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ABSTRACT

This paper uses an ARCH framework to study stock market linkages in Latin American markets. We provide evidence that most markets exhibit ARCH effects even when multivariate information sets are incorporated. The correlations between Latin America with the US and developed markets have increased over time for all countries except Argentina. The linkages across Latin American countries also have strengthened. We also find that the volatility transmission between the US and Latin America has increased more recently. In contrast, the volatility transmission among Latin American countries has decreased. Overall our results reveal that Latin American financial markets are becoming more globalized and integrated not only with other countries in the region but also with developed markets.

RESUMO

Este artigo emprega o método ARCH para estudar os elos dos mercados de ações da América Latina. Nós oferecemos evidência de que a maioria dos mercados apresentam efeitos ARCH mesmo quando conjuntos de informação multivariados são incorporados. As correlações entre a América Latina e os EUA e os mercados desenvolvidos aumentaram com o tempo para todos os países, menos a Argentina. Os elos entre os mercados latinos também se fortaleceram. Nós também encontramos evidência de que a transmissão de volatilidade entre a América Latina e os EUA aumentou recentemente. Por outro lado, a transmissão de volatilidade entre os mercados latinos diminuiu. De forma geral, nossos resultados revelam que os mercados da América Latina estão mais globalizados e integrados, não somente com os outros países da região, mas também com os mercados desenvolvidos.

1 – INTRODUCTION

The issue of dynamic interdependence among stock markets has become an important topic in the modern literature of financial economics. The empirical literature has pointed towards a rapidly increasing degree of financial market integration. In the early 1990s, King, Sentana, and Wadhwani (1994) find no integration of capital markets. Bekaert and Harvey (1995) provide evidence of a partial integration of equity markets.

However, recent literature shows an increase in stock market integration (ALBUQUERQUE, LOAYZA, and SÉRVEN, 2005, and KIM, MOSHIRIAN, and WU, 2005). As shown by Ibrahim (2005), the degree of linkages or interdependencies among the stock markets provides important implications on potential benefits of international portfolio diversification.

This paper builds on recent literature of stock market linkages. Most studies so far are limited to developed countries, particularly the US, U.K. and Japan. Many studies on emerging markets address mostly the correlations among markets. Some studies that address linkages use older databases that do not reflect dramatic institutional changes that took place in these markets or do not consider the volatility transmissions.

We use a recent and comprehensive database of returns from 1994 to 2007 to study the linkages among four of the largest emerging markets in Latin America. This sample allows us to study whether the recent globalization of world markets has actually brought these stock markets closer together within their regions and outside their regions.

We investigate these linkages through mean and volatility of returns using the autoregressive conditional heteroskedasticity (ARCH) technique. We provide evidence that most markets exhibit ARCH effects even when multivariate information sets are incorporated. The correlations between Latin America with the US and developed markets have increased over time for all countries except Argentina. The linkages across Latin American countries also have strengthened.

We also find that the volatility transmission between the US and Latin America has increased recently. In contrast, volatility transmission among Latin American countries has decreased. Overall our results reveal that Latin American financial markets are becoming more globalized and integrated not only with other countries in the region but also with developed markets.

This paper is organized as follows. Section 2 presents a brief review of literature. Section 3 presents the data and discusses the methodology. Section 4 contains our empirical results for the stock market linkages in Latin America. Section 5 concludes.

2. REVIEW OF LITERATURE

There has been mounting evidence of volatility transmission among markets (EUN AND SHIM, 1989, KING AND WADHWANI, 1990, HAMAO, MASULIS, AND NG, 1990, ENGLE AND SUSMEL, 1993). A question that remains open is the integration of emerging markets with major world markets. There is evidence that the correlation of returns has been increasing with time but this does not imply that a market is becoming more integrated. In general, an examination of the correlation between stock market indexes indicates that there could be opportunities to reduce portfolio risk by investing in emerging stock markets. However, the volatility may be quite high. These markets can also be considered at least partially segmented (AGGARWAL and Leal, 1995, CHAN, GUP and PAN, 1992, ERRUNZA, LOSQ AND PADMANABHAN, 1992, and LESSARD, 1973).

Research addressing the linkages among emerging markets is still limited. DeFusco, Geppert, and Tsetsekos (1994) use cointegration analysis for weekly IFC indexes returns of 13 emerging markets for the 1989-93 period. They conclude that there is no co-integration between the markets themselves and the markets and the US. Vieira da Silva, Timbosi Filho, and Menezes (2000) find evidence of co-integration relation among the Argentinean, Brazilian and the US stock exchanges.

Some studies have addressed the presence of conditional heteroskedasticity in emerging markets without analyzing linkages among the markets. Errunza et al. (1994) investigate the presence of conditional heteroskedasticity in eight selected emerging markets. They conclude that there are substantial degrees of conditional heteroskedasticity in most markets and that some markets could be predictable even after adjusting for ARCH effects. Sewell et al. (1993) find similar results for Korea and Taiwan. Aggarwal, Inclan and Leal (1999) examine events that cause large shifts in the volatility of emerging stock markets. They find that most events tend to be local. The October 1987 crash is the only global event during the 1985-1995 period that caused a significant jump in the volatility of emerging markets.

Chan, Gup, and Pan (1992) use co-integration in a sample of Asian markets and conclude in favor of segmentation. Their results are supported by those of Park and Fatemi

(1993), who analyze linkages among seven markets and the US and Japan by using vector auto-regression. They conclude that, although the linkages have grown stronger over time, they are particularly weak for the emerging markets in the sample. Errunza, Losq, and Padmanabhan (1992) investigate the integration between emerging markets and the US, and conclude that, while markets cannot be considered integrated, they are not completely segmented.

Most of the studies on stock market interdependence in emerging markets have been done in the Asian or Latin American countries. Stock market interdependence in the emerging markets in Asia seems to be a widely accepted fact (MASIH and MASIH, 1997, 1999). Although there is substantially less literature on stock market interdependence in Latin America, some studies show that the stock markets in this region are also interdependent (CHRISTOFI and PERICLI, 1999).

3. DATA AND METHODOLOGY

Our sample consists of the largest capitalization markets in Latin America: Argentina, Brazil, Chile, and Mexico. Our study is comprehensive for the region in that it considers 93% of the market capitalization of the Caribbean and Latin American markets at the end of 2006. Total market capitalization of the Caribbean and Latin American markets was 2.7% of the world's capitalization and 15% of emerging markets capitalization.

The index levels for our sample are obtained from January 2, 1994 to October 31, 2007. The series of returns are collected from the Datastream and Economatica databases. Specifically, the data consists of the closing daily levels of the Merval (Argentina), Ibovespa (Brazil), IGPA (Chile), and IPC (Mexico). For comparison, we use the following proxies: the S&P 500, and the MSCI Latin America, Emerging Markets, and World indexes. We compute daily, weekly and monthly dollar returns. The daily stock market indexes are transformed into weekly rates of return based on Wednesday prices.

First, univariate statistics are calculated including first order autocorrelations and Ljung-Box test statistics. The accepted norm of squared returns is used as an approximation for each country´s volatility. The use of ARCH to model the conditional time-varying volatility in financial data has become a popular tool. With ARCH models, the volatility component of a series is assumed to be predictable using past available information, such as past volatility.

In general, these models assume that past shocks have a positive but decreasing impact on volatility over time. Similar to Engle and Susmel (1993), we use a time varying structure of stock returns variances to test for common volatility and to analyze whether stock markets have the same volatility process. This makes perfect sense in light of the findings of Aggarwal and Leal (1995) that correlations of volatility between emerging countries (within themselves and with the US and Japan) is much higher than the correlation of mean returns.

Next, several ARCH tests are done using different information tests. In the first set of tests, the own squared returns are regressed against a constant and 4 lags similar to Engle and Susmel (1993). The test statistic is the uncentered R^2 times the sample size. It has a Chi-squared distribution with 4 degrees of freedom. This univariate ARCH test allows us to study whether similarities exist across markets.

The second set of ARCH tests use an intraregional multivariate information set. The regressors are own squared returns as well as the squared returns of other countries. The tests are repeated using the MSCI Latin America, Emerging Markets, and World indexes to examine intraregional and international linkages.

The purpose of these tests is to capture common patterns and spillover effects across countries. The statistic is a Chi-squared distribution with degrees of freedom equal to the number of regressors. The models do not estimate the ARCH process but test whether ARCH effects exist. Overall, these tests allow us to examine whether markets share common volatility processes and if these are intraregional or international.

4. EMPIRICAL RESULTS

Descriptive Statistics

Our data is summarized in Table 1. The mean monthly dollar returns vary from 0.33% in Argentina to 1.91% in Brazil. It is clear that Latin American markets are much more volatile than developed markets. In fact, the volatility in Argentina and Brazil is 3 times higher than in the US. Chile is the least volatile market with a standard deviation of less than 50% of those of Argentina and Brazil. The World index has the lowest monthly standard deviation (3.90%). The World Index is mainly made up of developed markets and also benefits from the most diversification.

Table 1

Descriptive Statistics for Latin American US$ Returns from January 1994 to October 2007

			Panel A: Daily Returns				
	Average	Std Dev	Skewness	Kurtosis	1st Autocorrel	Ljung Box (250)	Obs
Argentina (Merval)	0.01	2.30	-0.47	9.00	0.08***	341.07***	3608
Brazil (IBOVESPA)	0.08*	2.65	-0.02	5.60	0.10***	272.17***	3608
Chile (IPGA)	0.04**	0.91	-0.18	3.09	0.20***	448.21***	3608
Mexico (IPC)	0.05	2.05	0.58	17.76	0.08***	347.33***	3608
MSCI Latin America	0.05*	1.62	-0.29	7.87	0.15***	322.99***	3608
MSCI Emerging Markets	0.03	1.04	-0.67	3.79	0.26***	624.57***	3608
US (S&P 500)	0.03**	1.02	-0.13	3.98	0.18***	452.08***	3608
MSCI World Market	0.03**	0.79	-0.22	2.88	-0.02***	356.86***	3608
			Panel B: Weekly Returns				
	Average	Std Dev	Skewness	Kurtosis	1st Autocorrel	Ljung Box (52)	Obs
Argentina (Merval)	0.06	5.30	-0.29	3.09	0.07*	68.91*	721
Brazil (IBOVESPA)	0.40*	6.09	-0.78	4.52	-0.09***	63.50	721
Chile (IPGA)	0.18**	2.41	-0.12	2.22	0.16***	87.49***	721
Mexico (IPC)	0.22	4.66	-0.11	3.10	0.05	91.01***	721
MSCI Latin America	0.22	3.93	-0.94	4.19	-0.02	58.96	721
MSCI Emerging Markets	0.12	2.75	-0.83	1.81	0.09**	93.05***	721
US (S&P 500)	0.17**	2.15	-0.17	2.14	-0.11***	64.33	721
MSCI World Market	0.14**	1.94	-0.30	1.91	-0.08**	69.65**	721
			Panel C: Monthly Returns				
	Average	Std Dev	Skewness	Kurtosis	1st Autocorrel	Ljung Box (12)	Obs
Argentina (Merval)	0.33	11.28	-0.61	2.55	0.05	8.99	166
Brazil (IBOVESPA)	1.91*	12.78	-0.40	2.04	0.05	6.20	166
Chile (IPGA)	0.82*	5.89	-0.34	1.93	0.16**	15.29	166
Mexico (IPC)	0.99	9.47	-1.22	3.26	0.06	11.06	166
MSCI Latin America	0.98	8.48	-1.23	3.98	0.03	4.78	166
MSCI Emerging Markets	0.55	6.67	-1.25	4.10	0.13*	11.38	166
US (S&P 500)	0.72**	4.06	-0.78	1.36	-0.01	8.35	166
MSCI World Market	0.63**	3.90	-0.87	1.53	0.03	6.30	166

***, **, * denote statistical significance at the 1%, 5% and 10%, respectively.

The unconditional distribution for most markets seems to be non-normal. Most Latin American markets, the U.S, and all broader indexes have negative skewness. All return series have fat tails as indicated by the kurtosis. Most markets also have autocorrelation in daily and weekly returns. The Ljung-Box statistic shows statistical significance for all countries (daily returns) and for Argentina, Chile, Mexico, MSCI Emerging and World (weekly returns).

The descriptive statistics on squared returns in Table 2 show that the level of skewness, kurtosis and autocorrelation is much higher than that of mean returns. The Ljung-Box statistics shows statistical significance for all countries (daily and weekly returns) and for Argentina, Brazil, Mexico, US, MSCI Emerging and World (monthly returns).

Table 2

Descriptive Statistics for Latin American Squared US$ Returns from January 1994 to October 2007

Panel A: Daily Squared Returns							
	Average	Std Dev	Skewness	Kurtosis	1st Autocorrel	Ljung Box (250)	Obs
Argentina (Merval)	0.05***	0.18	17.43	508.56	0.17***	1,948.9***	3608
Brazil (IBOVESPA)	0.07***	0.19	12.12	254.79	0.23***	2,462.4***	3608
Chile (IPGA)	0.01***	0.02	7.23	78.32	0.26***	1,192.2***	3608
Mexico (IPC)	0.04***	0.19	18.62	450.69	0.22***	1,937.6***	3608
MSCI Latin America	0.03***	0.08	13.60	264.86	0.20***	1,511.7***	3608
MSCI Emerging Markets	0.01***	0.03	7.78	98.25	0.16***	1,854.8***	3608
US (S&P 500)	0.01***	0.03	8.14	107.35	0.17***	5,092.1***	3608
MSCI World Market	0.01***	0.01	6.21	59.41	0.20***	3,786.7***	3608
Panel B: Weekly Squared Returns							
	Average	Std Dev	Skewness	Kurtosis	1st Autocorrel	Ljung Box (52)	Obs
Argentina (Merval)	0.28***	0.63	5.37	37.59	0.15***	204.04***	721
Brazil (IBOVESPA)	0.37***	0.93	7.31	71.41	0.23***	205.34***	721
Chile (IPGA)	0.06***	0.12	6.51	59.79	0.22***	118.22***	721
Mexico (IPC)	0.22***	0.49	4.69	26.67	0.23***	384.20***	721
MSCI Latin America	0.15***	0.38	6.71	61.49	0.20***	177.42***	721
MSCI Emerging Markets	0.08***	0.14	5.68	51.10	0.08**	171.83***	721
US (S&P 500)	0.05***	0.09	5.01	34.61	0.20***	329.24***	721
MSCI World Market	0.04***	0.07	5.04	35.73	0.24***	350.64***	721
Panel C: Monthly Squared Returns							
	Average	Std Dev	Skewness	Kurtosis	1st Autocorrel	Ljung Box (12)	Obs
Argentina (Merval)	1.27***	2.65	5.58	40.50	-0.01	20.71**	166
Brazil (IBOVESPA)	1.66***	3.17	4.52	26.89	0.06	24.46**	166
Chile (IPGA)	0.35***	0.67	5.34	40.30	-0.04	18.30	166
Mexico (IPC)	0.90***	1.93	5.68	38.90	0.15***	24.14**	166
MSCI Latin America	0.73***	1.65	8.58	92.40	0.00	9.69	166
MSCI Emerging Markets	0.45***	1.05	8.55	91.32	-0.03	22.57**	166
US (S&P 500)	0.17***	0.28	4.55	30.91	0.11	26.24***	166
MSCI World Market	0.16***	0.26	4.66	31.04	0.04	19.83*	166

***, **, * denote statistical significance at the 1%, 5% and 10%, respectively

Table 3 reports the results of the regressions of squared returns as the dependent variable and lags one to four as the independent variables. Squared returns serve as a proxy for volatility. The appropriate statistic TR^2 is also reported. This test statistic has a chi-squared distribution with four degrees of freedom, and is significant for all daily and weekly series of returns, and for the Mexican and US monthly returns. At least one lagged term is significant for each country's series, except for Argentinean and Brazilian monthly returns. The level of significance based on the t-statistics must be interpreted cautiously based on the results of Table 2.

Table 3
Regressions for ARCH Process in Squared Returns for Four Lagged Own Squared Returns

	Panel A: Daily Returns					
	Constant	Lag 1	Lag 2	Lag 3	Lag 4	TR^2
Argentina	0.03***	0.14***	0.04**	0.16***	0.05***	228.12***
Brazil	0.03***	0.13***	0.25***	0.14***	0.00	496.98***
Chile	0.00***	0.20***	0.12***	0.09***	0.03*	343.42***
Mexico	0.03***	0.19***	0.08***	0.06***	0.07***	246.26***
US	0.01***	0.14***	0.12***	0.12***	0.05***	289.43***
	Panel B: Weekly Returns					
	Constant	Lag 1	Lag 2	Lag 3	Lag 4	TR^2
Argentina	0.15***	0.09**	0.20***	0.06*	0.11***	67.47***
Brazil	0.22***	0.19***	0.09**	0.12***	0.01	56.93***
Chile	0.04***	0.22***	0.01	-0.01	0.08**	38.57***
Mexico	0.11***	0.17***	0.06*	0.15***	0.13***	78.44***
US	0.03***	0.16***	0.05	0.07***	0.17***	59.87***
	Panel C: Monthly Returns					
	Constant	Lag 1	Lag 2	Lag 3	Lag 4	TR^2
Argentina	1.07***	-0.01	0.08	0.12	-0.03	3.31
Brazil	1.32***	0.05	0.01	0.08	0.05	2.15
Chile	0.26***	-0.04	0.03	0.14*	0.07	4.31
Mexico	0.59***	0.12	0.26***	-0.03	0.00	13.86***
US	0.11***	0.08	0.22***	0.11	-0.07	12.04**

***, **, * denote statistical significance at the 1%, 5% and 10%, respectively.

Table 4 shows the results of the regressions of squared returns using information from other countries. Each country's squared return is regressed on the lagged squared returns of other countries and its own. We also include the US as a proxy for developed market. The intraregional multivariate information ARCH tests show evidence of heteroskedasticity in all daily and weekly series of returns. These results are similar to the univariate ARCH tests.

Table 4
Multivariate ARCH Process in Squared Returns for Latin America

Panel A: Daily Returns

	Constant	Argentina	Brazil	Chile	Mexico	Major	TR^2
The US as the Major Market							
Argentina	0.04***	0.14***	0.02	0.58***	0.01	0.04	128.98***
Brazil	0.05***	0.02	0.21***	0.94***	-0.06***	0.00	219.09***
Chile	0.01***	0.01***	0.01***	0.21***	0.00	-0.03***	279.16***
Mexico	0.03***	0.02	0.02	0.68***	0.18***	0.01	202.37***
MSCI World Index as the Major Market							
Argentina	0.04***	0.14***	0.02	0.57***	0.01	0.16	129.38***
Brazil	0.05***	0.02	0.21***	0.91***	-0.07***	0.39*	221.64***
Chile	0.01***	0.01***	0.01***	0.21***	0.00	-0.05**	275.68***
Mexico	0.03***	0.02	0.02	0.68***	0.18***	0.04	202.40***

Panel B: Weekly Returns

	Constant	Argentina	Brazil	Chile	Mexico	Major	TR^2
The US as the Major Market							
Argentina	0.20***	0.04	0.11***	0.62***	-0.05	-0.02	45.46***
Brazil	0.25***	-0.06	0.20***	-0.09	0.12	0.75**	44.74***
Chile	0.04***	-0.01*	0.02***	0.14***	0.01	0.00	52.56***
Mexico	0.19***	-0.03	0.16***	-0.62***	0.15***	-0.37**	75.79***
MSCI World Index as the Major Market							
Argentina	0.21***	0.04	0.11***	0.62***	-0.05	-0.08	45.53***
Brazil	0.25***	-0.06	0.20***	-0.09	0.11	1.07**	45.53***
Chile	0.04***	-0.01*	0.02***	0.14***	0.01	-0.03	52.70***
Mexico	0.19***	-0.03	0.16***	-0.62***	0.15***	-0.52**	76.43***

Panel C: Monthly Returns

	Constant	Argentina	Brazil	Chile	Mexico	Major	TR^2
The US as the Major Market							
Argentina	1.22***	-0.03	0.19**	-0.58	0.02	-0.33	4.12
Brazil	1.62***	-0.05	0.18	-0.84	-0.07	0.84	4.52
Chile	0.36***	-0.02	0.03	-0.04	0.00	-0.24	3.45
Mexico	0.89***	-0.08	0.00	-0.38	0.29***	0.00	7.95
MSCI World Index as the Major Market							
Argentina	1.27***	-0.01	0.24**	-0.43	0.02	-1.77	6.30
Brazil	1.66***	-0.05	0.19	-0.79	-0.07	0.32	4.06
Chile	0.36***	-0.02	0.04	-0.03	-0.01	-0.33	3.77
Mexico	0.88***	-0.02	-0.01	-0.40	-0.01	0.18	8.00

***, **, * denote statistical significance at the 1%, 5% and 10%, respectively.

Intraregional effects are also examined by replacing the US with the MSCI Latin index. The findings are similar to those with the US and are therefore not reported. Finally, we replace the US with the MSCI World index to examine interregional effects, and the evidence of time varying variance continues to hold. We can conclude that international stock markets are related through their volatilities.

Correlation Analysis

Table 5 reports the correlation coefficients between the returns for two time periods: 1994-2001 and 2002-2007. We choose these two periods to create pre- and post-crisis samples. In the first period, there were several extreme market events such as the Mexican devaluation at the end of 1994, the Brady bond crisis at the beginning of 1995, the Asian devaluations in 1997, the Russian crisis at the end of 1998, the Brazilian devaluation in 1999, and the Argentinean crisis at the end of 2001. There have been no major crises in emerging markets since then.

Two facts are clearly evident from the results: the correlations between Latin American markets and the US have increased over time for all countries except Argentina. The linkages among the Latin American countries have also strengthened. Increase in the correlations suggests that financial markets are getting more globalized and integrated. The integration is happening not only with other Latin American countries but also with the rest of the world, measured by the MSCI World index.

Table 5

Correlations Between Latin American US$ Returns for 1994-2001 / 2002-2007

	Panel A: Daily Returns				
	Brazil	Chile	Mexico	US	MSCI World
Argentina	0.58*** / 0.33***	0.42*** / 0.30***	0.53*** / 0.29***	0.40*** / 0.21***	0.42*** / 0.27***
Brazil		0.44*** / 0.52***	0.54*** / 0.57***	0.41*** / 0.46***	0.45*** / 0.53***
Chile			0.37*** / 0.48***	0.30*** / 0.36***	0.37*** / 0.48***
Mexico				0.45*** / 0.61***	0.46*** / 0.64***
	Panel B: Weekly Returns				
	Brazil	Chile	Mexico	US	MSCI World
Argentina	0.64*** / 0.31***	0.52*** / 0.26***	0.66*** / 0.36***	0.41*** / 0.29***	0.46*** / 0.35***
Brazil		0.54*** / 0.54***	0.63*** / 0.57***	0.45*** / 0.45***	0.52*** / 0.52***
Chile			0.48*** / 0.49***	0.35*** / 0.47***	0.38*** / 0.53***
Mexico				0.47*** / 0.59***	0.52*** / 0.65***
	Panel C: Monthly Returns				
	Brazil	Chile	México	US	MSCI World
Argentina	0.63*** / 0.43***	0.59*** / 0.40***	0.68*** / 0.39***	0.46*** / 0.29***	0.54*** / 0.33***
Brazil		0.61*** / 0.68***	0.69*** / 0.62***	0.53*** / 0.69***	0.63*** / 0.75***
Chile			0.49*** / 0.55***	0.42*** / 0.66***	0.50*** / 0.71***
Mexico				0.54*** / 0.69***	0.60*** / 0.73***

***, **, * denote statistical significance at the 1%, 5% and 10%, respectively.

Table 6 shows the correlation matrix for squared returns. Similar to the results of Table 5, the correlations of the squared returns of Latin America with the US and the MSCI World Index have increased over time for all countries except Argentina. This result is not surprising because the Argentinean market has not been integrated with other markets since its crisis at the end of 2001. Another interesting result is that correlations across Latin American countries have decreased. One possible explanation is that the volatility transmission between the US and Latin America has increased, whereas the volatility transmission across Latin American countries has decreased.

These results may be attributable to two factors. Firstly, developed markets, especially the US, are the most influential producers of information, so that reactions to US news dominate other markets (Becker, Finnerty, and Friedman, 1995). Secondly, international investors often overreact to news from the developed markets and place less weight on information from other markets (Masih and Masih, 1999).

Table 6

Correlations Between Latin American Squared US$ Returns for 1994-2001 / 2002-2007

	Brazil	Chile	Mexico	US	MSCI World
Panel A: Daily Returns					
Argentina	0.58*** / 0.07***	0.42*** / 0.12***	0.46*** / 0.06**	0.29*** / 0.03	0.34*** / 0.06**
Brazil		0.50*** / 0.35***	0.61*** / 0.37**	0.23*** / 0.29***	0.25*** / 0.32***
Chile			0.36*** / 0.35***	0.16*** / 0.16***	0.20*** / 0.23***
Mexico				0.26*** / 0.34***	0.24*** / 0.36***
Panel B: Weekly Returns					
	Brazil	Chile	Mexico	US	MSCI World
Argentina	0.61*** / 0.11**	0.55*** / 0.14**	0.47*** / 0.12**	0.13*** / 0.14**	0.25*** / 0.15***
Brazil		0.56*** / 0.35***	0.53*** / 0.46***	0.12** / 0.39***	0.27*** / 0.43***
Chile			0.33*** / 0.37***	0.05 / 0.13**	0.14*** / 0.16***
Mexico				0.09* / 0.28***	0.22*** / 0.38***
Panel C: Monthly Returns					
	Brazil	Chile	México	US	MSCI World
Argentina	0.56*** / 0.06	0.63*** / 0.14	0.65*** / 0.25**	0.59*** / 0.02	0.63*** / 0.01
Brazil		0.73*** / 0.48***	0.59*** / 0.51***	0.54*** / 0.80***	0.64*** / 0.86***
Chile			0.55*** / 0.40***	0.61*** / 0.43***	0.70*** / 0.49***
Mexico				0.48*** / 0.32***	0.51*** / 0.40***

***, **, * denote statistical significance at the 1%, 5% and 10%, respectively.

Our results must be interpreted cautiously because stock market relations are not stable over time, which means that the choice of sample period may influence the results of stock market interdependence analyses (Meric and Meric, 1989).

5. SUMMARY AND CONCLUSIONS

The issue of dynamic interdependence among stock markets has become an important topic in the modern literature of financial economics. This paper uses an ARCH framework to study intraregional and international stock market linkages in Latin American markets. We find that most markets exhibit ARCH effects, which continue to be exhibited even when multivariate information sets are incorporated.

We analyze returns and volatilities for two time periods: 1994-2001 and 2002-2007. We choose these two periods to create pre- and post-crisis samples. In the first period, there were several extreme market events such as the Mexican devaluation at the end of 1994, the Brady bond crisis at the beginning of 1995, the Asian devaluations in 1997, the Russian crisis at the end of 1998, the Brazilian devaluation in 1999, and the Argentinean crisis at the end of 2001. There have been no major crises in emerging markets since then.

Our results indicate that the correlations between Latin American markets and the US have increased over time. Further, linkages among Latin American countries also have strengthened. Increase in the correlations suggests that financial markets are getting more globalized and integrated. The integration is happening not only with other Latin American countries but also with the rest of the world. This greater integration implies that the long-run diversification benefits that can be gained by investors across Latin American stock markets tend to diminish.

Another interesting result is that correlations for squared returns across Latin American countries have decreased, and volatility transmission between the US and Latin America has increased. These results indicate that reactions to US news are more important than those from emerging markets.

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