ORIGINAL
Research article

Stock market integration in member countries of the Latin American Integrated Market (MILA)[*]

Integración bursátil en los países miembros del Mercado Integrado Latinoamericano (MILA)

Daniel Botero-Guzmán[**]
ORCID: https://orcid.org/0000-0002-6116-3896
Carlos Enrique Vecino-Arenas[***]
ORCID: https://orcid.org/0000-0001-9461-4916
Rafael Antonio Viana-Barceló[****]
ORCID: https://orcid.org/0000-0002-0567-0383
Álvaro Javier Vargas-Villamizar[*****]
ORCID: https://orcid.org/0000-0002-1379-0756

Abstract
The purpose of this paper is to determine the level of global and regional integration of the stock market in the MILA member countries: Colombia, Chile, Peru and Mexico. The Capital Asset Pricing Model (CAPM) is used to estimate an integration measure according to the law

---

[*] Original article. Research and innovation article. Research article. Article linked to the Universidad Autónoma de Bucaramanga, Colombia and the Universidad Industrial de Santander Bucaramanga, Colombia. It is part of the results of the research project: "Level of stock market integration and its determinants in MILA member countries".

[**] Master in Industrial Engineering, Master in Economics and Development, and Economist by the Universidad Industrial de Santander, Colombia. Professor and researcher at the Economics Programme at the Universidad Autónoma de Bucaramanga, Colombia. Email: dbotero400@unab.edu.co

[***] PhD in Management by the University of Montreal, Canada. Industrial Engineer by the Universidad Tecnológica de Pereira, Colombia. Professor and researcher at the School of Industrial and Business Studies at the Universidad Industrial de Santander, Colombia. Email: cvecino@uis.edu.co

[****] PhD in Economic Analysis by the University of Alcalá, Spain. Economist by the Universidad del Magdalena, Colombia. Professor and researcher at the School of Economics and Administration at the Universidad Industrial de Santander, Colombia. Email: ranviana@uis.edu.co

[*****] Master in Economics and Development, and Economist by the Universidad Industrial de Santander, Colombia. Professor and researcher at the Economics Programme at the Universidad Autónoma de Bucaramanga, Colombia. Email: avargas864@unab.edu.co

of one price. The results obtained indicate that only the global integration level of Chile showed a significant increase after the start of operations of the Latin American Integrated Market, while the regional integration levels of Colombia, Chile and Perú improved significantly after the emergence of MILA. This paper contributes to the academic literature on financial integration by estimating a de facto indicator that allows a more detailed analysis of this phenomenon. In addition, empirical evidence is presented on the evolution of the stock market integration of MILA member countries, an integration project that represented a milestone for Latin America but which has been little studied from the perspective presented here.

Keywords: Indicator, Integration, MILA, Stock Market, Regional, Global

Resumen

El objetivo de este estudio es determinar el nivel de integración, mundial y regional, del mercado de valores de los países miembros del MILA: Colombia, Chile, Perú y México. Se emplea el modelo CAPM (*Capital Asset Pricing Model*) para estimar una medida de integración acorde a la ley del precio único. Los resultados obtenidos evidencian que solo el nivel de integración mundial de Chile mostró un aumento significativo luego de que el Mercado Integrado Latinoamericano iniciara sus operaciones, mientras que los niveles de integración regional de Colombia, Chile y Perú mejoraron de manera significativa posterior a la aparición del MILA. Este trabajo contribuye a la literatura académica sobre integración financiera al estimar un indicador de facto que permite un análisis más detallado de este fenómeno. Además, se presenta evidencia empírica sobre la evolución de la integración del mercado accionario de los países miembros del MILA, un proyecto de integración que representó un hito para Latinoamérica pero que ha sido poco estudiado desde la perspectiva aquí planteada.

Palabras Clave: Indicador, Integración, MILA, Mercado Accionario, Regional, Mundial

SUMMARY

INTRODUCTION. – RESOLUTION SCHEME. - I. Research problem. - II. Methodology. - III. Drafting plan. - 1. Financial integration. - 2. Studies on international financial integration. - 3. Studies on MILA - 4. Characterization of the Latin American Integrated Market - IV. Research results. -CONCLUSIONS. - REFERENCES.

Introduction

Financial integration brings important benefits for the countries that participate in it. Among them, it allows them to face external shocks better, makes it possible to finance investment adequately, and diversifies investors' risks (Inter-American Development Bank, 2016). Seeking to capitalize on these benefits, Latin America has bet on financial integration in the last decade. After constant crises in the 1980s and 1990s, most Latin American countries, following the guidelines of the International Monetary Fund's adjustment programs, opened their economies to international financial institutions to attract capital, acquire technical expertise, and protect themselves from instability.

Given the new reality of the region, important initiatives promoting Latin American financial integration have emerged and have gained considerable political support. An outstanding example of this is the case of the Latin American Integrated Market (known in Spanish as MILA). MILA was born as an agreement between the stock exchanges of Colombia, Chile, and Peru, institutions that initiated the process of creating a regional market for trading equities of the three countries in 2009. After two years of hard work, the MILA began operations on May 30, 2011. Then, amid a Pacific Alliance summit in 2014, the Mexican Stock

Exchange joined the agreement. However, despite the importance of this initiative, more research is needed to take it as its main object of study from the perspective of stock market integration.

The purpose of this paper was to contribute to closing this research gap by determining the level of global and regional integration of the Colombian, Chilean, Peruvian, and Mexican stock markets from 2006 to 2018. In other words, we analyzed how the creation of MILA (and the subsequent incorporation of Mexico) modified the trend of stock market integration in the region. For this purpose, a measure of integration proposed by Levine & Zervos (1998) was used based on the pricing approach suggested by Korajczyk (1996) and the use of the CAPM (Sharpe, 1964; Lintner, 1965; Mossin, 1966). This research contributed to the literature by estimating a stock market integration indicator for MILA member countries.

The results may have important implications for the coordination and follow-up carried out by the economic and financial authorities of the countries. They may help consolidate MILA as a driving force for the development of the member countries' stock exchanges and, therefore, for the growth and development of the region's economy.

Resolution Scheme

1. Research problem

What has been the level of stock market integration, globally and regionally, in Chile, Colombia, Peru and Mexico; during the period 2006-2019?

2. Methodology

This research used daily data, adjusted for *splits* and dividends, of the prices of the 20 stocks[1] with the largest market capitalization on a quarterly basis in Chile, Colombia, Peru and Mexico; for a period from January 4, 2006 to March 29, 2019. The data was obtained through Económatica software. These 20 stocks represented on average, on a quarterly basis, 65.89% of the total market capitalization in Chile; 93.35% in Colombia; 78.78% in Peru and 74.89% in Mexico.

The global stock market integration indicator was initially calculated for Chile, Colombia, Peru, and Mexico. This indicator was estimated every quarter for each country, following the approach suggested by Korajczyk (1996), according to which pricing errors estimated from an international asset pricing model can be used to measure market segmentation. The world market is perfectly integrated if all assets are priced at the same systematic risk. The pricing error, given by the intercept in the asset pricing model, must be equal to zero.

The pricing errors used in this paper were generated from the following CAPM specification:

$$R_{it} = \alpha_i + \beta_i R_{wt} + \varepsilon_{it} \qquad [1]$$

Where R_{it} is the excess return of stock i in period t over the return offered by a risk-free asset. This risk-free rate is represented by the return offered by 3-month U.S. Treasury bills.

---

[1] Twenty stocks were chosen taking into account that Colombia is the country with the fewest share issuers and its most representative stock market index, COLCAP, is made up of this number of stocks.

R_{wt} is the excess return of a world market portfolio in period t over the return of the risk-free asset. The return of the world market portfolio is given by the daily return obtained from the *All Coutry World Index* (ACWI) calculated by Morgan Stanley Capital International (MSCI). This series was obtained through the *Bloomberg* platform.

Thus, if stock markets are perfectly integrated, the intercept of a regression from [1] should be zero:

$$\alpha_1 = \alpha_2 = \cdots = \alpha_m = 0 \qquad [2]$$

If this is not the case, the assumption of perfect integration would be denied. Following Levine & Zervos (1998), the quarterly estimate of the absolute value of the intercept generated from [1] was interpreted as a measure of market integration. To determine the indicator of stock market integration on a quarterly basis for each country the absolute value of α_i was averaged for the 20 stocks[2] chosen in each country each quarter. This final value was then multiplied by minus one, with the objective of being positively correlated with integration.

The same procedure described above was followed to calculate the stock market integration indicator at the regional level. The only change was the stock index used to represent the market portfolio; in this case, it was not the ACWI but the Latin America Index, also calculated by Morgan Stanley Capital International and obtained through the Bloomberg platform. It is necessary to highlight two critical estimation problems. The first is that this integration measure is based on the CAPM, and it could be the case that the data reject this model as a good representation of the risk-return ratio. Even so, this integration indicator provides time series estimates of the degree of market integration (Levine & Zervos, 1998).

A second problem with this CAPM-based integration indicator concerns stability. According to Korajczyk (1996), the estimation procedure assumes that the risk-return ratio is stable. Changes involving further integration will induce changes in the price ratio. In the long run (once a new steady state is reached), the higher integration will lead to smaller pricing errors. However, there will be larger pricing errors in the transition to the new steady state. This integration indicator will be biased against further integration.

At the end of the above calculations, we had a quarterly time series of the global stock market integration indicator and a quarterly time series of the regional integration indicator for each country. It represented 53 observations per country and 212 observations among the four countries. With these data, the average global and regional integration level was calculated for the entire study period, pre-MILA period, and post-MILA period for each member country. Mean tests were carried out by country and by type of integration, global or regional, to test whether the creation of MILA had increased the level of integration. The following hypothesis was formally tested:

$$H_0: \mu_a \geq \mu_d$$
$$H_1: \mu_a < \mu_d \qquad [3]$$

Where μ_a represented the average of the integration indicator (global or regional) pre-MILA, and μ_d represented the average of the integration indicator (global or regional) post-MILA.

---

[2] For each stock the regression specified in [1] was advanced. For each regression, the *Breusch* Pagan test was performed to detect heteroscedasticity, the *Breusch Godfrey* test to diagnose autocorrelation and the *Dickey-Fuller test* to check the stationarity of the errors and ensure a non-spurious relationship. Detailed results are not incorporated in the paper due to space constraints.

3. Drafting plan

3.1 Financial integration

Different measures of financial integration can be grouped into three broad categories: de jure, de facto, and hybrid indicators, the latter being a combination of the two previous ones (Quinn, Schindler & Toyoda, 2011). The de jure indicators reflect the legal and regulatory conditions a given country imposes to allow integration with the rest of the world. In contrast, the de facto indicators are calculated based on the actual level of financial connection.

There are also various definitions of financial integration. According to Eyraud, Singh & Sutton (2017), financial integration is the process by which financial markets in two or more countries or regions achieve greater connectedness. This process can take many forms, including cross-border capital flows, foreign participation in domestic markets, exchanging information and practices among financial institutions, or unifying market infrastructures. Integration can have a regional or global dimension, depending on whether a country's financial market is more closely related to neighboring countries or global financial centers. Integration can be achieved by facilitating the operation of domestic financial institutions abroad and international institutions within the country or through formal agreements between countries.

For Baele, Ferrando, Hördahl, Krylova & Monnet (2004), the market for a given set of financial instruments and/or services is fully integrated when all potential participants have the following characteristics: 1) they face a single set of rules when deciding to trade in the financial instrument and/or service, 2) they have the same access to the financial instrument and/or service and 3) they are treated when participating in the market.

Adam, Jappelli, Menichini, Padula & Pagano (2002) state that financial markets are integrated when the law of one price is fulfilled, which establishes that if two assets have the same level of risk and profitability, they should have a single price, regardless of where they are traded. If the law of one price is not complied with, arbitrage opportunities will arise. However, if there is free mobility of capital, any investor can exploit arbitrage opportunities, which will disappear, restoring the validity of the law of one price.

It tests the law of one price in financial markets; it is convenient to use an asset pricing model that allows us to know which risk factors are important for investors. The most widely used asset pricing model is the CAPM. It is based on the mean-variance approach of Markowitz (1952), which states that investors can earn a higher expected return by taking on additional risk if they do so in a diversified manner along the capital market line. In this sense, there are two prices in the market: i) the price of time or the risk-free rate and ii) the price of risk, i.e., the expected return generated by taking an additional unit of risk. The risk-free rate is tied to the presence of risk-free assets, whose variance is zero, by guaranteeing a fixed return over time.

The CAPM considers that investors can reduce much of the risk through diversification so that only the systematic risk, which cannot be eliminated, is present. Thus, to estimate an asset's expected return, only the systematic risk, which is the one that the market compensates for, should be taken into account.

The CAPM then posits that the expected return on a stock is a linear function of the beta coefficient, a measure of systematic risk that captures the covariance between the stock and the market. There are studies where the CAPM has been attempted to validate at the global level (Harvey, 1991; Harvey, 2000; Ferson & Harvey, 1993), assuming that global capital markets

are perfectly integrated. In this context, systematic risk is given by the covariance between the return of a country's market portfolio and the return of a world market portfolio.

3.2 Studies on international financial integration

Several studies have attempted to establish the level of integration of stock markets in different countries worldwide. Hooy & Goh (2008) start from the pricing approach suggested by Korajczyk (1996) and use the stock market integration index proposed by Levine & Zervos (1998). Based on a sample of 26 countries belonging to five different trading blocs, they conclude that the integration process has been negatively affected by three major events: The Asian financial crisis in 1997, the global recession in 2001, and the oil price hike 2004.

Wang & Moore (2008) set out to explore the dynamics of co-movements, as represented by the time-varying conditional correlation coefficient, of the Hungarian, Polish, and Czech stock markets with the Eurozone during the period 1994-2006; they make use of a DCC-GARCH (Dynamic Conditional Correlation Generalized Autoregressive Conditional Heteroscedasticity) model to identify statistically significant correlation estimators that can account for the integration of the markets of the three countries with those of the Eurozone. They conclude that significant dynamic correlations exist between these emerging markets and the Eurozone markets. The level of linkage increases after the entry of these countries into the European Union. Chambet & Gibson (2008) estimate the level of financial integration using a multivariate GARCH (Generalized Autoregressive Conditional Heteroscedasticity) model from the weekly returns of 25 countries from 1995 to 2004. They find that emerging markets still need to be more segmented and that the crisis of the 1990s diminished the degree of integration.

For Pukthuanthong & Roll (2009), correlations between stock market indexes can be a poor way of establishing integration because multiple variables affect returns, such as global macroeconomic factors or factors associated with the industry, which can cause imperfect correlation even when markets can be perfectly integrated. For these authors, perfect integration implies that the same international factors explain 100.00% of the returns in both countries, which is why they propose a new measure of integration based on a multifactor model that they use to investigate recent global integration trends.

Their measure is an adjusted coefficient of determination, which they empirically validated using data from 81 countries from 1973 to 2006. They conclude that there is strong evidence of the growth of integration in most countries and that in some of them, this process has been faster, as in the case of the members of the European Community or South Korea. At the same time, some countries have gone in the opposite direction, i.e., their integration has decreased, such as Bangladesh, Nigeria, Pakistan, Sri Lanka, and Zimbabwe.

Büttner & Hayo (2011) analyze the determinants of stock market integration among European Union member countries from 1999-2007. They apply a DCC-MGARCH (Diynamic Conditional Conditional Correlation Multivariate Generalized Autoregressive Conditional Heteroscedasticity) model to obtain the conditional dynamic correlations between markets (which they use as an indicator of the level of integration). The authors find a significant trend of increasing integration. Alotaibi & Mishra (2017) developed an international integration index for the stock markets of six countries, part of the Cooperation Council for the Arab States of the Gulf, from 2002 to 2013. They employ an international asset pricing model and the DCC-GARCH methodology. Their objective is to examine the level of integration of the stock market regionally and internationally and then to explain the determinants using a linear dynamic panel

estimation technique proposed by Arellano-Bond (1991). Among its conclusions are that none of the countries that took part in the study is segmented; trade openness, market capitalization, and business volume have a significant and positive impact, while inflation and the global financial crisis have a significant and negative impact on the integration index.

3.3.Studies on MILA

Several research papers have focused on studying the Latin American Integrated Market (MILA). Romero, Ramirez & Guzman (2013) analyzed the common factors of the Chilean, Colombian, and Peruvian stock markets to establish whether financial integration influences the returns that investors achieve by diversifying. Over some time from January 2009 to June 2012, using the daily returns of the 15 most traded stocks in each country, a strong correlation was observed between the asset values of these nations, which is evidence that financial integration diminishes the benefits of diversification.

On the other hand, Uribe & Mosquera (2014) explored the effect of the entry into force of MILA in terms of portfolio efficiency. To do so, they constructed a Sharpe ratio with daily data of the stock indexes of the three countries. The main result of the research is that the agreement has yet to generate a structural transformation in any of the three countries; this may be because the Latin American Integrated Market, at that time, was still an incipient market with low transaction volumes.

Bolaños, Burneo, Galindo & Berggren (2015) set out to determine how MILA impacted its founding countries' main stock market indicators. They used several measures such as annual return, standard deviation, correlation coefficient, and volume traded from November 2008 to August 2013 to achieve their objective. The authors found that the impact of MILA, in terms of profitability, risk, and correlation, has been marginal and negative on volume. Another result of the study is the existence of barriers to the perfect integration of the markets, such as the particularities in the tax systems of each country.

Ortegón & Torres (2016) constructed a state of the art with the research conducted on MILA. They took into account journal articles published after 2010 in specialized databases. They used nine articles to construct this state of the art. Mathematical models, comparisons of benefits and difficulties, correlation analysis, Sharpe ratios, and Johansen's test were constructed. In turn, these articles point out MILA's main advantages are greater availability of options for listed companies, greater value creation, and a greater division of labor. On the other hand, the main disadvantages identified are transaction costs, exchange rate risk, and lack of homogeneity in accounting information. Finally, they indicate that it is hoped that future studies will include Mexico since all the studies that were part of this work exclude it and that the impacts and correlation of MILA with other integration initiatives can be considered.

Although several studies have taken the Latin American Integrated Market as an object of study, they have not attempted to estimate a de facto stock market integration indicator that would make it possible to verify whether its creation has effectively contributed to a greater degree of stock market integration at a global and regional level or whether it is necessary to reorient what has been done so far. All the studies cited assume that there should be a change in stock market integration, at least as a starting point, with the implementation of this agreement and try to find its influence on other variables, such as profitability, risk, efficiency, and correlation between assets, among others. However, they need to focus on checking whether the effective integration level has changed.

3.4. Characterization of the Latin American Integrated Market (MILA)

The MILA results from an agreement signed between four stock exchanges: the Colombian Stock Exchange, the Santiago Stock Exchange, the Lima Stock Exchange, and, later, the Mexican Stock Exchange. Its objective is to promote the development of local stock markets and contribute to integrating the stock market among its participants, achieving greater competitiveness for them (Sandoval, Vásquez & Sabat, 2015). The agreement does not imply a total corporate or operational unification of the stock exchanges and, at the moment, only covers the equity markets. It is an integration project that seeks to give greater depth to the stock market of the member countries.

The following describes some indicators that allow us to contextualize its evolution and current state. The information reported in the monthly reports, known as MILA News, published on the Latin American Integrated Market website, is used. Figures 1, 2, 3, 4, and 5 show numbers corresponding to December of each year. The market capitalization of MILA went from USD 599,271 million in December 2011 (the year of its implementation) to USD 889,000 million in March 2019. Given the December 2014 entry into the Mexican market, the increase seems logical. Figure 1 shows the evolution of market capitalization from 2011 to 2018 so that comparisons can be made, on the one hand, between the years prior to 2014 (where there were three member countries) and on the other hand, from 2014 onwards (where there are now 4 countries that currently make up the MILA).

It is also possible to appreciate the percentage growth of market capitalization, which started falling in December 2013 (-18.62% concerning December of the previous year), had its highest growth in 2014 (64.11%) to fall sharply in 2015 (-21.95%). From there, it grew consecutively (2.46% in 2016 and 18.1% in 2017), falling again in 2018 (-10.72%).

Figure 2 shows each market's share in the MILA's total market capitalization. Before Mexico's entry, Chile's average share was 43.83%, Colombia's 35.81% and Peru's 20.36%. From 2014 onwards, the average share of each country became 26.67% for Chile, 13.29% for Colombia, 12.58% for Peru and 47.46% for Mexico. These data not only show a loss of participation by Colombia, Chile, and Peru but also reveal a loss of relative importance of Colombia to Peru and Chile.

Daniel Botero-Guzmán, Carlos Enrique Vecino-Arenas, Rafael Antonio Viana-Barceló &
lvaro Javier Vargas-Villamizar

Figure 1. *MILA market capitalization and growth rate*
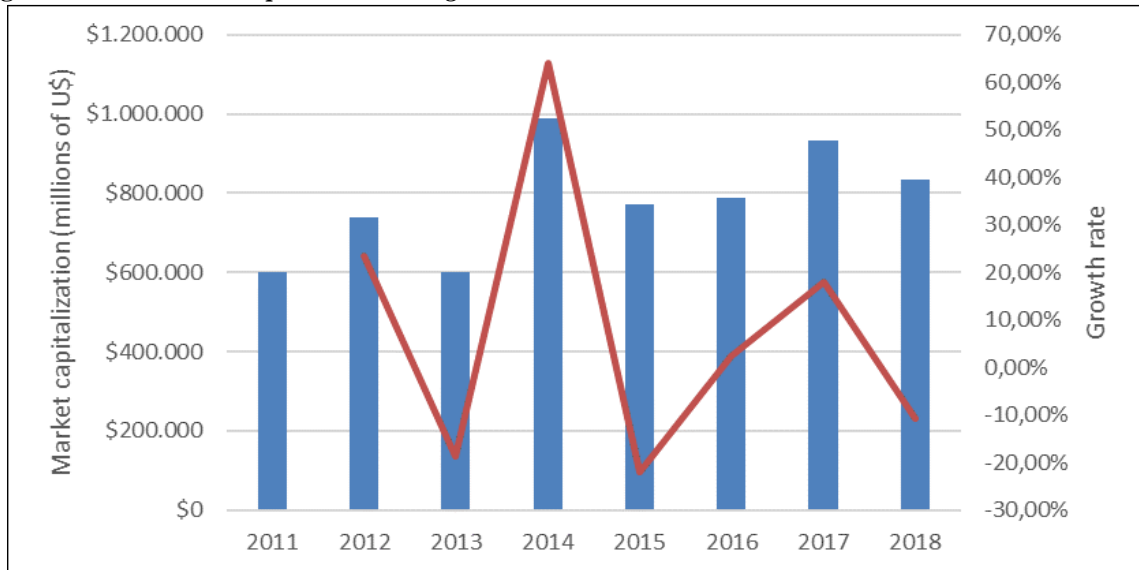
Source: Prepared by the authors based on MILA NEWS reports.

Figure 2. *Share by country in MILA market capitalization*

Source: Prepared by the authors based on MILA NEWS reports.

The total traded volume increased from USD 6,330 million in december 2012 to USD 13,139 million in March 2019. Figure 3 shows the evolution of the total traded volume from 2012 to 2018. In 2014, the highest traded volume was probably triggered by the entry of Mexico and the enthusiasm that this situation may have generated in investors, which would later moderate. The growth rate of the total volume traded is also observed; the highest growth occurred again in 2014 (125.47%), then there was a strong contraction in 2015 (-30.45%), and subsequently, there was again a growth of 3.60% in 2016, 8.22% in 2017 and only 1.87% in 2018.

Figure 3. *MILA total traded volume and its growth rate*
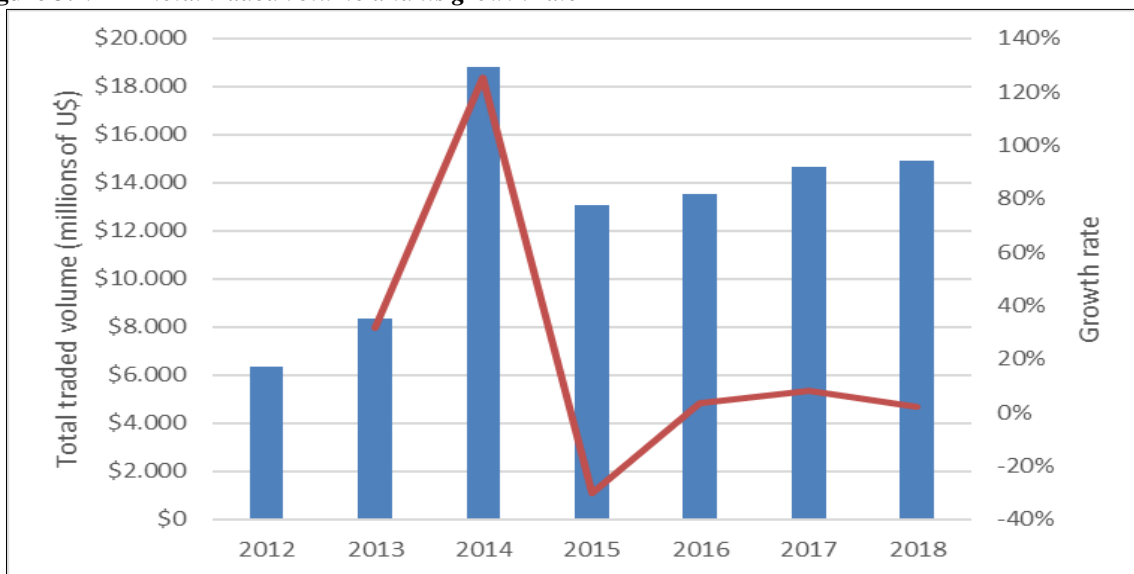
Source: Prepared by the authors based on MILA NEWS reports.

Figure 4 shows the share of each member country in the total volume traded. Before 2014, Chile's average share was 61.50%, Colombia's 22.73% and Peru's 15.77%. After Mexico's entry, the average share became 21.96% for Chile, 7.40% for Colombia, 2.18% for Peru and 68.46% for Mexico.

Figure 4. *Share by country in MILA total traded volume*
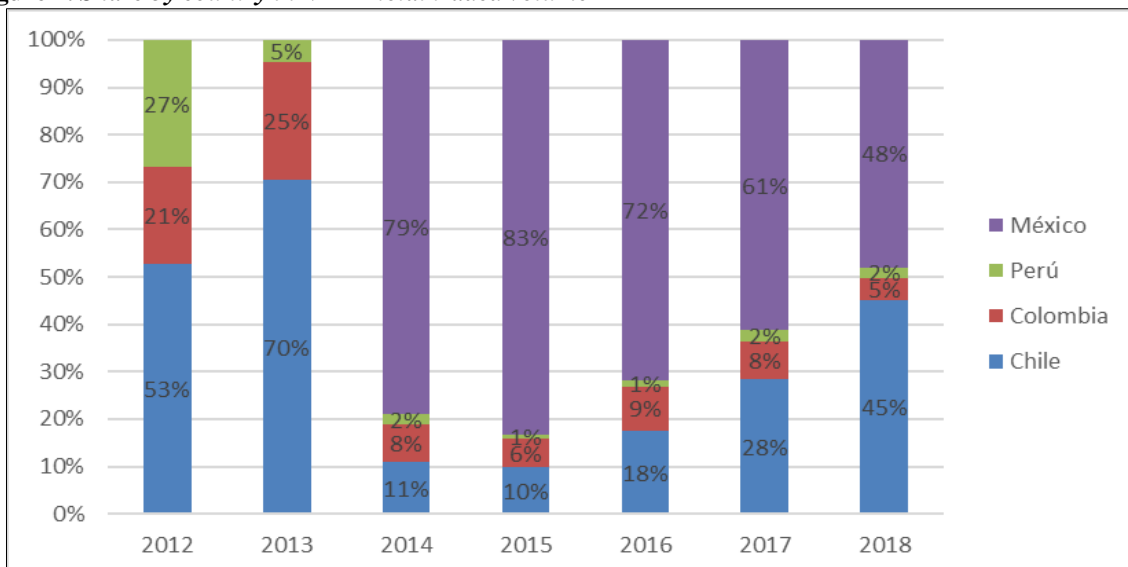
Source: Prepared by the authors based on MILA NEWS reports.

Figure 5 shows the evolution of the number of share issuers in each MILA member country. At the end of 2011, the Latin American Integrated Market had 546 companies; there was a significant increase with the entry of Mexico in 2014, and from then on, there has been a slight downward trend. Peru is the market with the most companies, followed by Chile, Mexico, and Colombia.

Figure 5. *Number of Share Issuers in MILA Member Countries*
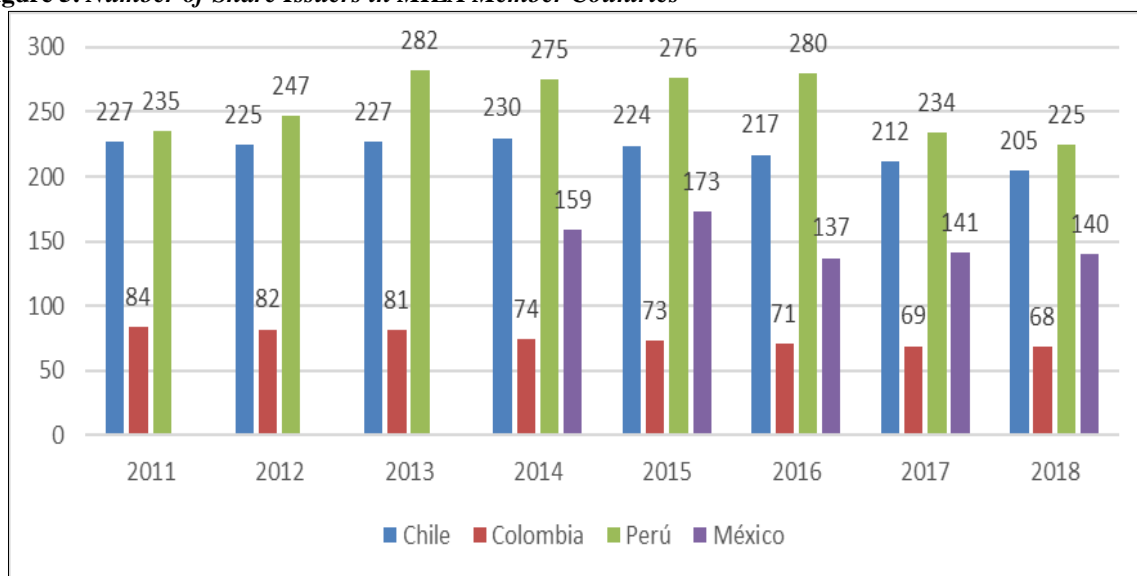
Source: Prepared by the authors based on MILA NEWS reports.

Finally, figure 6 shows the historical performance of some stock indexes created by Standard & Poor's rating agency. One of the oldest is the S&P MILA Andean 40, launched on August 28, 2011, and is designed to measure the performance of the 40 largest and most liquid stocks in Chile, Colombia, and Peru. Then, on July 7, 2014, three more indices were launched: the S&P MILA Alliance Composite, the S&P MILA Pacific Alliance Completion, and the S&P MILA Pacific Alliance Select. The first is designed to serve as a broad benchmark for the Pacific Alliance region. The second measures the performance of companies with small market capitalization, and the latter measures the returns of the largest and most liquid companies in Chile, Colombia, Peru, and Mexico.

Figure 6. *Historical performance MILA stock indexes 2011-2019.*
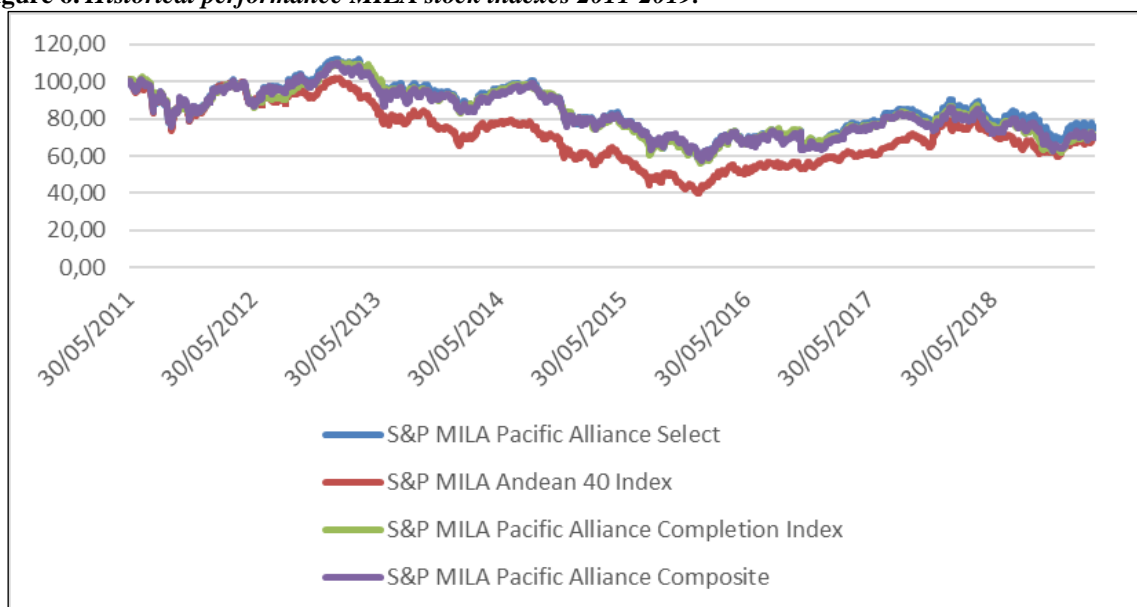
Source: Prepared by the authors based on S&P Dow Jones Indices.

The correlation matrix, calculated for the daily data of these four indices from May 30, 2011, to March 29, 2019, indicates a strong positive relationship between all indices with correlation coefficients above 0.89. These indices show several trend changes since the inception of MILA. From the time this integration initiative was launched until the last quarter of the same year, there was a downward trend. Then, there is an upward trend until late 2012 or early 2013; performance falls again until early 2016. From there, there is a slow but sustained recovery until early 2018, and then a downward behavior is seen until the end of 2018, which begins to reverse during the first quarter of 2019.

4. Research results

Table 1 shows the results of the estimated average global and regional integration indicator for the entire study period, pre-MILA period, and post-MILA period for Chile, Colombia, Mexico, and Peru. Reviewing the results pre-MILA, it is clear that Mexico had the highest average global and regional integration. In the post-MILA period, Chile had the highest global and regional average. Now, when we compare the average integration index in the pre-MILA period with the post-MILA period, we can see a higher level of integration, both global and regional, in all countries.

Table 1. *Descriptive statistics Estimated integration indicator*

Pre-MILA

	CHILE		COLOMBIA		PERU		MEXICO	
	Global	*Regional*	*Global*	*Regional*	*Global*	*Regional*	*Global*	*Regional*
Mean	-0.3133	-0.2788	-0.2940	-0.3004	-0.4019	-0.3995	-0.2176	-0.2183
Standard error	0.0384	0.0278	0.0257	0.0300	0.0328	0.0331	0.0130	0.0117
Median	-0.2730	-0.2502	-0.2769	-0.2350	-0.3729	-0.3774	-0.1972	-0.2051
Deviation	0.1802	0.1306	0.1205	0.1406	0.1537	0.1554	0.0780	0.0700
Range	0.5818	0.3936	0.4255	0.4838	0.5422	0.5297	0.2833	0.3103
Minimum	-0.6904	-0.5030	-0.5515	-0.6070	-0.7077	-0.6939	-0.3921	-0.4000
Maximum	-0.1086	-0.1095	-0.1260	-0.1232	-0.1656	-0.1642	-0.1088	-0.0897
Observations	22	22	22	22	22	22	36	36

Post-MILA

	CHILE		COLOMBIA		PERU		MEXICO	
	Global	*Regional*	*Global*	*Regional*	*Global*	*Regional*	*Global*	*Regional*
Mean	-0.1695	-0.1580	-0.2920	-0.2799	-0.2776	-0.2874	-0.1951	-0.1999
Standard error	0.0125	0.0120	0.0517	0.0450	0.0226	0.0209	0.0136	0.0123
Median	-0.1440	-0.1381	-0.1878	-0.1871	-0.2488	-0.2615	-0.1714	-0.1800
Deviation	0.0697	0.0666	0.2877	0.2505	0.1261	0.1164	0.0562	0.0509
Range	0.2622	0.2258	1.0217	0.8952	0.5442	0.4369	0.1943	0.1683
Minimum	-0.3407	-0.3062	-1.0776	-0.9546	-0.6739	-0.5801	-0.3219	-0.2950
Maximum	-0.0786	-0.0804	-0.0559	-0.0594	-0.1296	-0.1433	-0.1276	-0.1267
Observations	31	31	31	31	31	31	17	17

Entire period

	CHILE		COLOMBIA		PERU		MEXICO	
	Global	*Regional*	*Global*	*Regional*	*Global*	*Regional*	*Global*	*Regional*
Mean	-0.2292	-0.2081	-0.2928	-0.2884	-0.3292	-0.3339	-0.2104	-0.2124
Standard error	0.0199	0.0157	0.0318	0.0289	0.0206	0.0197	0.0099	0.0089
Median	-0.1837	-0.1633	-0.2299	-0.2126	-0.3069	-0.3059	-0.1948	-0.1978

Deviation	0.1450	0.1143	0.2316	0.2105	0.1501	0.1438	0.0720	0.0646
Range	0.6118	0.4226	1.0217	0.8952	0.5781	0.5506	0.2833	0.3103
Minimum	-0.6904	-0.5030	-1.0776	-0.9546	-0.7077	-0.6939	-0.3921	-0.4000
Maximum	-0.0786	-0.0804	-0.0559	-0.0594	-0.1296	-0.1433	-0.1088	-0.0897
Observations	53	53	53	53	53	53	53	53

Source: Prepared by the authors

To check whether these differences are statistically significant, table 2 shows the results of comparing means by country and type of integration. Assuming a significance level of 5.00%, Chile and Peru show a significant increase in stock market integration with the world and regional markets after the creation of the Latin American Integrated Market. Colombia and Mexico do not show a statistically significant change in their levels of integration (neither global nor regional). These results maintain the study's conclusions by Arouri, Jawadi & Nguyen (2008), who point out that the connection of Latin American countries with the world stock market is relatively low. Within the MILA member countries, there are only positive and significant changes in this regard for Chile and Peru.

Table 2. *Means difference test global and regional integration, pre and post MILA.*

	Chile	Colombia	Peru	Mexico
Global Integration Means difference test				
T Statistic	-3.56102291	-0.03427402	-3.12344463	-1.19795857
P(T<=t) one tail	0.00075726	0.48640863	0.00165923	0.11882498
Critical value t (one-tailed)	1.70814076	1.6810707	1.68385101	1.68195236
Regional Integration Means difference test				
Statistic t	-3.98831652	-0.37972985	-2.86256636	-1.08461812
P(T<=t) one tail	0.00020648	0.35289342	0.00343953	0.14213884
Critical value t (one-tailed)	1.69912703	1.67655089	1.68709362	1.68195236

Source: Prepared by the authors

Figures 7-10 show the evolution of the global stock market integration indicator for each MILA member country. These figures provide valuable information on the trend of integration with the world market for the pre-MILA period (blue line) and post-MILA period (red line). The black line represents the MILA creation. In the case of Chile (figure 7), there is an upward trend in the level of global integration before it enters into MILA. This trend disappears after the creation of the Latin American Integrated Market, and the level becomes approximately constant.
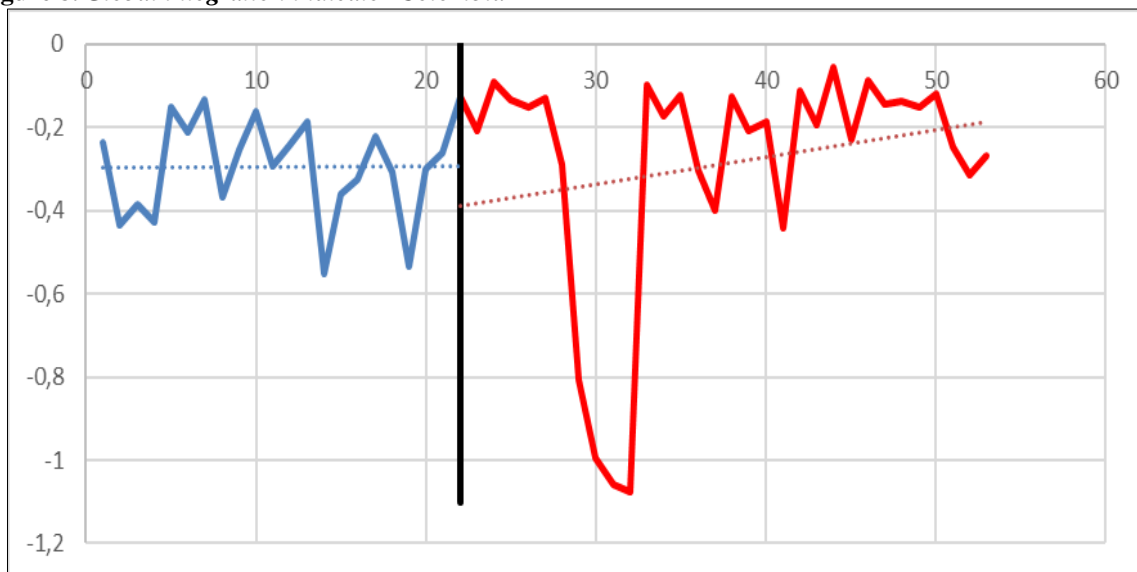
Figure 7. *Global integration indicator Chile*
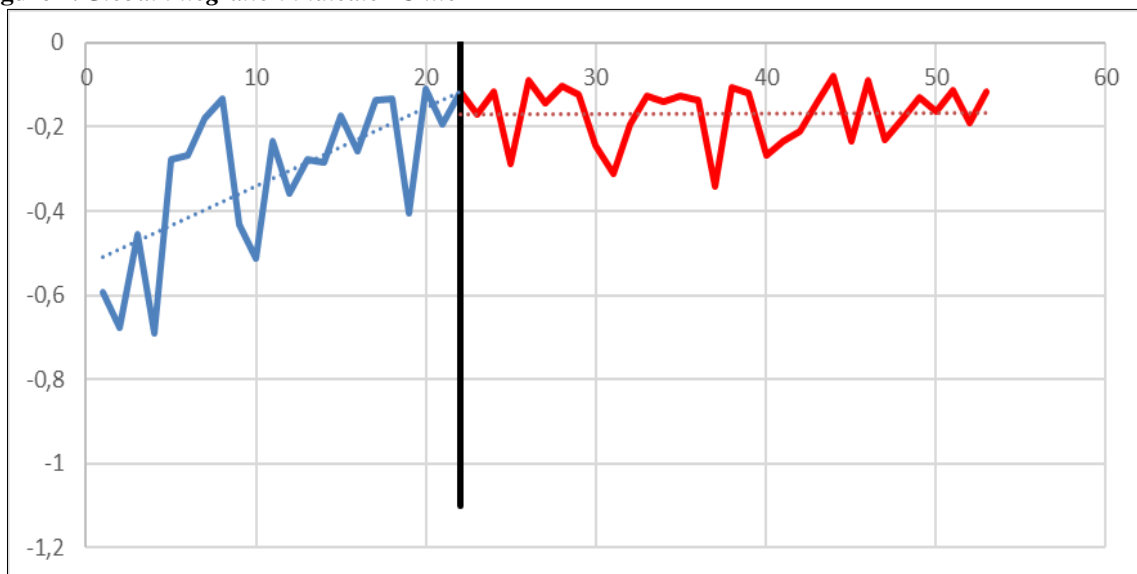
Source: Prepared by the authors

Colombia (figure 8) showed a constant level of integration prior to the creation of MILA. After this initiative came into operation, a change implies an upward trend in the level of connection with the world market.

Figure 8. *Global integration indicator Colombia*

Source: Prepared by the authors

The evolution of Peru's global stock market integration (figure 9) in the study period before the birth of the MILA shows an upward trend. After the formal start of transactions in the Integrated Market, a change towards a slight downward trend can be seen.
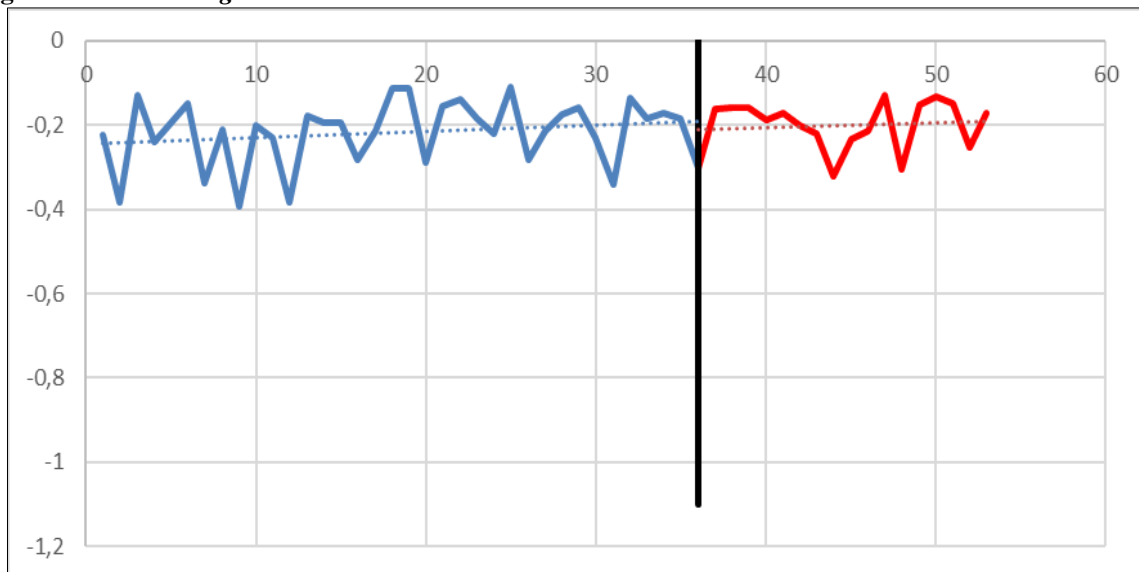
Figure 9. *Global integration indicator Peru*
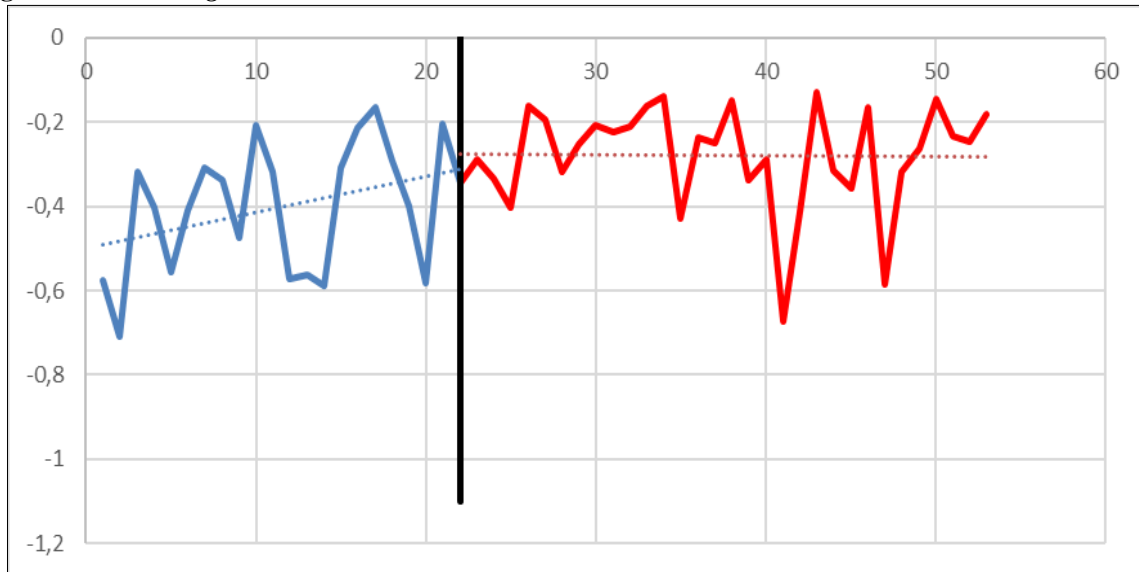
Source: Prepared by the authors

Figure 10 does not show a change in the trend in the level of global integration for Mexico after it entered the MILA. Its level of stock market integration has remained practically constant throughout the entire study period.
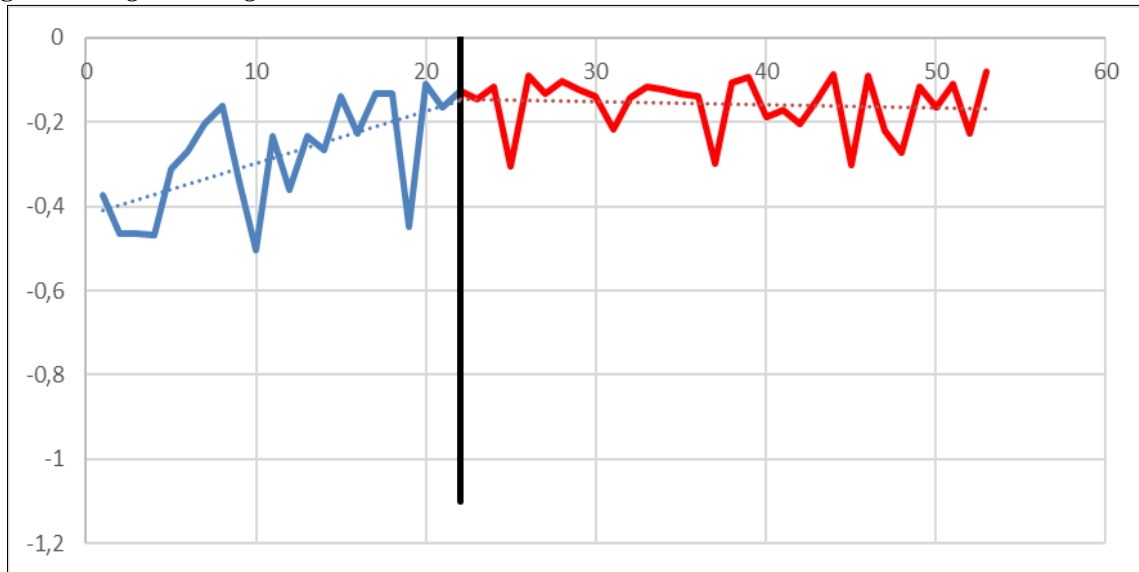
Figure 10. *Global integration indicator Mexico*

Source: Prepared by the authors

Figures 11-14 show the evolution of the regional stock market integration indicator for each MILA member country. These figures provide valuable information on the trend of integration with the regional market for the pre-MILA period (blue line) and post-MILA period (red line). The black line represents the MILA creation. Chile (figure 11) showed an upward trend in its integration with the region, but after it entered into MILA, this has turned slightly downward.
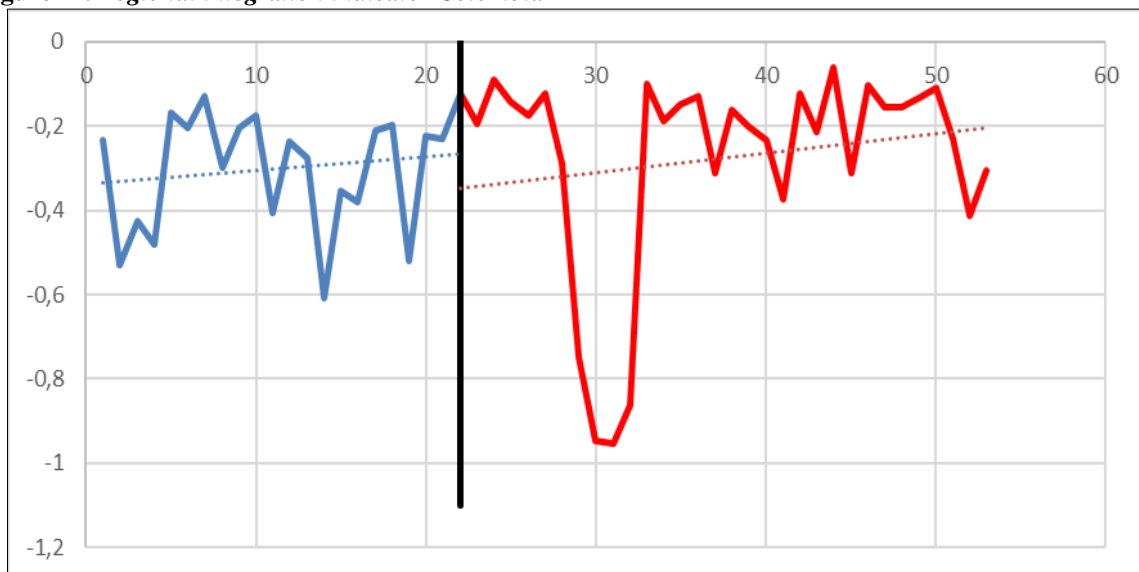
Figure 11. *Regional integration indicator Chile*

Source: Prepared by the authors

In Colombia (figure 12), there is a more marked upward trend after the creation of MILA than before the entry into force of this integration agreement.

**Figure 12.** *Regional integration indicator Colombia*

Source: Prepared by the authors

Peru (figure 13) showed an upward trend prior to MILA. After the beginning of transactions in the Latin American Integrated Market, this trend disappeared, and a level of integration was established that has remained practically constant.

16

Figure 13. *Regional integration indicator Peru*
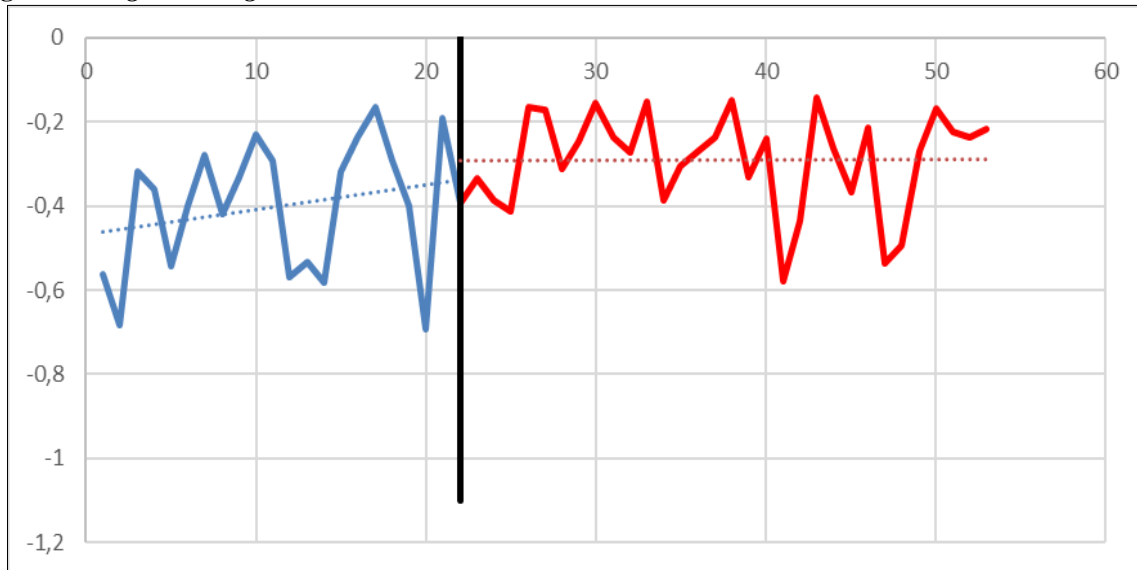
Source: Prepared by the authors

Finally, Mexico (figure 14) showed a slight trend toward a higher level of integration with the region before it participated in MILA. However, after its formal entry into the Integrated Market, the level of integration has become constant during this period.

Figure 14. *Regional integration indicator Mexico*
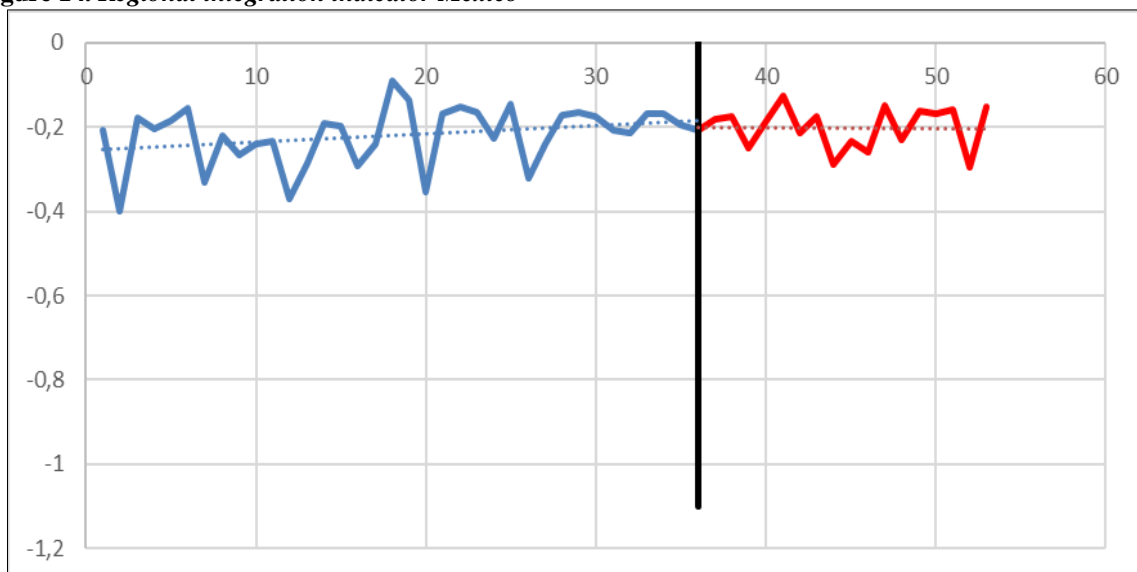
Source: Prepared by the authors

These findings confirm what Bekaert & Harvey (1995) pointed out about the complexity, delay, and possible setbacks in the integration process and prevent reaching the same conclusions as Carrieri, Errunza & Hogan (2007) and Jong & Roon (2005), who indicated that, although there are substantial differences in the degree of integration, there is evidence of a significant increase in the degree of integration of emerging countries.

It should be noted that the results of this study are limited in that only graphical analysis and some basic statistical tests, which do not imply causality, have been used to determine the

impact of MILA on integration levels. The results obtained would only partially explain this. Future research should be oriented to determine and validate which economic and financial variables are significant in explaining stock market integration. It should also compare the evolution of the integration trend, global and regional, of MILA member countries with that of other Latin American countries that are not part of this initiative.

Conclusions

Stock market integration contributes to the development of participating stock markets by providing companies and investors with greater opportunities for asset trading, hedging, and risk diversification. A larger market attracts foreign investors, increasing transaction volume and generating greater liquidity. This research contributes to the literature by estimating a de facto stock market integration indicator, globally and regionally, for MILA member countries over a period from 2006 to 2019.

MILA has been a milestone for the region. It stands out for its figures regarding the number of issuers, market capitalization, and total traded volume and for giving visibility to markets that were previously almost imperceptible to international investors. However, at the country level, there are still important challenges to overcome. Only Chile and Peru show a significant increase in stock market integration with the global and regional markets after the creation of MILA. In contrast, Colombia and Mexico do not show a statistically significant change in their levels of integration.

Additionally, when observing the integration trends of the member countries, there is no similar dynamic. However, they differ widely, which implies recognizing that the integration process of each country is different and unique and associated with a wide set of variables (Botero & Díaz, 2017). In other words, while MILA has served as an important impetus within the stock market integration process, the acceleration of this process may imply financial, monetary, and fiscal reforms that minimize risks and maximize the benefits of integration. In this sense, the coordination, follow-up, and commitment of the economic and financial authorities of the member countries will be fundamental.

References

Adam, K., Jappelli, T., Menichini, A., Padula, M., & Pagano, M. (2002). *Analyse, compare, and apply alternative indicators and monitoring methodologies to measure the evolution of capital market integration in the European Union. Report to the European Commission.* https://www.vwl.uni-mannheim.de/media/Lehrstuehle/vwl/Adam/eu_commission_report_jan_2002.pdf

Alotaibi, A., & Mishra, A. (2017). Time Varying International Financial Integration For Gcc Stock Markets. *The Quaterly Review Of Economics And Finance,* 63, 66-78. https://doi.org/10.1016/j.qref.2016.03.001

Arellano, M., & Bond, S. (1991).. *The Review* Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Of Economics Studies*, 58(2), 277-297. https://doi.org/10.2307/2297968

Arouri, M., Jawadi, F., & Nguyen, D. (2008). International Stock Returns Linkages: Evidence From Latin America Markets. *European Journal Of Economics, Finance And Administrative Sciences,* 11(11), 57-65. https://www.researchgate.net/profile/Arouri-Mohamed/publication/228454326_International_Stock_Return_Linkages_Evidence_from_Latin_American_Markets/links/0f31753c3a81479f1e000000/International-Stock-Return-Linkages-Evidence-from-Latin-American-Markets.pdf

Baele, L., Ferrando, A., Hördahl, P., Krylova, E., & Monnet, C. (2004). *Measuring financial integration in the euro area*. Occasional Paper Series, No. 14. European Central Bank. https://www.ecb.europa.eu/pub/pdf/scpops/ecbocp14.pdf

Banco Interamericano De Desarrollo. (2016). *Integración financiera en mérica latina: realidades, desafíos y propuestas estratégicas. Documento de la serie: "en ruta hacia la integración". Sector de instituciones para el desarollo. División de mercados de capital e instituciones financieras*. Documento Para Discusión No. Idb-Dp-434. https://publications.iadb.org/publications/spanish/document/Documento-de-la-serie-En-Ruta-hacia-la-Integraci%C3%B3n-Integraci%C3%B3n-financiera-en-Am%C3%A9rica-Latina-realidades-desaf%C3%ADos-y-propuestas-estrat%C3%A9gicas.pdf

Bekaert, G., & Harvey, C. (1995). Time-Varying World Market Integration. *The Journal Of Finance*, 50(2), 403-444. https://doi.org/10.1111/j.1540-6261.1995.tb04790.x

Bolaños, E., Burneo, K., Galindo, H., & Berggrun, L. (2015). emerging Markets Integration in Latin America (MILA) Stock Market Indicators: Chile, Colombia And Perú. *Journal Of Economics, Finance And Administrative Science,* 20(39), 74-83. https://doi.org/10.1016/j.jefas.2015.08.002

Botero, D., & Díaz, J. (2017). Análisis de la relación rentabilidad riesgo en el mercado accionario internacional para un mundo parcialmente integrado. *Ensayos de Economía*, 27(51), 109- 124. https://doi.org/10.15446/ede.v27n51.69070

Büttner, D., & Hayo, B. (2011). Determinants of european stock market integration. *Economic Systems*, 35(4), 574-585. https://doi.org/10.1016/j.ecosys.2010.10.004

Carrieri, F., Errunza, V., & Hogan, K. (2007). Characterizing world market integration through time. *The Journal of Financial and Quantitative Analysis*, 42(4), 915-940. https://doi.org/10.1017/S0022109000003446

Chambet, A., & Gibson, R. (2008). Financial integration, economic instability and trade structure in emerging markets. *Journal Of International Money And Finance*, 27(4), 654-675. https://doi.org/10.1016/j.jimonfin.2008.02.007

Eyraud, L., Singh, D., & Sutton, B. (2017). *Benefits of global and regional financial integration and latin america. IMF working paper. Western Hemisphere Department. International Monetary Fund*. https://www.brookings.edu/wp-content/uploads/2017/04/global_20170426_imf-working-paper.pdf

Ferson, W., & Harvey, C. (1993). The risk and predictability of international equity returns. *The Review of Financial Studies*, 6(3), 527-566. https://doi.org/10.1093/rfs/6.3.527

Harvey, C. (1991). The world price of covariance risk. *The Journal of Finance*, 46(1), 111-157. https://doi.org/10.1111/j.1540-6261.1991.tb03747.x

Harvey, C. (2000). The drivers of expected returns in international markets. *Emerging Markets Quaterly*, 32-49. https://people.duke.edu/~charvey/Research/Published_Papers/P69_The_drivers_of.pdf

Hooy, C. W., & Goh, K. L. (2008). Stock market integration across national boundaries: causes and impediments. *Capital market review*, 16(1), 13-26. https://www.mfa.com.my/wp-content/uploads/2016/06/Vol.16-Issue-1-2008-002.pdf

Jong, F., & Roon, F. (2005). Time varying market integration and expected returns in emerging markets. *Journal of Financial Economics*, 78(3), 583-613. https://doi.org/10.1016/j.jfineco.2004.10.010

Korajczyk, R. (1996). A measure of stock market integration for developed and emerging markets. *The World Bank Economic Review,* 10(2), 267-289. https://doi.org/10.1093/wber/10.2.267

Levine, R., & Zervos, S. (1998). Capital control liberalization and stock market development. *World Development*, 26(7), 1169-1183. https://doi.org/10.1016/S0305-750X(98)00046-1

Levine, R., & Zervos, S. (1998). Stock markets, banks and economic growth. *The American Economic Review*, 88(3), 537-558. https://www.jstor.org/stable/pdf/116848.pdf?casa_token=SaWO8yOYIVEAAAAA:Dz Kczxun9cEf-UbXvGRbppRPOEAt6LCFVjIXpsM33BuGp_p4gMrNoS78MwQ97HTqAbCqF9Y6lx J5wc4zJ_KyTZY5jAYzDVHL-sp5g-V3DNecWQ_Nz1qJ

Lintner, J. (1965). Securiti prices, risk and maximal gains from diversification. *The Journal Of Finance*, 20(4), 587-615. https://doi.org/10.2307/2977249

Markowitz, H. (1952). Portfolio selection. *The Journal Of Finance*, 7(1), 77-91. https://doi.org/10.2307/2975974

Mossin, J. (1966). Equilibrium in a capital asset market. *Econometrica,* 34(4), 768-783. https://doi.org/10.2307/1910098

Ortegon, J., & Torres, F. (2016). El Mercado Integrado Latinoamericano, Mila Estado Del Arte. *Cuadernos Latinoamericanos de Administración*, 12(23), 7-16. https://doi.org/10.18270/cuaderlam.v12i23.2111

Pukthuanthong, K., & Roll, R. (2009). Global market integration: an alternative measure and its application. *Journal Of Financial Economics*, 94(2), 214-232. https://doi.org/10.1016/j.jfineco.2008.12.004

Quinn, D., Schindler, M., & Toyoda, M. (2011). Asessing measures of financial openness and integration. *Imf Economic Review*, 59(3), 488-522. https://doi.org/10.1057/imfer.2011.18

Romero, Y., Ramirez, F., & Guzman, D. (2013). Mercado Integrado Latinoamericano (Mila): análisis de correlación y diversificación de los portafolios de acciones de los tres países miembros en el período 2007-2012. *Cuadernos De Contabilidad*, 14(34), 53-74. https://revistas.javeriana.edu.co/index.php/cuacont/article/view/6067

Sandoval, E., Vasquez, A., & Sabat, R. (2015). integración de los mercados accionarios de Chile, Colombia y Perú en El Mercado Integrado Latinoamericano (Mila). *Revista Innovar. Universidad Nacional De Colombia,* 25(1), 71-84. https://doi.org/10.15446/innovar.v25n1Spe.53195

Sharpe, W. (1964). Capital asset prices: a theory of market equilibrium under conditions of risk. *The Journal Of Finance*, 19(3), 425-442. https://doi.org/10.1111/j.1540-6261.1964.tb02865.x

Uribe, J., & Mosquera, S. (2014). Efectos del MILA en la eficiencia de portafolio de los mercados de acciones colombiano, peruano y chileno. *Cuadernos De Administración. Universidad del Valle*, 30(52), 75-83. http://www.scielo.org.co/pdf/cuadm/v30n52/v30n52a08.pdf

Wang, P., & Moore, T. (2008). Stock market integration for the transition economies: time varying conditional correlation approach. *The Manchester School*, 76(1)., 116-133. https://doi.org/10.1111/j.1467-9957.2008.01083.x