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IS THE MEXICAN STOCK MARKET BECOMING MORE EFFICIENT?

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Abstract

This paper studies the recent evolution of market efficiency in the Mexican Stock Exchange by testing the hypothesis that stock prices have become "more efficient" through time. This is done by observing the evolution of the coefficients of the regressions between individual stocks returns and a market proxy sample portfolio. The sample of shares was selected under the criterion of a greater frequency of trading. Following Morck, Yeung and Yu' (2000) work, we built a Market Proxy Sample Portfolio (MPSP) that includes 27 larger firms issuing shares (with respect to a relative capitalization measure), frequently traded shares, listed in the Mexican Stock Exchange. The database included daily closing prices from January 1999 to May 2010. The results of the tests indicate there is a downward trend in the magnitude of the average R2 during the first half of the decade, but there is an inflection in the trend in the last three years of the period of study, which may be explained by the extraordinary turbulence that prevailed during the 2007-2009 financial crisis.

Resumen

En este trabajo se estudia la evolución reciente de la eficiencia del mercado en la Bolsa Mexicana de Valores probando la hipótesis de que los precios de las acciones tienden a ser "más eficientes" a través del tiempo. Para ello se observa la evolución de los coeficientes de las regresiones entre los rendimientos individuales de las acciones y un "proxy" del portafolio del mercado. La muestra fue seleccionada bajo el criterio de mayor bursatilidad. Con base en el trabajo de Morck, Yeung y Yu (2000) se utilizó un "portafolio muestra del mercado" (MPSP) que incluyó a 27 grandes emisoras (con respecto de una medida relativa de la capitalización), de gran bursatilidad, listadas en la Bolsa Mexicana de Valores. La base de datos incluyó precios diarios de cierre entre enero de 1999 y mayo de 2010. Los resultados de las pruebas indican que hay una tendencia a la baja en la magnitud del promedio de R2 durante la primera mitad de la década, pero hay una inflexión en la tendencia en los últimos tres años del periodo bajo estudio, lo cual puede ser explicado por la extraordinaria turbulencia que prevaleció durante la crisis financiera 2007-2009.

JEL Classification:G14, G15
Keywords: Information and Market Efficiency, International Financial Markets

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1. Introducción

The close relationship between the relative size and the degree of sophistication of a country's financial industry and its economic development has been widely documented. For example, Schumpeter (1934) emphasized the role of financial intermediaries in economic development stimulating technological innovation. The transference of capital from old to new industries, or from traditional to innovative practices and technologies to produce the same goods and services is made possible because the financial intermediaries are capable of extending credit to entrepreneurs. Bagehot (1973), explained why the English financial market was more successful than those of other countries to mobilize savings and allocate them to financing of long-term projects, and concluded that the development of its financial industry was a precondition of the industrial revolution in England.Under a different perspective, McKinnon (1973) and Shaw (1973) highlighted the negative effects of "financial repression", meaning the intervention of governments in the financial markets, as one of the main sources of backward economic development. Both authors concluded that "financial liberalization" would impulse economic growth.

In an attempt to give empirical support to the subject, Goldsmith (1969) studied the changes observed in domestic financial structures as economies grow, assessed the impact of overall financial development on economic growth, and tested if financial structure influences the pace of economic growth. He found there is a positive correlation between financial development and economic growth, but he did not provide enough evidence on how financial development promotes economic growth.

More recently, several other researchers have documented the idea that the financial system plays a crucial role in alleviating market frictions and hence influencing savings rates, investment decisions, technological innovation and, therefore, long-term economic growth rates; *i.e.* there is a positive relationship between the progress of the financial sector and economic development (Levine and Serbos 1988; Levine 1997; Demirgüç-Kunt, A. 2001; Rajan and Zingales 2001).

Wurgler (2000) said that to achieve an optimal capital allocation in the economy requires that investments be directed to those activities that are expected to generate higher returns, and that resources invested in less-than-average profitability sectors with poor prospects are withdrawn. The allocation of limited economic resources among concurrent needs in modern economies is expected to follow that precept and, as a consequence, progressive improvement of living standards will result. He studied 65 countries and found that "those with developed financial sectors increase investment more in their growing industries and decrease investments more in their declining industries, than those with underdeveloped financial sectors".

However, there are another position that suggests that the operations of the financial sector merely respond to economic development, adjusting to changing demands from the real sector, and conclude that assigning preeminence to the financial sector is a misrepresentation of the real economic causality relationship. (Robinson 1952; Lucas 1988).

Evidence suggests that while each school's interpretation of the relationship between financial-development and economic-development is partially true, evidence shows that those countries that have achieved a more advanced economic development stage, also count with a comparatively more developed financial sector. In that sense, the causality issue becomes a matter of theoretical discussion and empirical verification but it seems that economic development and a more developed economy evolve hand in hand, lending support to each other.

Focused on the more specific role of capital markets as part of the financial intermediation system, Levine (1991) showed that more liquid stock markets promote investments in long duration projects because investors can sell easily their equity claims to future profits of long term projects undertaken by firms.

In the recent past there has been an increasing convergence of "commercial-banking" centered and "capital-markets" centered economies towards a more equilibrated mix. During the period that goes from 1980, one decade before the decision to adopt the euro was made, and until the year 2000, one decade after its adoption, there were profound changes in the composition of the financial markets in Europe. While there were also notable changes in Great Britain and the United States, the magnitude of the European transformation was much more dramatic, as discussed in detail by Rajan and Zingales (2003), who reported the percentage represented by commercial bank loans and the capital markets with respect to the country's GDP for selected European countries and for the United States and Great Britain. The former group included the "euro area" countries (after the introduction of the euro in 1999), while the latter is referred to as "Anglo Saxon" countries because of the important institutional and legal similarities of the financial markets of the two member countries.

While the participation of the commercial banking loans in Europe represented an average 64.7% in 1980, the percentage grew to 93.7% in 2000. For the Anglo Saxon the corresponding data were 31.5% and 90.7%, respectively. The relative importance of the commercial banking industry in Europe increased in approximately 50% and in the Anglo countries 200%. From a significantly smaller relative participation in 1980, the Anglo countries commercial banking loans converged in 2000 to almost the same level as the European group. However, the growth of the capital markets was still more dramatic. The proportion of capital markets to GDP grew from an average of 2%, to as much as 105% during the same period, while the corresponding figures for the Anglo countries were 42% and 169.4%.

There was convergence in terms of the average size of commercial loans for both groups, but the relative economic importance of the European capital markets was still far from that observed for the Anglo countries. However, it needs to be emphasized that the growth of the average relative importance of capital markets in the euro area group was equivalent to 50 times, or 5000%, compared to only 250% for the Anglo group.

Table 1. Economic Importance of the Financial Industry in the Euro area vs. the Anglo Saxon countries (1980-2000).

	Bank Loans to the Private Sector as a % of GDP		Stock Market Capitalization as % of GDP		Number of Companies to population*	
	1980	2000	1980	2000	1980	2000
Austria	0.742	1.04	0.03	0.156	8.74	11.975
Belgium	0.272	0.792	0.09	0.783	22.85	15.707
Denmark	0.244	.	0.09	0.686	42.54	42.135
Finland	0.462	0.534	na	2.383	n.a.	29.73
France	0.731	0.864	0.09	1.087	13.99	13.72
Germany	0.864	1.207	0.09	0.668	7.46	9.071
Greece	0.52	0.526	0.085	0.942	n.a.	30.869
Ireland	0.315	1.069	na	0.843	n.a.	20.053
Italy	0.555	0.77	0.07	0.703	2.36	5.058
Luxembourg	1.21	1.099	0.001	1.771	205.556	122.727
Netherlands	0.632	1.398	0.19	1.701	15.12	14.754
Portugal	0.855	1.408	0.006	0.567	n.a.	10.889
Spain	.	1.012	0.087	0.882	13.213	25.817
Sweden	0.415	0.457	0.11	1.476	12.39	32.92
Average Continental Europe	0.647	0.937	0.02	1.046	34.422	27.53
UK	0.276	1.32	0.38	1.84	47.22	32.37
U.S.	0.354	0.493	0.46	1.549	23.11	25.847
Average Anglo-American	0.315	0.907	0.42	1.694	35.165	29.109

* Number of companies to population is the ratio of number of domestic companies whose equity is publicly traded in a domestic stock exchange and the country's population in millions. n.a. = not available.

Source: Elaborated with data from Tables 1 and 2, from Rajan and Zingales (2003).

In this work we discuss the recent evolution of the Mexican capital markets and propose a measurement of its Market Efficiency, one of the pillars of a solid capital market functioning, as we will discuss in more detail below.

The 1994-1995 devaluation, financial crisis and economic downturn in Mexico represented a heavy burden the economy that was gradually overcome during the rest of the decade. However, with the new century arrived a series of extraordinary international events that produced uncertainty and excess volatility in the financial markets, including the "dot.com bubble-burst" (1999-2000), the war on terrorism initiated by the United States after the September 11, 2001 attacks in New York City, and the Global Financial Crisis of 2007 -2009.

In the meantime, the Mexican commercial banking sector rebuilt its strength and experienced significant transformations that have produced a robust pillar on which to continue the industrialization and modernization of the economy. However, in what corresponds to the role of the capital markets as a source of funding for economic development, only the corporate and the government bonds' markets have fared reasonably well. While in terms of profitability

the Mexican stock market has been one of the most attractive worldwide for many consecutive years, its depth and breadth has not developed in an equally satisfactory way. In effect, during the last years there was a reduction in the number of listed firms, an evolution that seems contrary to global tendencies. For that reason, we consider that a study to improve an understanding of the characteristics and working mechanisms of the Mexican Stock Exchange can provide government authorities and practitioners with additional elements that may help a resurgence of its economic role. A more robust development of the Mexican Stock Exchange is a prerequisite for the funding of more ambitious projects of internationalization and innovation by Mexican listed firms.

2. The Efficient Markets Hypothesis

Fama (1970) introduced the concept of an "efficient stock market" to the Financial Economics literature. Simply stated, it means that investors aim to outguess the market by using public information. In so doing they bid up or down the price of securities, incorporating public information into prices and, as a consequence at any moment all securities must be priced at their intrinsic economic value. This is one of the most important theories in Finance and Economics (Ball 1994).

During the last four decades the "Efficient Markets Hypothesis" (EMH) became a dominant topic in the literature of empirical finance studies. According to it, a certain stock's equilibrium price remains unchanged until new "relevant" information is incorporated to the original set because the market will interpret what its implications are in terms of future expected cash flows and risk, and reformulate the asset's worth appraisal. "Information is reflected by security prices when prices change because of changes in demand. The process of disseminating and analyzing information to develop new expectations about future prices determines the degree of efficiency in the market." (Dyckman and Morse, 1986). The outcome might as well be an increase or a reduction of the stock's market price, depending on the relative magnitude son the investors' supply and demand decisions in reaction to the new piece of information. Accordingly, the new equilibrium price will hold until yet another piece of relevant information reaches the market. Elton and Gruber [1991] neatly express this idea when they write: "When someone refers to Efficient Capital Markets, they mean that security prices fully reflect all available information." The EMH maintains that the market is capable of assimilating relevant information as soon as it arrives, and incorporating it into securities prices. The market's ability to adjust to a new equilibrium price as soon as the relevant information set changes depends on the existence of investors who can gather, analyze and interpret information on the stocks they are trading. By constantly surveying the market and because of the large size of their transactions, they ensure that equilibrium prices are competitive. "Any arbitrage opportunity is rapidly exercised, until it vanishes." (Dyckman and Morse, 1986).

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The 1990s were a period of change for the composition of both institutional and individual investors' portfolios. For many years emerging financial markets had been characterized as too risky because of their frequently intense volatility and, consequently, by large wealth creation and destruction episodes. Also the presence of infrequent trading limited the number of securities to invest in and the such markets were deemed to be "incomplete" in the sense that portfolios could not be exactly replicated with derivative instruments because, simply, such instruments were non existing (Hakkanson 1977)

A better understanding of the nature and functioning of emerging countries' financial markets represents an important subject to discuss, considering its aim is to identify the institutional conditions that eventually allow their gradual qualitative transformation into mature markets (often times led by quantitative changes) and, in that sense, contribute to the design of more efficient economic development models through the promotion of the financial sector consolidation and maturation process.

In this paper we study a small sample of stocks traded in the Mexican Stock Exchange (Bolsa Mexicana de Valores) and evaluate if the individual stock prices' behavior has become more "efficient", in the sense proposed by the Efficient Markets Hypothesis (Fama 1970, 1971), and operationalized by, for example, Morck *et al.* (2000).

As the pricing mechanism is recognized to be more efficient, a securities' market is perceived as more reliable and attractive by investors. In that sense, efficiency contributes to the development of a more mature financial industry, with significantly positive expected side effects. In brief, this study attempts to interpret whether there is a gradual transition from a less developed stock market towards a more mature one during a period that covers a period of a little more than one decade.

In more than one sense, this study fills a gap in the literature by addressing the efficiency with which market trading at the Mexican Bolsa incorporates new information into stock prices and, thus, falls within the field of study of the Efficient Markets Hypothesis (Fama 1970, 1991; Ball 1994).

3. The Measurement of Efficiency in Capital Markets

Capital Markets allow the formation of stock prices in the most efficient way when information flows freely and there are no impediments to the trading activity of investors (Fama1970, 1991). While the theoretical conception of the relationship between financial markets efficiency and improved allocation of capital has been in place for some time, little direct evidence was documented until Wurgler (2000) reported relevant findings that support the argument that

"developed financial markets, as measured by the size of the domestic stock and credit markets relative to GDP, are associated with a better allocation of capital." That is so, according to Wurgler, because countries with more developed financial markets increase their investment in growing industries and reduce it in declining industries. Accordingly, countries with less developed financial systems "both overinvest in their declining industries and under invest in their growing industries".

Several attempts to measure the efficiency with which stocks incorporate relevant information into their prices have focused on the coefficient of determination of a regression between the stock price changes and the corresponding stock market index returns. The higher the R^2, the more the volatility of stock returns is explained by general factors that affect all stocks and that are reflected in the market index.

Roll (1988), for example, observed low R^2 statistics for common asset pricing models due to vigorous firm-specific return variation not associated with public information, which implies either private information that is relevant to specific stocks has a significant influence on their prices, or occasional frenzy unrelated to concrete information (Durnev *et. al.* 2000).

Durnev *et al.* (2000) tested Roll's possible explanations for low $R^2 s$ and showed that "firms and industries with lower market model R^2 statistics exhibit higher association between current returns and future earnings, indicating more information about future earnings in current stock returns", which is consistent with Roll's first argument (*i.e.* firm-specific return variation not associated with public information).

Morck *et al.* (2000) support the idea that greater individual stock price variation as a proportion of total variation (low R^2) means more specific information content in price behavior and, therefore, more efficient stock markets. They argue that the extent to which stocks move together depends on the relative importance of firm-level and market-level information capitalized into stock prices.

One of their most compelling findings of Morck *et al.* was that stock prices in economies with high per capita GDP move in a relatively unsynchronized manner. In contrast, stock prices in low per capita GDP economies tend to move together. They also mentioned that the degree of co-movement in U.S. stock prices declined more or less steadily during the 20^{th} century, and offered three plausible explanations:

• Firms in low-income countries might have more correlated fundamentals, and this correlation might make their stock prices move more synchronously.

• Low-income economies often provide poor and uncertain protection of private property rights and this fact could make informed risk arbitrage in their stock market unattractive. According to De Long *et al.* (1989, 1990), a reduction in informed trading can increase market-wide noise trader risk, which we would observe as increased market-wide stock price variation unrelated to fundamentals.

• In countries that provide poor protection of public investors from corporate insiders, problems such as inter-corporate income shifting could make firm-specific information less useful to risk arbitrageurs, and therefore impede

the capitalization of firm-specific information into stock prices. This would result in reduced firm-specific stock price variation, again increasing stock return synchronicity.

The relative magnitude of the coefficient of determination and its evolution through time represent one of the most theoretical consistent measurements of the efficiency of the pricing mechanism of stocks and that is the approach we follow in this study, adopting a series of methodological procedures to test if the Mexican stock market may be said to be improving in efficiency during the last decade.

4. Efficiency in the Mexican Stock Exchange

Although there are very few studies that attempt to measure the efficiency of the Mexican Stock Exchange, some have documented evidence that questions the capacity of Mexican publicly traded stock prices to reflect major changes that occur to the issuing companies.

For example, Battacharya *et al.* (2000) studied a sample of Mexican public corporations' event worthy news. They included all restructuring announcements, including changes in capital structure, mergers, takeovers acquisitions, spin-offs, joint ventures, privatizations announcements, board change announcements, atypical earnings and dividend announcements, during the period from July 1994 through June 1997.

The same authors tested each firm-series for abnormal returns for every day in the event period, using the Brown and Warner (1985) methodology; *i.e.*, they used a market model to define excess returns for each firm for each event related date. A t-statistic was estimated for each firm for each event day. The null hypothesis was the excess returns for each day were equal to zero. They used a t-distribution to decide on the rejection of the null hypothesis, relying on a two-tailed t-test at a 5% significance level and also used the approach proposed by Corrado (1989) to test if the absolute values of excess returns observed during the event window are or not higher than those in the normal period. The latter test does not make any distributional assumptions, focusing instead on the rank of the observations instead of their values. In both tests Battacharya *et al.* found there was nothing unusual about returns, volatility of returns, volume of trade, or bid-ask spreads in the events' windows.

They proposed four possible explanations for that phenomenon:

- First, the stock market may be informational inefficient, which implies that stock prices are not linked to firm values. In such a stock market, stock prices will not change when new information about firm value is released through corporate announcements.

- Second, it is possible that corporations in an economy do not make value-relevant news announcements. "Even if stock markets in this fictional economy are informationally efficient, prices are left with no announcement stimuli against which to respond."

- Third, although a stock market may be efficient, and the news may be value-relevant, the news provided may be completely anticipated. They exemplify this case with Israeli inflation-indexed bonds whose price anticipated 85% of the news contained in a consumer price index.

• Fourth, insider trading prohibitions may not exist in a stock market or, in case they exist, are not enforced. In such a stock market, the superior information of insiders may have been incorporated in stock prices through their trades prior to its public announcement. Under that hypothesis, news would represent a surprise for everybody else, except the traders themselves.

The cited authors explored the first three hypotheses and concluded there was not supportive evidence. To test the fourth, they focused their attention on two types of stock series, the A-shares and the B-shares. Mexican companies issue many different types of equity, called series, but A and B series have interesting characteristics to test for market efficiency: "Legally, A-shares may only be held by Mexican nationals and account for at least 51% of a firm's voting rights, while B-shares are open to foreigners, although they are limited to 49% of the ownership. Other than segmentation by ownership, these two series are similar. In particular, owners have equal rights to cash flows and voting privileges." (Battacharya *et al.*). They didn't find significant differences in the proportion of rejections in the event window for both types of series. What is interesting is that for B-shares, although there is no dramatic spike displayed in the event window, the highest observed level occurs in the event window. They concluded that corporate announcements seem to have no impact on returns of A-shares and seem to have a marginal impact on returns of B-shares.

Besides Battacharya et al (2000), there are very few other published studies that have pursued the objective to measure the efficiency of the Mexican Market (Hakim 1992; Kawatsu 1999; Urrutia 1995), so the subject results attractive and relevant, considering that country's economy is entering into a period of fast expansion that will demand increasing volumes of reliable funding, as well as an increasingly deep securities market capable to absorb growing balances of retirement funds managed by the legally obligatory private pension funds that augment the volume of resources that need to be invested by the day. The Mexican "Administradoras de Fondos para el Retiro" (or AFOREs), were authorized to invest part of their holdings in the stock market a few years ago and all of them have underutilized that prerogative in a good measure due to the shallowness of the Mexican Bolsa. It is in that perspective that the Mexican Stock Market has a great opportunity to perform a relevant economic function and become an important motor of investment and employment in the country.

5. Estimating the Mexican Stock Exchange Efficiency

The way this study proposes to measure the efficiency of the Mexican Stock Exchange through the 2000-2010 is by following Durnev *et al.*'s methodology, *i.e.,* by empirically measuring the sensitivity of our sample stocks' returns to the overall market returns, as measured by a composite index, which represents a proxy measurement of the theoretical Market Portfolio of the CAPM derivation. We contend that if an individual stock return's regression with respect to the composite index coefficient of determination decreases through time, that evidence may be interpreted as a confirmation that the stock's returns are increasingly responding to fundamental information specific to the issuer, and responding less to the overall general market conditions (Roll 1988). Phrased differently, if a stock's market price reflects information that is relevant to the

issuing firm's performance, then its dependence with respect to the overall market information should consistently diminish.

To make our analysis operational, we defined the following null hypothesis: the Mexican Stock Exchange pricing mechanism' efficiency consistently improves through time. We then proceeded to operationalized the testing process as follows: if the pricing mechanism does improve through time and individual stock's prices gradually respond to information that is relevant for the valuation of the issuer, the $R^2 s$ of individual stocks' regressions against a market portfolio proxy should show a diminishing trend through time.

Emerging markets (EM) are characterized by frequently intense volatility and, consequently, by repetitive episodes of large-scale wealth creation and destruction. Another typical characteristic of EM is the presence of infrequent trading affecting a large proportion of the traded issues. Infrequent trading affects the price formation mechanism, but it also limits the availability of derivative contracts on thinly traded stocks. Such markets can be considered "incomplete", in the sense that portfolios cannot be exactly replicated with derivatives, simply because these are not traded (Hakansson1977). Of course, incompleteness also reduces the ability of the price formation mechanism to perform efficiently because often times arbitrage opportunities are not captured due to the inexistence of the necessary vehicles to execute arbitrage strategies.

The Bolsa Mexicana de Valores is an emerging capital market with a very small number of actively traded stocks, and with a relatively low level of average daily transactions. From a statistical analysis point of view, "thin trading" represents a serious inconvenience because if a stock is not frequently traded, or even skips trading during one or more consecutive days, when a transaction finally takes place the observed price variation incorporates information that corresponds not only to that specific moment, but to the whole period, since its last trade. Due to the absence of trading during several days/weeks/months very large movements take place when trading occurs, and the estimation of OLS regressions statistical parameters is biased as a consequence. So the frequency of trading is a characteristic of time series data that can affect the reliability of the estimated parameters and requires extensive and sometimes complex corrections and adjustments (see, for example, Scholes and Williams 1977).

In this analysis, we opted for a limited portfolio of stocks that showed the highest frequency of trading as of June of 2009, and tracked that sample for the whole period of analysis. Our sample was selected based on the criteria of greater frequency of trading.[1] The selection criteria we used for our sample was basically the same that the Bolsa Mexicana de Valores uses to choose the stocks it follows with its IPyC index, except for the fact that the Bolsa's sample is modified periodically. We built a portfolio named the "Market Proxy Sample Portfolio"(MPSP) that included 27 large (by capitalization measure), highly

[1] In some cases our sample stocks are also traded in foreign stock markets like NYSE, the Bolsa de Madrid, etc.

liquid (frequently traded) stock issues listed in the Bolsa Mexicana de Valores. Our database included daily closing prices for our sample of stocks, for the period that goes from January 1999 until May 2010.

Since our study covers almost ten years of data, using the group of stocks used to calculate the Mexican Bolsa Indice de Precios y Cotizationes (IPyC), we would have unwillingly incorporated a survival bias into our study. Our MPSP was calculated following the same methodology used to obtain the IPyC, and made sure that the chosen stocks didn't include any series that had disappeared during the observation period. The IPyC is a value weighted index, where the capitalization value of each share divided by the sum of all-shares-in-the-sample capitalization value represents the weight of each share, and is obtained according to the following formula:

$$I_t = I_{t-1}\left(\frac{\sum P_{it} * Q_{it}}{\sum P_{it-1} * Q_{it-1} * F_{it}}\right)$$

where:

$I_t = IPyC$ in time t

P_{it} =Price of stock i in time t

Q_{it} = Number of shares i traded in day t

F_{it} = Adjustment factor for ex-rights

In order to verify how much do individual stock prices respond to general market conditions, affecting the whole sample in a similar measure and, thus, not only reflecting individually relevant information but information that influenced the overall sample, we initially ran two different regressions; the first included all the daily observations (from April 5, 1999 through May 18, 2009); and the second subdivided the sample in two subperiods (from April 5, 1999 through February 3, 2004 and from February 4, 2004 May 18, 2009).

In running each individual, we adjusted the MSPS by controlling for the influence of the regressed stock returns on the MPSP returns, converting it into an "Adjusted Market Proxy Sample Portfolio" (AMPSP). By performing that adjustment to the original market proxy we eliminated the possibility of spurious results that could result because the individual stock's daily returns were included in both, the regressor and the regressand.

The absolute average size of the R^2 of the regressions, confirmed Morck *et. al.'s* (2000) results. Table 2 presents the outcomes of the first regression for each stock in our sample. In all cases the regressions were very highly significant (P-Value < 0.00) and with an average R^2 value of 0.2380, which was similar to the results obtained by Morck *et al.* for the Mexican Stock Exchange in 1995 (Average $R^2 = 0.29$). While in more advanced economies studies report much smaller $R^2 s$ for equivalent regression analyses, the Mexican sample fits close to the mean of the distribution presented in that paper.

Table 2. Daily Individual Stocks Returns vs. AMPSP Returns, April 5, 1999- May 18, 2009

	R^2	F test	P-value
ALFA	0.2274	249.3408	0.0000
AMX	0.0380	9.1617	0.0001
ARA	0.2237	15.5269	0.0000
AUTLAN	0.0277	2.9682	0.0031
BIMBO	0.1780	23.5201	0.0000
CEMEX	0.3263	410.3753	0.0000
COMER	0.2135	190.0590	0.0000
ELEKTRA	0.2703	456.4541	0.0000
FEMSA	0.3832	790.4140	0.0000
CARSO	0.3407	1315.5750	0.0000
GEOB	0.3053	184.1314	0.0000
INBURSA	0.1315	14.3699	0.0000
GFNORTE	0.3228	208.3361	0.0000
GMEXICO	0.2145	97.4180	0.0000
GMODELO	0.2291	756.5928	0.0000
ICA	0.1818	281.9979	0.0000
ICHB	0.1983	20.4427	0.0000
KIMBERA	0.2034	324.8830	0.0000
MEXCHEM	0.0631	9.2797	0.0000
PE&OLES	0.0901	117.0049	0.0000
SIMECB	0.1293	68.2502	0.0000
SORIANA	0.2997	543.6324	0.0000
TELECOA1	0.4251	1882.6680	0.0000
TEMLMEX	0.3664	735.6486	0.0000
TELEVICPO	0.4294	636.0249	0.0000
TVAZTCPO	0.2972	537.4527	0.0000
WALMEXV	0.3095	127.5923	0.0000

Source: Stock prices and market capitalization data for the whole observation period was obtained from Bloomberg Services.

A lower R^2 for our period of study (1999-2009) than that reported by Morck *et al.* for 1995 supports the idea that the Mexican Stock Exchange is gradually improving its pricing mechanism efficiency.

We tested the same hypothesis again, but this time dividing our observations sample in two and running the same process. If there was an improvement in the efficiency of the Mexican Stock Exchange pricing mechanism we expected to see a decreasing R^2 for each stock, from one period to the next. Our results are presented in Table 3, below.

Table 3. Daily Individual Stocks Returns vs. AMPSP Returns, two sub-periods: April 5, 1999 to February 3, 1994 and February 4, 2004 to May 18, 2009.

	Period 1			Period 2		
	R^2	F test	P-value	R^2	F test	P-value
ALFA	0.187772	64.55842	0.000000	0.297556	543.9039	0.000000
ARA	0.156593	12.51847	0.000000	0.317482	12.36308	0.000000
BIMBO	0.141476	10.92773	0.000000	0.229431	19.62928	0.000000
CEMEX	0.369517	133.0478	0.000000	0.368128	248.9636	0.000000
COMER	0.210736	13.51795	0.000000	0.248293	102.1851	0.000000
ELEKTRA	0.340972	314.1658	0.000000	0.18208	144.2309	0.000000
FEMSA	0.438944	264.0825	0.000000	0.321146	112.4061	0.000000
CARSO	0.38074	256.999	0.000000	0.316592	68.42923	0.000000
GEOB	0.207371	104.7166	0.000000	0.449068	233.9073	0.000000
INBURSA	0.175108	65.09732	0.000000	0.105931	19.65658	0.000000
GFNORTE	0.308478	82.47646	0.000000	0.387092	84.3486	0.000000
GMEXICO	0.127984	58.91331	0.000000	0.378895	103.234	0.000000
GMODELO	0.179545	11.93288	0.000000	0.298059	16.12135	0.000000
ICA	0.08581	8.866081	0.000000	0.41458	454.2935	0.000000
ICHB	0.230407	16.06545	0.000000	0.307763	52.63228	0.000000
KIMBERA	0.206319	327.5397	0.000000	0.206245	73.48749	0.000000
PE&OLES	0.01507	9.318412	0.000000	0.242524	98.89078	0.000000
SIMECB	0.021321	3.953729	0.000000	0.268751	127.3159	0.000000
SORIANA	0.366086	144.029	0.000000	0.261289	37.06059	0.000000
TELECOA1	0.493085	281.1781	0.000000	0.361152	16.96384	0.000000
TEMLMEX	0.442232	122.6393	0.000000	0.299749	70.28214	0.000000
TELEVICPO	0.448209	338.4507	0.000000	0.421612	186.6095	0.000000
TVAZTCPO	0.350873	20.39766	0.000000	0.219725	361.5742	0.000000
WALMEXV	0.345131	78.01056	0.000000	0.287352	41.70568	0.000000
Period 1:	**From 4/5/1999 to 2/3/2004**					
Period 2:	**From 2/4/2004 to 5/18/2009**					

This time, the average R^2 for the first sub period was 0.2596 and for the second sub period 0.2996, contradicting our expectations of an increasingly efficient pricing mechanism. An increasing average R^2 suggests that, instead of reflecting more specific return factors in their evolution, individual stock prices tended to behave more similarly to the rest of the stocks in the sample.

In order to fine tune the analysis, we separated our sample in three sub-periods, with an approximately equal number of observations. The results confirmed there is no clear tendency in the R^2 of our regressions through time. During the first sub-period the average R^2 was 0.2310, and improved to 0.1856 for the second sub-period, but significantly deteriorated during the third sub period reaching an average 0.2949.

While the results for the first two sub-periods suggest a trend towards a more efficient pricing mechanism "à la Morck et al", the third result seems contradictory. We believe that a possible explanation of that disappointing result is that the third sub period included the extremely highly volatile episode of the Subprime Mortgages driven Financial Crisis of 2007-2009 and that, when markets experience panic, they move at unison, without discriminating different individual stocks' fundamental value driving factors. In any case, the previous periods' results offer evidence to reasonably argue the Mexican Bolsa is gradually improving its efficiency.

Table 4: Daily Individual Stocks Returns vs. AMPSP Returns, three even sub-periods: between April 5, 1999 May 18, 2009

	Period 1		Period 2		Period 3	
	R^2	F test	R^2	F test	R^2	F test
ALFA	0.1553	155.6942	0.1858	193.4830	0.3143	388.2700
AMXL	0.0520	20.9102	0.0478	42.6104	0.0212	18.3350
ARA	0.1561	156.6597	0.1873	195.3947	0.3476	451.3702
AUTLAN	0.0136	4.9435	0.0437	16.5027	0.0987	40.9529
BAN	0.2959	355.1574	0.2071	221.5323	0.4104	589.5472
BIMBO	0.1435	141.9480	0.1469	146.0316	0.2540	288.3127
CARSO	0.4043	574.9730	0.1850	192.4785	0.3336	423.9581
CEMEX	0.3753	508.8037	0.2868	341.0437	0.3666	490.1666
COMER	0.2293	251.9355	0.1512	151.0294	0.2160	232.1860
ELEK	0.3801	-4.5306	0.1875	195.2697	0.1491	148.3904
FEMSA	0.4533	702.2759	0.2443	274.0992	0.3480	452.1354
GEO	0.1862	189.6393	0.2128	229.2039	0.4606	723.1711
GMEX	0.1122	106.8079	0.1624	164.3653	0.3926	547.4769
ICA	0.1002	93.8372	0.0946	88.5677	0.4274	632.2525
ICHB	0.0990	41.6572	0.1124	55.4815	0.3424	439.4505
INB	0.1780	176.6536	0.1410	139.1892	0.0967	90.6955
KIMB	0.2189	237.3931	0.1136	108.6336	0.2186	236.9499
MEXCHEM	0.0001	0.0325	0.1285	58.5448	0.3313	197.1822
MOD	0.1831	189.7866	0.1517	151.7019	0.3281	413.6261
PENOLS	0.0170	13.7568	0.0366	31.7245	0.2497	281.8142
SIMEC	0.0264	14.9601	0.1592	104.5359	0.4027	372.9070
SORIANA	0.3645	485.8075	0.2595	296.5411	0.2386	265.4055
TELEC	0.4989	843.3099	0.3452	447.0383	0.3722	502.1231
TELEV	0.4415	668.0842	0.4017	569.3501	0.4249	625.8088
TELMX	0.4544	705.4613	0.3096	380.3529	0.2919	349.1505
TVAZT	0.3650	486.9057	0.2481	279.7748	0.2406	268.3111
WALMEX	0.3340	424.8261	0.2625	301.7738	0.2849	337.3720

At a more detailed level, some stocks observed a consistent improvement (reduction) in their R^2 from the first through the third period (AMX, ELEK, INB, SORIAN, TELMX and TVAZT), while some others consistently deteriorated (ALFA, ARA, AUTLAN, BIMBO, GEO, GMEX, ICHB, MEXCHEM, PENOLS, SIMEC), but the rest didn't follow a consistent pattern. However, given the frequently observed deviation of daily stock prices' returns distribution from normality it is always more recommended to study the behavior of portfolios. By looking at the portfolio averages, the improvement in R^2 observed from the first to the second sub-periods, and then its deterioration during the third period we can conclude that in the long run, there is a tendency of the Mexican Stock Exchange to improve its pricing mechanism efficiency, but that during the last sub-period, which included the extreme turbulence of the Financial Crisis, there was a reduction in its pricing mechanism's efficiency.

6. Conclusion

Efficiency in pricing stocks is a desirable characteristic that investors search around for in Emerging Markets. Available evidence suggests that more developed economies enjoy more informational efficient stock markets (Morck *et al.* 2000). Previous studies have explored the efficiency of the Mexican market without concluding much, beyond positioning it among the intermediate evolution stock exchanges of the world in terms of the accuracy with which stock prices reflect the fundamental conditions that are particular to each of them.

Our analysis suggests that there are some indications the Mexican Stock Exchange pricing mechanism efficiency improved when comparing Morck *et al.'s* (2000) results with our sample regressions average R^2 (*i.e.*, from 1995 to the period that goes from 1999 to 2009). And again, there was an apparent improvement in between the first and second sub periods of our third analysis. While there was a deterioration of that trend during the third sub period, and this last piece of evidence challenges the evidence in favor of an improvement trend, a possible explanation may consist on the fact that stock prices moved much more in parallel during the turbulent times of the financial crisis episode of 2007-2009.

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