

STOCK MARKET DEVELOPMENT AND ECONOMIC PERFORMANCE: THE CASE OF MEXICO

DESARROLLO DEL MERCADO ACCIONARIO Y DESEMPEÑO ECONOMICO: EL CASO DE MEXICO

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Abstract

We evaluate the association between stock market development and the aggregate economy for the long-run and the short-run. We perform cointegration and common cycle tests considering various stock market indicators, real GDP and industrial production for the Mexican economy. While controlling for structural breaks in the series, we identify the existence of common trends but not common cycles. Specifically, stock market activity and real variables exhibit a positive and significant relationship in the long-run; however, they appear to have different responses to transitory shocks. These results confirm that stock market development is conducive to economic growth.

Keywords: Economic growth, financial markets, efficient market hypothesis, cointegration, common cycles.

JEL Classification: C32, E20, G20.

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Resumen

Se evalúa la relación entre el desarrollo del mercado accionario y la economía agregada para el largo y corto plazos. Se llevan a cabo pruebas de cointegración y ciclos comunes considerando indicadores del mercado accionario, PIB real y producción industrial para la economía mexicana. Identificamos la existencia de tendencias comunes pero no ciclos comunes, aun controlando por cortes estructurales. Específicamente, la actividad del mercado accionario exhibe una relación positiva y significativa con el sector real en el largo plazo, pero responde de manera distinta a choques transitorios. Los resultados confirman que el desarrollo del mercado accionario conlleva al crecimiento económico.

Palabras clave: Crecimiento económico, mercados financieros, hipótesis de mercados eficientes, cointegración, ciclos comunes.

Clasificación JEL: C32, E20, G20.

INTRODUCTION

Economic growth is perhaps the most studied subject in economics literature. The theme has been analyzed under various perspectives and schools of thought. While we find consensus with respect to some of the factors that contribute to development –investment in physical and human capital for instance–the controversy on the significance of others remains. In this document we tackle one of these contentious issues: financial markets and in particular the stock market. The debate on the importance of these markets has been intense and goes back many decades. Some authors have suggested that the financial system is an essential component of the growth engine, others are more skeptical. Along the first stream of thought we may mention Goldsmith (1969) and McKinnon (1973) who identify a close relationship between the real economy and stock market performance. Also, Arestis, Demetriades and Luintel (2001) and Van Nieuwerburgh, Buelens and Cuyvers (2006) find a positive impact of financial activity on the aggregate economy for developed countries. In contrast, Lucas (1988) and Stern (1989) suggest that financial markets have no particular function in promoting economic growth¹.

Beyond the debate, one fact remains uncontested: analysis of the effects of stock markets on the aggregate economy for developing countries is scarce. Relatively few documents on this topic are found in the literature. To mention a few, Caporale, Peter Howells and Soliman (2004) conduct a study for Argentina, Chile, Greece, Korea, Malaysia, Philippines and Portugal. The authors conclude that efficient financial

¹ Levine (1997) provides a nice description of the discussion.

markets improve economic performance. Similar findings are described in Enisan and Olufisayo (2009), who consider the case of seven African economies during the 1980-2004 periods. For the particular case of Mexico, which is the country of interest in this paper, we were able to identify only three studies that explicitly examine the interaction of financial markets with the real economy. Kassimatis and Spyrou (2001) estimate cointegration vectors for market capitalization of the Mexican Stock Exchange (MSE) and industrial production. They find a positive and significant relationship. Similarly, Ron Delgado (2001) analyzes the long-run correlation between financial variables and industrial production. He shows that financial performance, as measured by the value of the MSE, influences economic activity. Mejia (2003), on the other hand, considers a short-run horizon and finds a countercyclical behavior of financial variables with respect to the business cycle².

The present exercise complements these studies by conducting an analysis of the statistical link between stock market behavior and the performance of the aggregate economy for the long-run and the short-run. Different from previous papers, we use econometric techniques that control for the stochastic nature of the variables. In particular, as opposed to Kassimatis and Spyrou (2001) and Ron Delgado (2001), we account for the structural breaks evident in the time series of interest. In addition, we not only consider cointegration tests to evaluate the existence of common trends, but also conduct common cycle tests to determine if the variables share transitory movements. Finding cointegration would imply that financial markets and macroeconomic variables exhibit co-movements over long horizons, demonstrating that economic performance and the evolution of the stock market are significantly associated. The existence of a common cycle would suggest that the Mexican stock market and the country's economy show similar responses to transitory shocks. What do we expect to find? Since the statistical properties of variables representing the real economy of Mexico are well-established (real Gross Domestic Product (GDP) and industrial production are non-stationary variables integrated of order 1, $I(1)$)³, the answer largely depends on the stochastic behavior of financial variables. There are two broad possibilities. First, if the dynamics of the series adhere to the efficient market hypothesis (EMH), then common trends may exist but not necessarily common cycles. Validation of the EMH would imply that the stock market series are non-stationary processes and hence sharing common trends with macroeconomic variables is a possibility. The existence of common cycles, however, will depend on whether stock prices exhibit a significant cycle. If they do, then common cycles may be found, otherwise common cycles cannot be identified. Second, if the EMH does not hold, that is the stock market series are stationary processes, then no cointegration tests can be performed. It is worth mentioning that although Ron Delgado (2001) finds that Mexican financial variables are $I(1)$ series, we choose to conduct our own tests to determine the stochastic properties of these series. We do so noting that the tests used in said paper do not control for the numerous structural breaks characteristic of the Mexican economy. Here we estimate

² Mexico is included as part of larger samples in various studies, see for example Ghimire and Giorgioni (2013). Here we confine the description to documents explicitly analyzing Mexico.

³ See for instance Garces (2006).

various specifications that allow for changes in the behavior of the series and therefore, argue that our results are more robust than those reported in the past.

A note on the EMH is also worth including. While the debate on whether the EMH holds for developed economies—particularly the US—is intense, for the case of developing countries the controversy is barely noticeable. For Mexico there is really no critical mass discussing the issue. It is true that various studies have included Mexico in analyzing the behavior of stock market variables, but only a few have explicitly focused on the Mexican stock exchange. As such, the econometric estimation we perform in this paper should be taken as the first to recognize the specifics of the Mexican economy.

The rest of the document is organized as follows: in Section I we present a concise description of the relevant literature. The intention is to provide context to this document in relation to previous exercises. In Section II we introduce the data and produce an illustrative graphical analysis. Section III carries out the empirical estimations and discusses the results. Section IV concludes.

SECTION I. FINANCIAL MARKETS AND ECONOMIC ACTIVITY

The analysis of the interrelation among the development of financial markets and economic activity responds to an evident empirical regularity: robust (weak) financial markets are found in developed (developing) economies. Even though a vast number of documents have embarked on analyzing this fact, to date there is still some disagreement in terms of the importance of financial development on economic growth. Early in the second half of the previous century, economists advanced theories and empirical evidence that produced sharply different results. While some suggested a positive role for financial markets on economic development, others dismissed it. A prime example of the first is Goldsmith (1969), who finds a positive correlation between financial development and economic growth in a cross sample of countries. On the other side, the pioneer in the counterargument is Lucas (1988) who holds that the importance of financial matters is overstated.

It should be noted that the disagreement appears to be not so much on whether the development of financial markets is associated with economic growth, but about the causality of the relation and its importance. Most economists would agree on the positive contributions that robust financial markets bring to the economy, especially in the case of advanced economies. Numerous papers have stated these. For example, Levine (1991, 2005) poses that by disseminating information about firms, financial markets facilitate a more efficient allocation of resources, promoting economic activity. Also, stock markets reduce liquidity risk and lower the cost of capital which stimulate earnings and lead to increased productivity. Higher capital accumulation and productivity are conducive to economic growth. Along this line of reasoning, it is argued that financial markets reduce transaction costs and information asymmetries, resulting in a reduction of liquidity constraints and an improvement in the allocation of capital. Other authors have emphasized the role of financial markets as monitoring entities. Effective monitoring reduces moral

hazard problems and improves the optimal use of resources. In their seminal paper, Jensen and Meckling (1976) highlight the role of the stock market in promoting corporate control. Bhide (1993) also underlines the increase in productivity that comes from effective monitoring by the stock market. Similarly, Brown, Martinsson and Petersen (2013) suggest that strong shareholder protection and better access to equity financing encourage higher rates of research and development.

While the previously mentioned arguments on the positive contributions of financial markets to growth are widely accepted, the magnitude and causality of the effect have been questioned by several authors. Rioja and Valev (2014), for instance, find that stock markets do not enhance productivity or capital accumulation in developing economies, while they do so in developed countries. Calderon and Lin (2003), on the other hand, suggest that financial deepening does not contribute to the causal relation between financial development and economic growth in industrialized nations. Ghimire and Giorgioni (2013) argue that the impact of the stock market on economic growth depends on the variables chosen and the estimating methodologies. Empirical results are often tainted by a possible problem of self-selection bias. Additionally, a number of studies point to the bidirectional link among financial development and economic growth. Ergungor (2008), for example, establishes this relation and concludes that the financial system's structure is irrelevant to economic growth. Finally, with respect to the moral hazard argument, Myers and Majluf (1984) and Shleifer and Summers (1988) note that liquid markets may reduce the incentives for firm owners to monitor agents. Specifically, liquidity may result in more diffuse ownership which lessens the need for supervision.

In sum, in the case of developed countries most of the literature agrees on the positive association of financial markets and economic growth, though consensus is still to be reached in terms of the magnitude and direction on the relation. The evidence for developing economies, however, is not as abundant and hence does not allow for drawing definite conclusions. A number of studies considering middle-income and low-income countries have produced different results. While some authors identify a positive contribution of finance on economic growth, for instance Calderon and Lin (2003), others find a negative effect, De Gregorio and Guidotti (1995) for example. The conflicting results are due in large extent to the heterogeneity in the degree of sophistication of financial markets in these economies; not only relative to developed countries, but also across middle-income and low-income level nations. As shown in Rioja and Valev (2004), income level matters in determining the effect of finance on economic growth. They suggest that in low-income countries the contribution of financial development on economic growth is uncertain, while the same is large and positive in middle-income economies. Various other studies, including De Gregorio and Guidotti (1995), Demetriades and Hussein (1996), and Levine, Loayza and Beck (2000) also argue that the effect of finance depends on the stage of economic development. Theoretical explanations for this empirical finding generally pose that, for the effects of finance on economic activity to be significant, financial markets must reach a certain development threshold. Acemoglu, Zilibotti and Aghion (2006) suggest that countries follow different growth strategies based on their location relative to the technological frontier.

Countries behind it choose investment-based growth. Developed countries, on the other hand, have more incentives to innovate and require financial markets to fund research and development. Since the optimal level of financial development is not easily identified, determining the effect of financial markets on the economy for less developed countries poses a significant challenge.

This paper contributes to the literature by evaluating a developing country that is near or at the technological frontier, Mexico. As such, it represents an opportunity for further shedding light on determining how important financial markets are on emerging economies with well-established stock markets. Although various studies have included Mexico in their analysis, only a handful have explicitly examined it. Fact that is surprising given the importance of this economy as a middle-income country. In general, the results on the importance of financial markets on the Mexican economy are mixed. Rioja and Valev (2004), for instance, show that depending on how the country is classified, high or low region, the effect of financial deepening on economic growth may or may not be significant. In Ghimire and Giorgioni (2013) Mexico is considered a developed country (in the terminology of the authors it is a non-less-developed country). When turnover is used as a measure of stock market behavior, the results show a negative and significant relation with economic growth. In contrast, Kassimatis and Spyrou (2001) and Ron Delgado (2001) identify a positive association in the long-run. All in all, no consensus is found in regards of the importance of financial development on the Mexican economy, hence, the need for further analyzing and improving our understanding of the phenomenon.

For the empirical strategy we base the analysis on the general argument that links financial development to economic activity via liquidity: deepening of financial markets enhances capital liquidity which in turn promotes economic growth. We choose to conduct a study in the spirit of Kassimatis and Spyrou (2001) and Ron Delgado (2001) who analyze this channel by implementing a time series exercise. As it was indicated in the introductory section, our study enhances these exercises in two respects. First, we account for the structural breaks evident in time series data of Mexico. The results of the cointegration tests can then be considered more robust relative to those obtained with estimations that do not control for the breaks. Second, in our exercise we estimate the short-run relationship of the variables. Our intention is to establish whether activity in the stock market and the aggregate economy responds to common transitory shocks in the same manner. This exercise provides insight into the dynamics of the business cycle and cyclical fluctuations in the stock market. The results will unveil whether the cyclical patterns are synchronized. No other document in the literature has implemented this type of exercise for the case of Mexico. Once this association is determined, a variety of studies can be conducted. For instance, if it is determined that the cycles are synchronized, one could forecast the dynamics of the Mexican business cycle using liquidity measures of the stock market as leading indicators, as in Florackis *et al.* (2014). Description of the data and estimations follow.

SECTION II. THE REAL ECONOMY AND THE STOCK MARKET IN MEXICO

We consider three different indicators for the MSE to illustrate the development or deepening of the stock market: stock prices index (IPC), value of stocks (Value), and level of operations (Operations). In addition, we construct two measures of market activity by dividing Value and Operations by GDP. This transformation is done with the purpose of capturing stock market liquidity relative to the size of the economy. Indicators similar to these have been used in studies where Mexico was included, see for instance Ron Delgado (2001) or Ghimire and Giorgioni (2013). While the three variables intend to capture the development of the stock market, Value and Operations may be thought of as more specifically as measuring stock market liquidity, as suggested in Levine (1991). The variables Value and Operations are expressed in constant terms. The source for the stock market variables is the Central Bank of Mexico (Banco de México). Real GDP is measured in constant terms and the sample period covers from 1993 to the first quarter of 2011. Additionally, we include industrial production in real terms as a measure of economic activity. The frequency of this variable is monthly, as the stock market variables are, and will be used to estimate specifications for the stock market variables that were divided by GDP. The source for real GDP and industrial production is the National Institute of Statistics and Geography (INEGI).

Graph 1 illustrates the stock market variables. Graph 2 shows the IPC with real GDP. From Graph 1 it is evident that the various stock market indicators follow a similar dynamic: all of them exhibit the slowdown of 2001 and the collapse of 2009. Also, these variables have episodes in which their behavior changes significantly, that is, they exhibit structural breaks. A positive association between stock market activity and the real economy in the long-run is apparent in Graph 2. The mid-1990's and the most recent economic crises are evident. The similar behavior is more apparent in Graph 3, where four episodes of economic slowdown are clearly identified: 1994-1995, 1999, early 2000's and 2009. From this graph one can say that these variables share a common cycle, however, we have to keep in mind that these are just graphical illustrations. As was the case with the stock market variables, real GDP also presents various structural breaks. Thus, the econometric exercise that follows is implemented using methodologies that allow for these changes.

SECTION III. EMPIRICAL EXERCISE

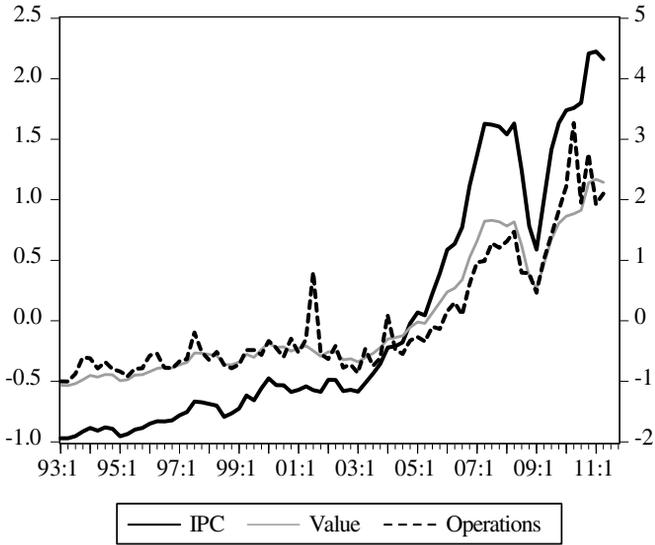
The empirical strategy consists of testing for the stochastic nature of the variables and then conducting cointegration and common cycle tests. Since the cointegration literature is ample, we spare the reader from its description. We briefly illustrate the common cycle methodology as suggested by Vahid and Engle (1993). The narrative below follows closely the technical discussion in Issler and Vahid (2001).

Consider an n -vector of $I(1)$ variables whose first difference is stationary and hence allows for a Wold representation as follows:

$$\Delta y_t = C(L)u_t \quad (1)$$

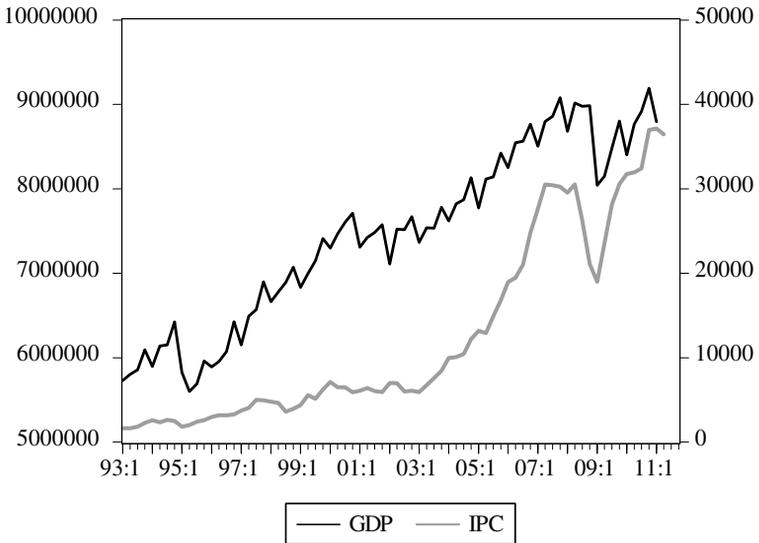
GRAPH 1

STOCK MARKET INDICATORS



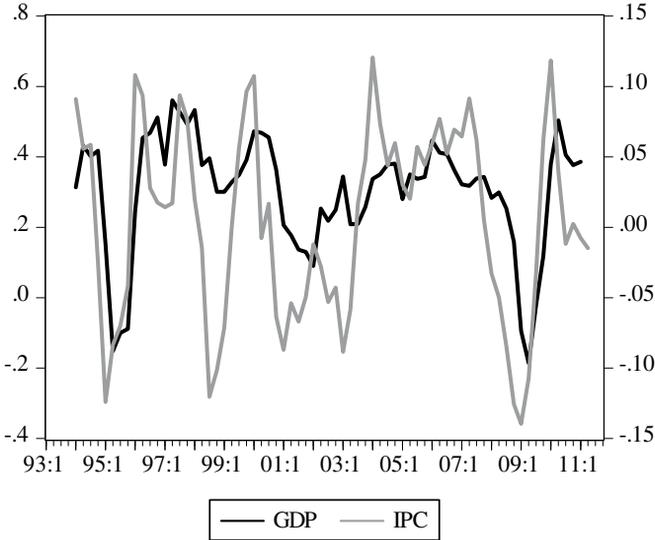
GRAPH 2

STOCK MARKET ACTIVITY AND REAL GDP IN LEVELS



GRAPH 3

STOCK MARKET ACTIVITY AND REAL GDP IN GROWTH RATES



Where $C(L)$ is a polynomial matrix with $\sum_{j=1}^{\infty} j|C_j| < \infty$, $C(0)=I_n$ and u_t is white noise. Defining $C^*(L)$ as $C^*(L)=(1-L)^{-1}(C(L)-C(1))$ we can rewrite (1) as:

$$\Delta y_t = C(1)u_t + \Delta C^*(L)u_t \tag{2}$$

Integrating (2) we get

$$y_t = C(1)\sum_{s=0}^{\infty} u_{t-s} + C^*(L)u_t \tag{3}$$

The first term on the right of (3) represents the trend component, the second the cyclical stationary element. In fact, this expression is the common trend-cycle decomposition of a time series in the spirit of Beveridge and Nelson (1981). It is said that the variables in y_t share common trends if there exists r linearly independent vectors stacked in a $r \times n$ matrix, α' , with $\alpha' = C(1) = 0$. Similarly, the variables in y_t share common cycles if there exist s linearly independent vectors, $s \leq n-r$, stacked in a $s \times n$ matrix $\tilde{\alpha}'$ with $\tilde{\alpha}' = C^*(L) = 0$.

While many methodologies are available for identifying cointegration, we choose Johansen (1991) since r can be obtained directly; for s we consider the common cycles test proposed in Vahid and Engle (1993). The same requires the estimation of the squared canonical correlations in the system, λ^2 , and then a test to determine if the smallest correlations are zero, $\lambda_i^2 = 0 \quad \forall i = 1 \dots s$. As such, the null hypothesis is the existence of common cycles. The test statistic is given by $C(p, s) = -(T - p - 1) \sum_{i=1}^s \log(1 - \lambda_i^2)$ and it is distributed χ^2 with $s^2 + snp + sr - sn$ degrees of freedom, where s refers to the number of common cycles, n is the number of variables, r is the number of cointegrating vectors and p represents the optimal lag structure. Since we consider bi-variate systems, the degrees of freedom can be at least 2 for 1 common cycle and 1 lag, and as many as the optimal number of lags may suggest.

As indicated before, expression (3) is the common trend-cycle representation of a time series. Taking this expression to the specific case of stock prices, we may think of it as the expression found in Fama and French (1988), where stock prices are illustrated as the sum of a random walk component and a stationary component:

$$p(t) = q(t) + z(t) \quad (4)$$

With $q(t) = q(t-1) + \mu + \eta(t)$ as the random walk component with drift and $z(t)$ representing the stationary element. Thus, $q(t)$ is equivalent to $C(1) \sum_{s=0}^{\infty} u_{t-s}$ in equation (3) and $z(t)$ to $C^*(L)u_t$. While it is accepted that the random component is significant, there is really no consensus as to the magnitude of $z(t)$, and, as we mentioned in the introduction, results from the tests we implement will depend on how large this component is. Specifically, for the case of real GDP and industrial production previous research shows that their cyclical component is significant, and it has been found that they share common movement with other series with the same properties. In the case of the stock market series, there is no evidence on how "big" the stationary component is. If the cycle is significant, then we may be able to identify a common cycle with the real variables, but if it is not, then no common cycle can be determined.

Unit Root Tests

We first verify the stochastic nature of the series by conducting unit root tests. We consider two methodologies, Kwiatkowski-Phillips-Schmidt-Shin (KPSS) and Harvey, Leybourne and Taylor (2011) to account for the evident structural breaks in the series. The results presented in Table 1 are conclusive; all the series are integrated of order 1. With respect to real GDP and industrial production, these findings are consistent with those of many other authors including Noriega and Rodríguez-Pérez (2011) for GDP, and Garces (2006) for industrial production. For the stock market variables Ron Delgado (2001) finds, without including structural breaks, that they are non-stationary in levels but stationary in first differences. Now that structural breaks have been included, we can consider these results as robust.

TABLE 1

UNIT ROOT TESTS

Series	KPSS		Harvey <i>et al.</i>	
	Level	First Diff.	MDF1	MDF2
GDP	1.099*	0.185	-2.716**	-2.978**
Stock	1.134*	0.041	-2.549**	-3.260**
Value	1.097*	0.056	-2.254**	-2.701**
Value/GDP	1.049*	0.065	-2.469**	-3.121**
Operations	1.030*	0.043	-2.992**	-3.732**
Operations/GDP	0.943*	0.031	-3.038**	-3.953**
Ind. Prod.	1.032*	0.099	-3.084**	-3.875**

* Reject the null of stationarity.

** Do not reject the null of a unit root.

Notice that so far we have determined that stock market variables contain a significant random walk component, but have no evidence of significance for the transitory component. We cannot establish any conclusions as to whether stock market variables reflect an efficient behavior. It is still possible that these series contain a large and significant predictable component.

Cointegration Tests

We now proceed to test for the presence of common trends. We consider bivariate systems containing one variable as a proxy for stock market development, or liquidity, and one to capture the behavior of the aggregate economy. We estimate three different cointegration methodologies: the Engle and Granger residuals test (EG), the cointegration test suggested by Johansen, and the Hatemi-J (2008) routine for testing for cointegration under the presence of structural breaks. The Johansen methodology allows for determining the number of cointegrating vectors, r , and the other two tests are included for robustness. The results are presented in Table 2. The EG statistics suggest the existence of cointegration in all cases. Johansen's trace and eigenvalue tests identify cointegration only in the GDP–Stock and GDP–Operations systems. The Hatemi-J test, which controls for structural breaks, finds cointegration for all cases except Industrial Production–ValueGDP under the Za and Zt statistics; the ADF criterion identifies cointegration only for GDP–Stock and Industrial Production–OperationsGDP. Reasonably, we can take the Hatemi-J results as the most reliable and adequate test. If so, then we can determine that there exists a common trend between GDP and the three stock market variables; and between industrial production and Operations as a proportion to GDP. No substantial evidence of a common trend is found for industrial production and the value of stocks.

The normalized cointegrating vectors are also presented in Table 2. A positive relationship between GDP and the stock market variables is clear. The magnitude of the coefficients is relatively small, in the [0.148-0.188] interval. Since we considered the logarithms of the variables and normalized with respect to GDP, these coefficients can be

interpreted as long-run elasticities. Hence, a one percentage change in the stock market indicator is associated with a percentage change in GDP anywhere from 0.148 to 0.188. The relationship between industrial production and the value of stock market operations is very similar to what is found for GDP. In sum, we may assert that, while no causal relation is established, stock market activity and the aggregate economy share a common trend in the long-run⁴. In other words, financial development is positively associated with economic growth, as suggested by the liquidity argument previously sketched.

Qualitatively, our results when using GDP as a measure of economic activity are similar to those reported in Ron Delgado (2001). However, the magnitude is significantly lower. While the author reports a coefficient of 0.743, our results suggest an elasticity of 0.165 on average. The difference can be explained by the fact that our estimations account for the structural breaks of the Mexican economy, while the previous paper does not. Clearly, not accounting for the breaks may result in an overstated estimation of the importance of financial markets on GDP. Interestingly, the opposite is true when industrial production is used instead of GDP; our results are relatively larger than Ron Delgado's. The discrepancy can be explained by the different econometric techniques employed in both analyses. In sum, not controlling for the stochastic characteristics of the time series can lead to results that are not entirely robust⁵. With respect to the results in Kassimatis and Spyrou (2001), we can only make reference to the results

TABLE 2

COINTEGRATION TESTS

Systems	EG	Johansen		Hatemi			Normalized
	Residuals	Trace	Eigenvalue	ADF	Zt	Za	Cointegrating Vector
GDP, Stock	0.234 ^a	0.090 ⁺	0.089 ⁺	-5.747***	-7.772*	-66.782***	1, -0.148 (0,005)
GDP, Value	0.274 ^a	0.406	0.365	-5.405	-6.953*	-59.154***	1, -0.188 (0,008)
GDP, Operations	0.493 ^b	0.055 ⁺	0.091 ⁺	-4.885	-6.600*	-54.991***	1, -0.159 (0,012)
Ind. Prod, ValueGDP	0.299 ^a	0.2982	0.246	-5.296	-4.225	-30.008	
Ind. Prod, OperGDP	0.507 ^b	0.2635	0.2631	-6.148**	-7.110*	-60.032***	1, -0.159 (0,018)

a Do not reject the null of stationarity at 10%.

b Do not reject the null of stationarity at 1%.

+ Reject the null of no cointegration.

* Reject the null of no cointegration at 1%.

** Reject the null of no cointegration at 5%.

*** Reject the null of no cointegration at 10%.

⁴ Evidently, we are not suggesting any causal relationship between the variables. We could have normalized with respect to the stock market variable and the qualitative results would have remained.

⁵ One can argue that the results might be different due to the different sample periods. While this possibility is feasible, it is highly unlikely that a difference of the magnitude indicated in the text can be explained by the different periods of analysis.

for industrial production, since the authors did not consider GDP. Qualitatively our results are somewhat similar, though we only obtain a positive association between financial development and economic activity for one of our two stock market variables. Since the variables employed in this exercise are different from the one used in the previous paper, we cannot strictly compare the magnitudes directly⁶. Nonetheless, it is worth mentioning that the sizes of the coefficients are similar.

Common Cycle Tests

Our final estimation examines the existence of a common cycle by identifying common movements in the short run. We consider the systems for which cointegration was identified, namely GDP-Stock, GDP-Value, GDP-Operations, and Industrial Production-OperationsGDP. Test results are presented in Table 3. Notice that the p values for the existence of one common cycle suggest that GDP-Stock, GDP-Value and Industrial Production-OperationsGDP share common movements in the short-run, however, none of the t statistics for the coefficients are significant. This is an unexpected result. We would have anticipated seeing significant short-run coefficients for the systems for which there is evidence of a common cycle. In fact, taking these statistics at face value we would have to say that there is a common cycle and the normalized co-movement vector with respect to the real variable is $(1, 0)$, but this is not of much interest.

A more appealing interpretation of the results is that one of the variables in the system does not exhibit a significant transitory component. That is, the variables contain a stationary element but it is not “very large.” Given that there is ample evidence of a significant cyclical component on GDP and industrial production, we can firmly eliminate them as candidates, which leave us with the stock market variables. Thus, with the evidence from the common cycle tests, we can establish that the variables used in this exercise as a proxy for stock market development behave as a random walk with no significant cycle, as suggested by many authors dating back to Beveridge and Nelson (1981). In their seminal paper they propose that financial variables, such as the ones we have considered here, contain all relevant information and their prices reflect this fact. In other words, the behavior of financial variables is consistent with the EMH.

As we indicated in the introduction, the topic of whether financial variables contain a significant stationary component has been the center of intense debate. In Fama (1970) the analysis describes a set of works that, for the most part, argue in favor of the random walk hypothesis. On the other hand, various authors including Lo and MacKinlay (1988) strongly disagree with the EMH. For the case of Mexico this issue barely begins to create controversy. Only a handful of articles have examined the stock market variables explicitly. In addition to Ron Delgado (2001), Chen, Firth and Meng Rui (2002) and Mejia (2003) find that the stock market index of the MSE

⁶ They considered market capitalization.

is a series integrated of order 1, but their unit root tests did not consider structural breaks in the series, nor did the authors estimate the magnitude and significance of the transitory component in the variable. With an improvement on the unit root testing, Chaudhuri and Wu (2003) test for the random walk hypothesis including structural breaks. Their results weakly reject the null of a random walk and no testing on the magnitude of the stationary component of the series is conducted; similar results are found in Li and Chen (2010)⁷. Overall, we can confidently say that there is some evidence that stock market variables in Mexico are series integrated of order 1, but no evidence other than what we provide here is available suggesting the magnitude of the transitory component on these series.

TABLE 3
COMMON CYCLE TESTS

System	p values		Coefficient	t stat
	s=1	s=2		
GDP, Stock	0.608*	0.000	0.640	1.507
GDP, Value	0.647*	0.000	0.634	1.621
GDP, Operations	0.030	0.000	-0.970	-0.656
Ind. Prod., OperGDP	0.806*	0.000	-0.193	-0.937

* Do not reject the null of the existence of one common cycle.

Finally, we should emphasize that the purpose of this paper is to establish the relationship between financial development, as measured by stock market activity, and the aggregate economy for the long-run and for the short-run. The results pertaining to the nature of stock market variables and their association with the EMH, while important, are not the main focus of this analysis. Clearly, a more thorough and robust examination of the stochastic properties of these variables is called for.

SECTION IV. CONCLUSION

The importance of financial markets as an input in the production process has been discussed for decades. While some argue that they are essential components, others remain skeptical. For the most part, this discussion centers on developed economies, and for the US the number of documents on the subject is ample. In the case of developing economies the evidence on this topic is scarce, and Mexico is not the exception. In this paper we conduct an analysis of the long-run and short-run relationship between variables of the Mexican stock exchange and the aggregate economy. We find that stock market indicators, including the price index, share a common trend with real GDP,

⁷ Evidence of a random walk for the stock market index of the MSE is also provided in Fernandez-Serrano and Sosvilla-Rivero (2003) among others.

improvements (declines) in stock market activity are associated with increases (decreases) in economic activity. This result is consistent with the widely accepted argument relating financial development with economic growth: robust financial markets provide capital liquidity and promote growth. We also determined that transitory shocks do not affect these variables equally. While variables of the aggregate economy appear to exhibit a significant transitory component, variables of the stock market do not. Our results suggest that stock market indicators contain a significant random walk component but an insignificant stationary element. As such, it is evident to us that the behavior of these financial variables is consistent with the Efficient Market Hypothesis. Clearly, our results are merely suggestive and more robust analyses should be carried out to fully identify the stochastic nature of these indicators.

REFERENCES

- ACEMOGLU, D., F. ZILIBOTTI and P. AGHION (2006). "Distance to Frontier, Selection, and Economic Growth", *Journal of the European Economic Association* 4, pp. 37-74.
- ARESTIS, P., P. DEMETRIADES and K. LUINTEL (2001). "Financial Development and Economic Growth: The Role of Stock Markets", *Journal of Money, Credit, and Banking* 33, pp. 16-41.
- BEVERIDGE, S. and C. NELSON (1981). "A New Approach to Decomposition of Economic Time Series into Permanent and Transitory Components with Particular Attention to the Measurement of the Business Cycle", *Journal of Monetary Economics* 7, pp. 151-174.
- BHIDE, A. (1993). "The Hidden Costs of Stock Market Liquidity", *Journal of Financial Economics* 34, pp. 31-51.
- BROWN, J., G. MARTINSSON and B. PETERSEN (2013). "Law, Stock Markets, and Innovation", *Journal of Finance* 68, pp. 1517-1549.
- CALDERON, C. and L. LIN (2003). "The Direction of Causality between Financial Development and Economic Growth", *Journal of Development Economics* 72, pp. 321-334.
- CAPORALE, G., M. PETER HOWELLS and A. SOLIMAN (2004). "Stock Market Development and Economic Growth: The Causal Linkage", *Journal of Economic Development* 29, pp. 33-50.
- CHAUDHURI, K. and Y. WU (2003). "Random Walk versus Breaking Trend in Stock Prices: Evidence from Emerging Markets", *Journal of Banking and Finance* 27, pp. 575-592.
- CHEN, G., M. FIRTH and O. MENG RUI (2002). "Stock Market Linkages Evidence from Latin America", *Journal of Banking and Finance* 26, pp. 1113-1141.
- DE GREGORIO, J. and P. GUIDOTTI (1995). "Financial Development and Economic Growth", *World Development* 23, pp. 433-448.
- DEMETRIADES, P. and K. HUSSEIN (1996). "Does Financial Development Cause Economic Growth? Time Series Evidence from 16 Countries", *Journal of Development Economics* 51, pp. 387-411.
- ENISAN, A. and A. OLUFISAYO (2009). "Stock Market Development and Economic Growth: Evidence from Seven sub-Saharan African Countries", *Journal of Economics and Business* 61, pp. 162-171.
- ERGUNGOR, E. (2008). "Financial System Structure and Economic Growth: Structure Matters", *International Review of Economics and Finance* 17, pp. 292-305.
- FAMA, E. (1970). "Efficient Capital Markets a Review of Theory and Empirical Work", *Journal of Finance* 25, pp. 383-417.
- FAMA, E. and K. FRENCH (1988). "Permanent and Temporary Components of Stock Prices", *Journal of Political Economy* 96, pp. 246-273.
- FERNANDEZ-SERRANO, J. and S. SOSVILLA-RIVERO (2003). "Modelling the Linkages between US and Latin American Stock Markets", *Applied Economics* 35, pp. 1423-1434.
- FLORACKIS, C., G. GIORGIONI, A. KOSTAKIS and C. MILAS (2014). "On Stock Market Liquidity and Real-Time GDP Growth", *Journal of International Money and Finance* 44, pp. 210-229.

- GARCES, D. (2006). "La Relación de Largo Plazo del PIB Mexicano y sus Componentes con la Actividad Económica en Estados Unidos y el Tipo de Cambio Real", *Economía Mexicana, Nueva Epoca* 15, pp. 5-30.
- GHIMIRE, B. and G. GIORGIONI (2013). "Puzzles in the Relationship between Financial Development and Economic Growth", *Journal of Applied Finance and Banking* 3, pp. 199-222.
- GOLDSMITH, R. (1969). *Financial Structure and Development*, Yale University Press, New Haven.
- HARVEY, D., S. LEYBOURNE and R. TAYLOR (2011). "Testing for Unit Roots in the Possible Presence of Multiple Trend Breaks Using Minimum Dickey-Fuller Statistics", *Working Paper*, Granger Centre for Time Series Econometrics and School of Economics, University of Nottingham.
- HATEMI-J, A. (2008). "Test for Cointegration with Two Unknown Regime Shifts with and Application to Financial Market Integration", *Empirical Economics* 35, pp. 497-505.
- ISSLER, J.V. and F. VAHID (2001). "Common Cycles and the Importance of Transitory Shocks to Macroeconomic Aggregates", *Journal of Monetary Economics* 47, pp. 449-475.
- JENSEN, M. and W. MECKLING (1976). "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure", *Journal of Financial Economics* 3, pp. 305-360.
- JOHANSEN, S. (1991). "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models", *Econometrica* 59, pp. 1551-1580.
- KASSIMATTIS, K. and S. SPYROU (2001). "Stock and Credit Market Expansion and Economic Development in Emerging Markets: Further Evidence Utilizing Cointegration Analysis", *Applied Economics* 33, pp. 1057-1064.
- LEVINE, R. (1991). "Stock Markets, Growth, and Tax Policy", *Journal of Finance* 46, pp. 1445-1465.
- LEVINE, R. (1997). "Financial Development and Economic Growth", *Journal of Economic Literature* 35, pp. 688-726.
- LEVINE, R., N. LOAYZA and T. BECK (2000). "Financial Intermediation and Growth: Causality and Causes", *Journal of Monetary Economics* 46, pp. 31-77.
- LEVINE, R. (2005). "Finance and Growth: Theory and Evidence" in P. Aghion and S. Durlauf, *Handbook of Economic Growth, Vol. 1: Part A*, Elsevier, pp. 865-934.
- LI, C. and T. CHEN (2010). "Revisiting Mean Reversion in the Stock Prices for both the US and its Major Trading Partners: Threshold Unit Root Test", *International Review of Accounting, Banking and Finance* 2, pp. 23-38.
- LO, A. and C. MACKINLAY (1988). "Stock Market Prices do not Follow a Random Walk: Evidence from a Simple Specification Test", *Review of Financial Studies* 1, pp. 41-66.
- LUCAS, R.E. (1988). "On the Mechanics of Economic Development", *Journal of Monetary Economics* 22, pp. 3-42.
- McKINNON, R. (1973). *Money and Capital in Economic Development*, Brookings Institution, Washington, D.C.
- MEJIA, P. (2003). "Regularidades Empíricas en los Ciclos Económicos de México: Producción, Inflación y Balanza Comercial", *Economía Mexicana, Nueva Epoca* 12, pp. 231-274.
- MYERS, S. and N. MAJLUF (1984). "Corporate Financing and Investment Decision when Firms have Information that Investors do not Have", *Journal of Financial Economics* 13, pp. 187-221.
- NORIEGA, A. and C. RODRIGUEZ-PEREZ (2011). "Estacionariedad, Cambios Estructurales y Crecimiento Económico en México", *Documento de Trabajo*, Banco de México.
- RIOJA, F. and N. VALEV (2014). "Stock Markets, Banks, and the Sources of Economic Growth in Low and High Income Countries", *Journal of Economics and Finance* 38, pp. 302-320.
- RIOJA, F. and N. VALEV (2004). "Finance and the Sources of Growth at Various Stages of Economic Development", *Economic Inquiry* 42, pp. 27-40.
- RON DELGADO, F. (2001). "Ajuste Dinámico y Equilibrio entre la Producción Industrial y la Actividad Bursátil en México", *Momento Económico* 118, pp. 21-38.
- SHLEIFER, A. and L. SUMMERS (1988). "Breach of Trust in Hostile Takeovers", in A. Auerbach, *Corporate Takeovers: Causes and Consequences*, University of Chicago Press, Chicago, pp. 33-56.
- STERN, N. (1989). "The Economics of Development: A Survey", *Economic Journal* 99, pp. 597-685.
- VAHID, F. and R. ENGLE (1993). "Common Trends and Common Cycles", *Journal of Applied Econometrics* 8, pp. 341-360.
- VAN NIEUWERBURGH, S., F. BUELENS and L. CUYVERS (2006). "Stock Market Development and Economic Growth in Belgium", *Science Direct, Explorations in Economic History* 43, pp. 13-38.