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Latin American integrated market. Is there cointegration after the entry of Mexico?

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Mercado integrado latinoamericano ¿hay cointegración después de la entrada de México?
Mercado integrado da américa latina. Existe cointegração apósa entrada do México?

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This article analyzes the existence of cointegration in the Latin American Integrated Market (MILA), after the entry of Mexico. Methodological tests do not detect a long-term stationary relationship between its four members. However, this relationship is detected for Chile-Colombia-Mexico; for Chile-Colombia and Colombia-Mexico, respectively.
Based on the number of cointegration relations and net financial position of each market, it is concluded that Colombia and Chile have benefited through their issuing companies. On the side of local investors, who diversify their resources in the remaining markets, are followed by Mexico. The least benefited has been Peru for not presenting cointegration.

Este artículo analiza la existencia de cointegración en el Mercado Integrado Latinoamericano (MILA), después de la entrada de México. Las pruebas metodológicas no detectan una relación de equilibrio a largo plazo entre sus cuatro miembros. Sin embargo, esta relación es detectada para Chile-Colombia-México; para Chile-Colombia y Colombia-México, respectivamente. Basado en el número de relaciones de cointegración y la posición financiera neta de cada mercado, se concluye que Colombia y Chile se han beneficiado a través de sus empresas emisoras. En el lado de los inversionistas locales, quienes diversifican sus recursos en los mercados restantes, les sigue México. El menos beneficiado ha sido Perú al no presentar cointegración.

Este artigo analisa existencia da cointegração no Mercado Integrado da América Latina (MILA), depois da entrada do México. As metodológicas não detectam uma relação de longo prazo entre seus quatro membros. Sem embargo, essa relação é detectada para Chile-Colômbia-México; para Chile- Colômbia e Colômbia-México, respectivamente. Com base no número do relações da cointegração e posição financeira em cada mercado, este artigo conclua a Colômbia e o Chile se beneficiaram a través da suas empresas emissoras. Do lado dos investidores locais, que desejam diversificar seus recursos nos demais mercados, segue o México. O menos beneficiado foi o Peru por não apresentar cointegração.

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1. Introduction

The literature on international finance points out that there are many benefits related to greater integration of international stock markets. On the one hand, one of the most relevant benefits for companies is that a much wider and diverse base of international investors, would allow them greater appreciation of their companies stocks and a reduction in the cost of raising capital.

On the other hand, from the point of view of investors, greater integration of international stock markets would allow them to achieve greater access to investment possibilities in securities, and thus, to diversify their portfolio risks more effectively than diversifying only in local stock markets. However, greater stock market integration, in addition to the benefits already mentioned, may have associated costs. This can lead to greater volatility and exposure of a local market to problems originating in the real or financial sector of an external market. These transmission problems (volatility spillover) are probably more significant when stock markets grow in integration and are faced with periods of generalized declines, thus diminishing the potential benefits of international diversification for investors.

Latin America has been showing greater economic and financial integration through multilateral agreements, regulatory policies and incentives for exchanging goods and capital flows. One of these agreements is related to the integration of stock markets of Colombia, Chile, Peru and Mexico, which starts from 2015, under the so-called MILA (Mercado Integrado Latinoamericano, hereafter) Platform that started operations on May 31, 2011, and initially formed by the stock markets of Colombia and Peru, whose purpose according to its promoters is to achieve a single Latin American market that offers to regional investors greater opportunities to diversify their portfolios, meet your investment needs and, equally, providing benefits to international issuers.
Although the purpose of the MILA is to capture the aforementioned benefits, it cannot be ignored that this platform can generate costs, which beyond those associated with operational processes, may be related to phenomena of volatility contagion, originated in a particular stock market, and which could be transferred to the remaining stock markets.

Traditionally, the approach that has been used by various authors to assess the degree of integration in the stock markets is that based on quantifying the changes experienced in the correlations between markets returns, as time goes by. However, this approach has the problem that correlations are determined by the influence of short-term shocks, originating in market transactions, as well as by the economic fundamentals that determine the long-term relationship between the markets examined.

One of the ways to deal with this problem is to examine the long-term relationship between the stock markets based on the methodological proposal developed by Engle and Granger (1987), who state that if two series of prices that follow a random walk, have a long-term equilibrium relationship, such series cannot be separated indefinitely one from another. The deviation from its long-term equilibrium relationship must be stationary with an average value equal to zero. If the above is validated, it can be concluded that the two series of prices are cointegrated. The previous concept of cointegration of two price series can be extended to the multivariate case, where if there is a long-term equilibrium relationship between a set of price series that are non-stationary, then there is a cointegration vector of these series that is stationary.

Key words
MILA, financial integration, cointegration.

Palabras clave
MILA, integración Financiera, cointegración.

Palavras chave
MILA, integração financeira, cointegração.

Códigos JEL:
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Considering that there may be benefits and costs related to greater liberalization, opening and integration of stock markets in the world, it is of interest to examine the evolution of a virtual long-term equilibrium relationship between the stock markets of Colombia, Chile, Peru, and Mexico, after the latter was incorporated into the MILA Platform in January 2015, on a horizon that goes beyond the short term.

This article differs, from other previous empirical studies related to cointegration of Latin American stock markets, in that the base of the analysis is focused on assessing the evolution of the possible cointegration between the four already indicated stock markets of the MILA, examining the data in one currency comparable among them, in this case, United States dollars, after the entry of Mexico, in a context where the MILA Platform has had precisely as its fundamental purpose to strengthen greater integration between the participating stock markets.

Undoubtedly, one way of evaluating the results of Mexico incorporation into the MILA Platform is corroborating that this has allowed a greater integration between the participating stock markets, which should be reflected in the presence of a representative cointegration vector of a long-term equilibrium relationship between these markets.

Next, the article continues with the literature review and MILA description and scope, then it follows with the data and methodology, next the results and finally the conclusions are presented.

2. Literature Review

Despite the literature about cointegration is abundant and with mixed results in terms of wether or not there is cointegration among non Latin American stock markets, the literature concentrated in Latin America is scarce. Taking this into consideration, this section presents some recent empirical studies based on Latin America stock market cointegration that were found after a review in diverse databases for the period 2010-2020.

Lahrech and Sylwester (2011) analyze how the stock markets of Argentina, Brazil, Chile and Mexico have become more integrated with the US stock market. Their results show an increase in joint movements between the returns of these Latin American markets with the US, although the magnitude and speed of these vary greatly among the four countries studied.

Lizarzaburu, Burneo, Galindo and Berggrun (2015), in spite of recognizing that they do not study directly the presence of a cointegration vector, they do analyze the effect that the MILA had during the first years of operation on some financial indicators. They conclude that the impacts in terms of profitability, risk and correlation were marginal and the effect on the volume was negative.

Sandoval and Soto (2016) examine the existence of cointegration among the MILA member stock markets, from one year before implementation and up to three years after. The results indicate that one year before and one year after implementation, the markets were not cointegrated. Only in the second

and third year was detected a significant cointegrating vector, showing a long-term equilibrium between the stock indices.

Aragón and Mata (2017) describe the volatility and address the degree of dependence on the returns of the main equity indexes of MILA. The authors find evidence that the degree of dependence between yields is low and that there is segmentation among some members. Chile and Mexico are mostly integrated markets, followed by Peru and Colombia.

Espinosa, Gorigoitía and Vieito (2017) analyze whether MILA has been beneficial for each of its participants. Their results show the creation of MILA increases the levels of correlation between stock returns and MILA has not benefited all countries in the same way due to benefits seem to be concentrated in the short term, however, in the long term these benefits dissipate.

Hardy, Magner, Lavin, Cardenas, and Jara-Bertin (2018) provide evidence on the effects of the MILA agreement, regarding improvements in the efficiency of the stock markets involved. The authors find that the MILA agreement generates partial improvements in the efficiency of these stock markets and also it does favor cointegration.

Fortunato, Martins and De Lamare Bastian-Pinto (2020) analyze the structural dependence between the stock markets of; Brazil, Chile, Colombia, Mexico, Peru and the global stock market return and volatility, the commodity prices, and the US political-economic uncertainty from 1998 to 2017. They show that global stock market return and commodity prices are the most significant influencers on these markets after their global financial market integration occurs and, therefore, they leave the idea that a possible cointegration vector could exist among them.

The literary review presented in this section shows mixed evidence regarding the integration and/or cointegration for the Latin American stock markets. This evidence, which is very similar to those from non Latin American stock markets, serves as motivation to examine the effects of the entry of a new participant to the MILA Platform, in this case Mexico, in a study period of more than four years, with the end to find a possible cointegration relationship between MILA stock markets.

3. Mila Description and Scope

The MILA originates initially after an agreement between the Lima Stock Exchange and the Colombian Stock Exchange then the Santiago Stock Exchange and finally the Mexican Stock Exchange join the Platform, which began operating in January 2015. This Platform was born with the idea of being an equity market, attractive to all types of investors, through which, they can access greater alternatives of financial instruments, improving the risk-return balance through diversification and the possibility of accessing to stock markets with an important presence of issuers positioned in the mining sector (Peru), retail (Chile), energy-financial (Colombia) and construction-financial (Mexico).

However, while the expected benefits may be significant, a greater integration of the stock markets may expose a local stock market to spillover effects originated in another external stock market, which can become negative and persistent for the associated markets, especially when they face periods of financial crisis. This can finally reduce the benefits of international financial diversification for investors in the region.

Next, it is presented the transactions made through the MILA Platform, since the incorporation of Mexico. This covers the period January 2015 to August 2019.

3.1. MILA Transactions

Table 1 shows the total transactions made by the investors of each MILA stock market in the rest of the stock markets, year after year, through the MILA Platform, after the entry of Mexico in 2015. These grew until 2017. However, in 2018 and over the course of 2019 they decreased sharply. This behavior is similar at the level of each member country, but from 2018 began to show a fall, with the exception of Peru. In terms of accumulated volume invested in the rest of the members during the 2015-2019 period, Peru stands out with approximately 130 million, then Chile with 68.3 million, followed by Mexico with 64.2 million and finally Colombia with only 4.7 million USD.

Table 1 - Volume traded through MILA Platform (In USD)

Periodo	*Chile*	*Colombia*	*Mexico*	*Peru*	*Total*
2015	$2.712.468	$35.125	$64.923	$33.361.014	$36.173.530
2016	$13.475.596	$30.154	$18.431.866	$13.982.744	$45.920.360
2017	$30.532.313	$2.752.922	$23.823.068	$6.455.843	$63.564.146
2018	$18.613.348	$1.749.484	$21.892.226	$64.734.198	$106.989.256
January - August 2019	$2.922.062	$118.987	$0	$11.472.982	$14.514.031
Total	$68.255.787	$4.686.672	$64.212.083	$130.006.781	$267.161.323

Note: Table 1 shows the annual volume traded through the MILA Platform (in USD) by the countries involved, from 2015 to 2019 (January-August). Source: Own elaboration based on MILA News reports.-

Regarding the relative participation of the transactions carried out by each country through the MILA Platform, in comparison to the total volume negotiated by each of them, it has been quite low, as shown in **Table 2**. However, the participation of MILA Platform grew from 2015 to 2017. Then, it has decreased with the exception of Peru that grew in 2018 and then fell as of August 2019.

Table 2 - Annual participation of transactions in the MILA Platform with respect to the total transactions of each stock market.

Periodo	*Chile*	*Colombia*	*Mexico*	*Peru*	*Total*
2015	0,012%	0,000%	0,000%	1,756%	0,019%
2016	0,054%	0,001%	0,013%	0,525%	0,027%
2017	0,084%	0,020%	0,019%	0,103%	0,035%
2018	0,032%	0,012%	0,018%	1,908%	0,055%
January - August 2019	0,010%	0,001%	0,000%	0,403%	0,013%

Note: Table 2 shows the percentage of annual participation of transactions in USD through the MILA Platform in relation to the total transactions made for each stock market, since the entry of Mexico. Source: Own elaboration based on MILA News reports.-

3.2. Cross Transacctions

On the other hand, in terms of cross transactions, that is, investments made by investors of a market in companies of the other markets of the MILA Platform, **Table 3** shows the cross transactions made by Chilean investors in Colombia, Mexico and Peru, those made by Colombian investors in Chile, Mexico and Peru, those made by Mexican investors in Chile, Colombia and Peru and finally those made by Peruvian investors in Chile, Colombia and Mexico during the period from 2015 to August 2019.

Table 3 - Cross transactions carried out in MILA Platform

Subperiods	*In*	*Made by Chile*	*Made by Colombia*	*Made by Mexico*	*Made by Peru*	*Total*
January 2015 - December 2015	Chile	$0	$23.440	$59.937	$19.474.142	$19.557.519
	Colombia	$79.007	$0	$0	$13.886.872	$13.965.879
	Mexico	$1.874	$0	$0	$0	$1.874
	Peru	$2.631.587	$11.685	$4.986	$0	$2.648.258
	Total	$2.712.468	$35.125	$64.923	$33.361.014	
January 2016 - December 2016	Chile	$0	$4.947	$10.308.186	$10.004.516	$20.317.649
	Colombia	$10.022.920	$0	$2.520.349	$3.802.915	$16.346.184
	Mexico	$3.066.244	$0	$0	$175.313	$3.241.557
	Peru	$386.432	$25.207	$5.603.331	$0	$6.014.970
	Total	$13.475.596	$30.154	$18.431.866	$13.982.744	
January 2017 - December 2017	Chile	$0	$1.348.964	$18.308.062	$5.128.104	$24.785.130
	Colombia	$10.381.777	$0	$3.890.185	$1.234.931	$15.506.893
	Mexico	$8.367.937	$0	$0	$92.808	$8.460.745
	Peru	$11.782.599	$1.403.958	$1.624.821	$0	$14.811.378
	Total	$30.532.313	$2.752.922	$23.823.068	$6.455.843	

January 2018 - December 2018	Chile	$0	$1.224.060	$20.053.612	$64.394.890	$85.672.562
	Colombia	$4.872.989	$0	$1.141.413	$339.308	$6.353.710
	Mexico	$5.868.997	$0	$0	$0	$5.868.997
	Peru	$7.871.362	$525.424	$697.201	$0	$9.093.987
	Total	$18.613.348	$1.749.484	$21.892.226	$64.734.198	
January 2019 - August 2019	Chile	$0	$28.896	$0	$10.380.920	$10.409.816
	Colombia	$502.346	$0	$0	$1.092.062	$1.594.408
	Mexico	$0	$0	$0	$0	$0
	Peru	$2.419.716	$90.091	$0	$0	$2.509.807
	Total	$2.922.062	$118.987	$0	$11.472.982	
January 2015 - August 2019	Total	$68.255.787	$4.686.672	$64.212.083	$130.006.781	

Note: Table 3 shows the USD cross-transactions carried out in the MILA Platform by Chilean investors in Colombia, Mexico and Peru, by Colombian investors in Chile, Mexico and Peru, by Mexican investors in Chile, Colombia and Peru and finally by Peruvian investors in Chile, Colombia and Mexico from January 2015 to August 2019, this is from the 2015 year of entry of Mexico to the MILA Platform. Source: Own elaboration based on MILA News reports.-

Table 3 shows that Chilean investors in 2015 made stocks purchases of companies from Colombia, Mexico and Peru, through the MILA Platform, worth USD 2,712,468. At the same time, Colombian, Mexican and Peruvian investors made stocks purchases of Chilean companies for a value of USD 19,557,519, thus generating a positive net position of capital inflows to Chile for a value of USD 16,845,051. This can be interpreted as a sign of confidence of the rest of the members of MILA in considering Chile as a relatively more attractive place to make investments, boosting the benefits of international diversification on the demand side and at the same time on the supply side of stocks from Chilean companies, a lower cost of raising capital. Similar situation is that of Colombia in 2015, with a net position of USD 13,930,754. However, Mexico and Peru show the opposite situation in that year. Mexico has a negative net position of USD 63,049 and Peru USD 30,712,756.

On the other hand, considering the period from January 2015 to August 2019, Chile and Colombia have a positive cumulative net position of USD 92,486,889 and USD 49,080,402, respectively. Mexico and Peru have a negative cumulative net position of USD 46,638,910 and USD 94,928.38, respectively. Thus, at the transactional level in the period already indicated, the MILA Platform has favored Chile and Colombia relatively more, on the side of its issuing companies by raising more resources at a lower cost. Then Peru and Mexico follow, on the side of their local investors, when they decide to diversfy their resources internationally through the Platform. Obviously, the above assumes that the four markets are cointegrated, a matter of empirical analysis that will be studied in the following sections of this article.

4. Data and Methodology

4.1. Data

In the development of this article, the daily closing prices (in United States dollars) of the main stock indices of the markets of Chile (SP IPSA), Colombia (COLCAP), Mexico (IPC) and Peru (SP BL25PT) were used, with data observed between January 20, 2015 and August 30, 2019, obtaining a total of 1204 data per country.

Stock index data were obtained from EconomáticaTM database, in USD. In financial econometrics the possible cointegration between the time series examined depends on the non-stationarity of the prices of these series. Given the above, it is convenient in methodological terms to examine first the non-stationarity by applying the unit root test, and then the cointegration test, which will be carried out based on the stock indices of the MILA stock markets.

4.2. Unit Root Test

One way to estimate whether or not a stationary time series Y_t exists is by applying the Augmented Dickey-Fuller test, ADF test. First, the Dickey-Fuller test (1979) is shown to have a global idea of the test, and then the augmented test of these authors is presented.

The Dickey-Fuller test is based on the following equation where the objective is to test the null hypothesis H_0: $\theta = 1$ versus the alternative hypothesis H_1: $\theta < 1$

$$Y_t = \theta Y_{t-1} + e_t \qquad (1)$$

In the practice of time series econometrics, it is customary to use equation [2] instead of [1] to carry out non-stationary tests for a series, where the objective is to test null hypothesis:

H_0: $\rho = 0$.

$$\Delta Y_t = \rho Y_{t-1} + h_t \qquad (2)$$

On the other hand, the ADF test allows, by incorporating in equation [3] p lags of ΔY_t, to control the presence of any dynamic structure in the dependent variable, to ensure that the residuals of equation [3] do not present autocorrelation with each other.

$$\Delta Y_t = \rho Y_{t-1} + \sum^{p}_{i=1} \delta_i \Delta Y_{t-i} + v_t \qquad (3)$$

To determine the statistical significance of the ρ parameter, Dickey-Fuller (1981) develops a set of additional statistical tests with their respective critical values, which are incorporated into the routines of the econometric packages such as EViews™.

According to the above, the null hypothesis of a series with unit root is rejected in favor of a stationary series in case that the value of the statistical test is more negative than the relevant critical value.

A topic of special attention is the amount of lags to consider in equation [3] as well as the incorporation of an intercept, a trend or both. To select the model that best fits the data, in econometric practice, information criteria (for example, Schwarz criterion) are used when executing the models.

4.3. Cointegration Test

In order to test for cointegration Johansen (1988) presents two tests; the Trace test and the Maximum Eigenvalue test, which are incorporated into theEViews™ routines.

Johansen and Juselius (1990), provide the critical values for the two previous tests. If the calculated value of the statistical test is greater than the critical value of the Johansen and Juseliues tables, the null hypothesis that there is a number of r cointegration vectors, it is rejected, in favor of the alternative that there is a number of r + 1 (for λ_{trace}test) or more than r (for λ_{me}test).

In this way, a cointegration analysis will be carried out for the stock indexes described above, for the period from January 20, 2015, when Mexico began operations on the MILA Platform, until August 30, 2019.

For this, it is necessary to analyze whether stationary conditions for each of the series are met, that is, zero mean and constant variance and covariance through unit root tests. The unit root test performed for each price series is based on the augmented Dickey-Fuller test.

Subsequently, a Johansen cointegration test is carried out in order to examine a long-term equilibrium relationship between the stock indices of MILA. To test if there is any linear combination of the series, the Trace test and the MaximumEigenvalue test mentioned above are performed.

The analysis starts with the next four stock markets; Chile, Colombia, Mexico and Peru. If there is no cointegration between them, the subsets of three will be analyzed. In this case the possible groupings are; Chile, Colombia and Mexico; Colombia, Mexico and Peru; Chile, Colombia and Peru; and then Chile, Mexico and Peru. The most parsimonious specification in lags based on the lowest or most negative value for the Schwarz criterion will be selected as the selection criteria for both the stationary test and the Johansen test, respectively. Finally, peer cointegration tests will be performed.

5. Results

The results of the unit root and cointegration tests are presented below. These results are reported from January 20, 2015, date of entry of Mexico to the MILA Platform until August 20, 2019.

In the first instance it must be verified if the conditions of stationarity are met. For this, the unit root tests (ADF test) are performed on the series in natural logarithms of SP IPSA, COLCAP, IPC and SP BL25PT stock indexes, establishing as a null hypothesis that each series is not stationary.

The results are presented in **Table 4**. As an example, in the case of the natural logarithm of the SP IPSA index, the ADF test value is equal to 0.1797 with a p-value of 0.7383. Thus, it is not possible to reject the null hypothesis at any conventional level of statistical significance and therefore the logarithmic series is not stationary. Similarly, for the remaining stock indexes, the same is concluded (with exception of Mexico Ln IPC at 10% level), and thus, each series contains at least one unit root.

Then, the test is carry out with the natural logarithms of the series in first differences, denoted as D(Ln SP IPSA), D(LnColcap), D(Ln IPC) and D(Ln SP BL25PT), respectively, and whose results are also reported in Table 4. For the SP IPSA index, the ADF test value is -26.3170 with a p-value of 0.0000. Thus, the null hypothesis is rejected at 1% level and it can be concluded that the natural logarithm of the series, in differences, it is stationary. Similarly, the same conclusion is obtained for the remaining stock indexes.

Table 4 - Augmented Dickey-Fuller Test and p-values in the period from January 20, 2015 (entry of Mexico to MILA) as of August 30, 2019. Indices in USD

Indices/Test	*Pais*	*ADF Test*	*p-value*
Ln SP IPSA	Chile	0.1797	0.7383
D(Ln SP IPSA)	Chile	-26.317***	0.0000
Ln Colcap	Colombia	-0.9969	0.2863
D(Ln Colcap)	Colombia	-22.6606***	0.0000
Ln IPC	México	-2.6846*	0.0770
D(Ln IPC)	México	-30.5779***	0.0000
Ln SP BL25PT	Perú	0.2265	0.7519
D(Ln SP BL25PT)	Perú	-26.3653***	0.0000

* p < 0.10 (significant at 10%)
** p < 0.05 (significant at 5%)
*** p < 0.01 (significant at 1%)

Table 4 shows the results of the ADF Test for the natural logarithm (Ln) series of SP IPSA, Colcap, IPC and SP BL25PT, together with the results for the series in first differences D(Ln SP IPSA), D(Ln Colcap), D(Ln IPC) and D(Ln SP BL25PT), for the period 01/20/2015 to 30/08/2019. After applying the Johansen test, the best adjustments according to the Schwarz criterion, are those that consider only one lag, omitting the drift and trend, with the exception of the natural logarithm of the Mexican case, which considers one lag and a drift. Source: Own elaboration based on outputs from EViews 9.0.-

Subsequently, on the basis that the series in natural logarithms result integrated of one degree, I(1), it can be verified if there is a cointegration vector between the four representative series of the MILA stock markets. For this, the Johansen cointegration test is performed, in order to examine a long-term equilibrium relationship between these series.

5.1. Period: 01/20/2015 – 08/30/2019

The results of cointegration are presented in **Table 5**. This table shows a summary of Johansen cointegration tests with the number of significant cointegration relationships at the conventional levels of significance, by model. The results of five alternative models are reported from the one that does not include intercept nor trend (second column of **Table 5**) to the last that includes quadratic trend and intercept (sixth column of **Table 5**). No cointegration vector is found that is significant, according to the Trace test or the Maximum Eigenvalue test, respectively, considering a lag interval 1 to 1, interval that yielded the most negative value for the Schwarz criterion. Intervals 1 to 2, 1 to 3 and 1 to 4 were

alternately tested, which resulted in less negative values for the Schwarz criterion and were therefore discarded.

Table 5 - ASummary of Johansen cointegration tests indicating the number of cointegration relationships for each type of test and model used during the period 01/20/2015 to 08/30/2019. The natural logarithm of the Stock Indices is based on USD. Stock markets analyzed; Chile, Colombia, Mexico and Peru

Data Trend:	*None*	*None*	*Lineal*	*Lineal*	*Quadratic*
Type of Test	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	NoTrend	No Trend	Trend	Trend
Trace Test	0	0	0	0	0
Maximum Eigenvalue Test	0	0	0	0	0

* p < 0.105 (significant at 10%)
** p < 0.05 (significant at 5%)
*** p < 0.01 (significant at 1%)
Table 5 shows that there are 1202 observations included for the Ln SP IPSA, Ln Colcap, Ln IPC series and Ln SP BL25PT. Lag Interval: 1 to 1. Source: Own elaboration based on outputs from EViews 9.0.-

Then, given that was not posible to find a significant cointegration relationship for the four markets together, it was tested whether or not there is a relationship when considering groups of three members. The grouping possibilities are:

1. Chile, Colombia and Mexico
2. Colombia, Mexico and Peru
3. Chile, Colombia and Peru
4. Chile, Mexico and Peru

Table 6 reports a summary of the results. Only the first grouping of Chile, Colombia and Mexico shows two significant cointegration relationships at 10%, one at 5% and zero at 1% level, under the model with quadratic trend and intercept (Trace test), considering a lag interval 1 to 1 for the Johansen test. After testing alternative combinations of lags intervals, 1 to 2; 1 to 3 and 1 to 4, the best fitted lag interval, according to Schwarz criterion was the lag 1 to 1. The remaining groupings were not significant at any statistical conventional level.

Table 6 - Summary of Johansen cointegration tests indicating the number of cointegration relationships for each type of test and model used during the period 01/20/2015 to 08/30/2019. The natural logarithm of the Stock Indices is based on USD. Stock markets analyzed; Chile, Colombia and Mexico

Data Trend:	*None*	*None*	*Lineal*	*Lineal*	*Quadratic*
Type of Test	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	NoTrend	No Trend	Trend	Trend
Trace Test	0	0	0	0	2*; 1**; 0***
Maximum Eigenvalue Test	0	0	0	0	0

* p < 0.10 (significant at 10%)
** p < 0.05 (significant at 5%)
*** p < 0.01 (significant at 1%)
Tabla 6 shows 1202 observations were included for the Ln SP IPSA, Ln Colcap, Ln IPC series. Lag Interval: 1 to 1. Source: Own elaboration based on outputs from EViews 9.0.-

Next, the existence of cointegration between the three stock markets, but in pairs, will be analyzed in order to identify which stock markets are cointegrated with each other. Possible combinations are:

1. Chile and Colombia
2. Chile and Mexico
3. Colombia and Mexico

Table 7 reports a summary of Johansen cointegration tests for the three peer combinations of the MILA member stock markets, which includes the number of cointegration relationships for the Trace test and for the Maximum Eigenvalue test, respectively, according to the model used during the period under study. This table reports the lag interval 1 to 1 since under this one it is possible to obtain the most parsimonious estimates with the lowest value for the Schwarz criterion. In the case of Chile-Colombia, a 10% significant cointegration vector was identified, according to the Trace and Maximum Eigenvalue test, respectively, when a quadratic deterministic trend and intercept are incorporated. In addition, a 5% significant cointegration vector is also found under the Trace test. In the case of Chile-Mexico, no significant 5% cointegration vector was found. Finally, in the case of Colombia-Mexico, two significant vectors were found at 10% and 5% level, respectively, under the Trace test and also when a quadratic trend and intercept are incorporated.

Table 7 - Summary of Johansen cointegration tests indicating the number of cointegration relationships for each type of test and model used during the period 01/20/2015 to 08/30/2019. The natural logarithm of the Stock Indices is expressed in USD. Stock markets analyzed in pairs; Chile-Colombia, Chile-Mexico and Colombia-Mexico

Chile- Colombia Series: Ln SP IPSA, Ln Colcap					
Data Trend:	*None*	*None*	*Lineal*	*Lineal*	*Quadratic*
Type of Test	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	NoTrend	No Trend	Trend	Trend
Trace Test	0	0	0	0	1*; 1**, 0***
Maximum Eigenvalue Test	0	0	0	0	1*
Chile- Mexico Series: Ln SP IPSA, Ln IPC					
Data Trend:	*None*	*None*	*Lineal*	*Lineal*	*Quadratic*
Type of Test	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	NoTrend	No Trend	Trend	Trend
Trace Test	0	0	0	0	0
Maximum Eigenvalue Test	0	0	0	0	0
Colombia – Mexico Series: LnColcap, Ln IPC					
Data Trend:	*None*	*None*	*Lineal*	*Lineal*	*Quadratic*
Type of Test	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	NoTrend	No Trend	Trend	Trend
Trace Test	0	0	0	0	2*, 2**, 0***
Maximum Eigenvalue Test	0	0	0	0	0

* p < 0.10 (significant at 10%)
** p < 0.05 (significant at 5%)
*** p < 0.01 (significant at 1%)
Table 7 shows that 1202 observations were included in each series. Lag Interval: 1 to 1. Source: Own elaboration based on outputs from EViews 9.0.-

6. Conclusions

This article analyzes the existence of a significant cointegration vector among the stock markets that form the MILA Platform, from the entry of Mexico on January 20, 2015 to August 30, 2019, with the purpose of examining the existence of a long-term equilibrium relationship between the stock markets of Chile, Colombia, Mexico and Peru.

The results show no evidence of significant cointegration relationship at any conventional statistical level.

However, when carrying out the cointegration tests for clusters of three stock markets, a significant cointegration vector was found in the case of the grouping of Chile, Colombia and Mexico. Similar results were also found when peer comparisons were made, where those from Chile-Colombia and Colombia-Mexico are also significant.

It is observed that the stock markets of Chile, Colombia and Mexico have benefited from the MILA Platform. Colombia and Chile, on the side of the companies issuing shares, which by exhibiting a long-term stationary equilibrium relationship and possessing a positive net position at the level of cross transactions, allows them to raise capital at a lower cost.

On the other hand, Mexico by being cointegrated and possessing a negative net position that would benefit to its investors (demand side) who can take advantage of the benefits of international diversification. However, these benefits do not include the case of the Peruvian stock market, which does not present cointegration with the other members of MILA.

The previous results are linked to the net positions at the transactional level shown by the equity markets that form the MILA platform. Chile and Colombia stand out in this regard by showing positive net positions of approximately 92.49 and 49.08 million USD since Mexico entered the Platform in 2015, which clearly shows the confidence and desire of foreign investors to invest in Chilean and Colombian companies.

Finally, it is concluded that since the entry of Mexico to the MILA Platform, the equity markets of Chile, Colombia and Mexico are cointegrated, where Colombia has a strong influence on the groupings since it is also cointegrated with Chile and Mexico, which does not happen when grouping Chile with Mexico.

Thus, the Colombian stock market has been the most benefited by presenting greater number of cointegration relationships among the participants together with a positive net position at the transactional level on the Platform, which has benefited to its issuing companies relatively more than its local investors when they invest in the rest of the MILA member stock markets. Then, under these same criteria, Chile and Mexico continue while Peru has been the most affected by not presenting cointegration among the members.

This article opens the possibility of future research in the context of MILA. By observing the trend of the volumes traded in cross terms, the respective net positions compared to the total volumes traded in each stock market as the persistence of a long-term equilibrium relationship, it is an issue that should continue to be examined in the future. In addition, the entry of new members to the MILA Platform in the future opens the possibility of studying these stock markets and the effects of their respective entries on the issues already mentioned.

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