-Real Sector Nexus: Theory and Empirical Evidence (No. 43). Vienna.

Boubakari, A., & Jin, D. (2010). The Role of Stock Market Development in Economic Growth: Evidence from Some Euronext Countries. International Journal of Financial Research, 1(1), 14–20. https://doi.org/10.5430/ ijfr.v1n1p14

Boyd, J., & Smith, B. (1996). The Coevolution of the Real and Financial Sectors in the Growth Process. The World Bank Economic Review, 10(2), 371–396. https://doi.org/10.1093/wber/10.2.371

Brown, R. L., Durbin, J., & Evans, J. M. (1975). Techniques for Testing the Constancy of Regression Relationships over Time. Journal of the Royal Statistical Society. Series B (Methodological), 37(2), 149–192. https://doi. org/10.2307/2984889

Caporale, G. M., Howells, P. G., & Soliman, A. M. (2004). Stock Market Development and Economic Growth: The Causal Linkage. Journal of Economic Development, 29(1), 33–50. https://doi.org/10.1109/TIP.2011.2118224

Castillo-Ponce, R. A., Rodriguez-Espinosa, M. de L., & Gaytan-Alfaro, E. D. (2015). Stock Market Development and Economic Performance: The Case of Mexico. Revista de Análisis Económico, 30(1), 41–56. https://doi. org/10.4067/S0718-88702015000100003

Cole, D. C., & Shaw, E. S. (1974). Financial Deepening in Economic Development. The Journal of Finance, 29(4), 1345. https://doi.org/10.2307/2978421

Cuche, N. A., & Hess, M. K. (1999). A Monthly Series of Swiss GDP: Business Cycle Indicator and Research Tool. Retrieved June 22, 2018, from http://id3414.securedata.net/cuche/download/pdf/papers/wp-0899.pdf

Engle, R. F., & Granger, C. W. J. (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing. Econometrica, 55(2), 251–276. https://doi.org/10.2307/1913236

Fink, G., Haiss, P., & Vukšić, G. (2009). Contribution of Financial Market Segments at Different Stages of Development: Transition, Cohesion and Mature Economies Compared. Journal of Financial Stability, 5(4), 431–455. https://doi.org/10.1016/j.jfs.2008.05.002

Ghimire, B., & Giorgioni, G. (2013). Puzzles in the Relationship Between Financial Development and Economic Growth. Journal of Applied Finance & Banking, 3(5), 199–222. Retrieved September 7, 2018, from http:// www.scienpress.com/Upload/JAFB/Vol 3_5_15.pdf

Goldsmith, R. W. (1959). Financial Structure and Development. In R. W. Goldsmith (Ed.), The Comparative Study of Economic Growth and Structure (pp. 114–123). National Bureau of Economic Research.

Graff, M. A. (2001). Financial Development and Economic Growth - A New Empirical Analysis. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.258928

Hatemi-J, A. (2008). Tests for Cointegration with Two Unknown Regime Shifts with an Application to Financial Market Integration. Empirical Economics, 35(3), 497–505. https://doi.org/10.1007/s00181-007-0175-9

Ho, S. Y., & Iyke, B. N. (2017). On the Causal Links Between the Stock Market and the Economy of Hong Kong. Contemporary Economics, 11(3), 343–362. https://doi.org/10.5709/ce.1897-9254.247

Hoque, M. E., & Yakob, N. A. (2017). Revisiting Stock Market Development and Economic Growth Nexus: The Moderating Role of Foreign Capital Inflows and Exchange Rates. Cogent Economics and Finance, 5(1–17). https://doi.org/10.1080/23322039.2017.1329975

Inusah, N. (2018). Toda-Yamamoto Granger No-causality Analysis of Stock Market Growth and Economic Growth in Ghana. Journal of Accounting, Business and Finance Research, 3(1), 36–46. https://doi. org/10.20448/2002.31.36.46

Johansen, S. (1988). Statistical Analysis of Cointegration Vectors. Journal of Economic Dynamics and Control, 12(2), 231–254. https://doi.org/10.1016/0165-1889(88)90041-3

Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. Econometrica, 59(6), 1551. https://doi.org/10.2307/2938278

Kajurová, V. (2017). A Note on Relationship Between Economic Activity and Stock Market Development: A Case of Euro Area Countries. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 65(6), 1953– 1965. https://doi.org/10.11118/actaun201765061953

Kassimatis, K., & Spyrou, S. I. (2001). Stock and Credit Market Expansion and Economic Development in Emerging Markets: Further Evidence Utilizing Cointegration Analysis. Applied Economics, 33(8), 1057–1064. https://doi.org/10.1080/000368401300182824

King, R. G., & Levine, R. (1993). Finance and Growth: Schumpeter Might Be Right. The Quarterly Journal of Economics, 108(3), 717–737. https://doi.org/10.2307/2118406

Lahura, E., & Vega, M. (2017). Stock Market Development and Real Economic Activity in Peru. Empirical Economics, 53(3), 1011–1038. https://doi.org/10.1007/s00181-016-1149-6

Laurencenson, J., & Chai, J. C. H. (2003). Financial Reform and Economic Development in China. Northpampton, MA: Edward Elgar Publishing Limited. Levine, R., & Zervos, S. (1998). Stock Markets, Banks, and Economic Growth. The American Economic Review, 88(3), 537–558. https://doi.org/10.1016/j.ribaf.2006.05.002

Lucas, R. E. (1988). On the Mechanics of Economic Development. Journal of Monetary Economics, 22(1), 3–42. https://doi.org/10.1016/0304-3932(88)90168-7

Lütkepohl, H. (1982). Non-causality Due to Omitted Variables. Journal of Econometrics, 19(2–3), 367–378. https://doi.org/10.1016/0304-4076(82)90011-2

McKinnon, R. I. (1973). Money and Capital in Economic Development. Washington, D.C.: Brookings Institution Press.

Men, M., & Li, R. (2006). An Empirical Study on the Relationship Between Stock Index and the National Economy: The Case of China. In University of International Business & Economics Working Paper. Retrieved August 30, 2018, from https://faculty.washington.edu/karyiu/confer/beijing06/papers/men-li.pdf Menegaki, A. N. (2019). The ARDL Method in the Energy-Growth Nexus Field; Best Implementation Strategies. Economies, 7(4), 105. https://doi.org/10.3390/economies7040105

Mishkin, F. S., & Eakins, S. G. (2015). Financial Markets and Institutions. Reading, Mass: Addison Wesley.

Newey, W. K., & West, K. D. (1987). A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix. Econometrica, 55(3), 703–708. https://doi.org/10.2307/1913610

Pan, L., & Mishra, V. (2018). Stock Market Development and Economic Growth: Empirical Evidence from China. Economic Modelling, 68(January), 661–673. https://doi.org/10.1016/j.econmod.2017.07.005

Paramati, S. R., & Gupta, R. (2013). An Empirical Analysis of Stock Market Performance and Economic Growth: Evidence from India. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2335996

Patrick, H. T. (1966). Financial Development and Economic Growth in Underdeveloped Countries. Economic Development and Cultural Change, 14(2), 174–189. https://doi.org/10.1086/450153

Perron, P. (1989). The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis. Econometrica, 57(6), 1361–1401. https://doi.org/10.2307/1913712 Pesaran, M. H., &

Pesaran, B. (1997). Working with Microfit 4.0: Interactive Econometric Analysis. Oxford, UK: Oxford University Press.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. Journal of Applied Econometrics, 16(3), 289–326. https://doi.org/10.1002/jae.616

Pradhan, R. P. (2018). Development of Stock Market and Economic Growth: The G-20 Evidence. Eurasian Economic Review, 8(2), 161–181. https://doi.org/10.1007/s40822-018-0094-4

Robinson, J. (1952). The Generalisation of the General Theory. In The Generalisation of the General Theory and other Essays (2nd. Ed., pp. 1–76). https://doi.org/10.1007/978-1-349-16188-1_1

Ron Delgado, F. E. (2001). Ajuste Dinámico y Equilibrio entre la Producción Industrial y la Actividad Bursátil en México. Momento Económico, 118(1), 21–38. Retrieved November 18, 2017, from http://www.revistas.unam. mx/index.php/rme/article/view/4291

Schumpeter, J. A. (1911). The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle. Boston, MA: Harvard University Press.

Shestha, M. B., & Chowdury, K. (2005). ARDL Modelling Approach to Testing the Financial Liberalisation Hypothesis (No. WP 05-15). Retrieved from http://www.uow.edu.au/commerce/econ/wpapers.html

Sims, C. A. (1992). Interpreting the Macroeconomic Time Series Facts. European Economic Review, 36(5), 975– 1000. https://doi.org/10.1016/0014-2921(92)90041-T

Tinoco, M. A., Torres, V. H., & Cabezas, D. A. (2011). Stock Market Development, Financial Development and Economic Growth in Southeast Asia and Latin America. XI Seminario Internacional Sobre La Cuenca Del Pacífico, 1–14. Colima, Mexico: Universidad de Colima.

Toda, H. Y., & Yamamoto, T. (1995). Statistical Inference in Vector Autoregressions with Possibly Integrated Processes. Journal of Econometrics, 66(1–2), 225–250. https://doi.org/10.1016/0304-4076(94)01616-8

Vahid, F., & Engle, R. F. (1993). Common Trends and Common Cycles. Journal of Applied Econometrics, 8(4), 341–360. https://doi.org/10.2307/2285000