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Volatility transmission among Latin American stock markets under structural breaks

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HIGHLIGHTS

- We investigate the volatility spillovers among five major Latin American Stock markets.
- We employ a multivariate DCC GARCH model which allows for structural breaks in variance.
- The dynamic correlations obtained from the DCC GARCH model show that volatility spillover effects among the markets are not strong.
- We find that the markets in the sample are interdependent but we cannot infer the contagion effects among the markets.

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ABSTRACT

The paper investigates the volatility spillovers among five major Latin American (LA) stock markets under the presence of the structural breaks in variance. We employ a multivariate dynamic conditional correlation (DCC GARCH) model allowing for structural breaks in variance. The dynamic correlations show that volatility spillover effects among the markets are not strong. Causality in mean tests indicate one way causality from BOVESPA to all markets, whereas causality in variance tests indicate one way causality only from BOVESPA to IPSA. These findings suggest that while the markets in the sample are interdependent, there is not enough statistical evidence to infer the contagion effects among the markets.

1. Introduction

In the light of recent and still growing literature of causality in mean and variance, this paper investigates whether there exist volatility spillovers between major Latin American (LA) equity markets and attempts to identify the structure of the causal relationships if any.

Analyzing volatility spillover mechanism and causal relationships between markets can be useful for the pricing of securities, developing trading strategies, hedging strategies, and regulatory strategies within, and across the markets [1,2]. For this purpose, we adopt two main approaches, which are widely used in the previous studies. The first approach uses dynamic conditional correlations obtained from multivariate GARCH models. Among the several multivariate GARCH models, we use the DCC-GARCH model. As explained below, DCC-GARCH model was originally developed by Engle [3] and it is extended to include the asset-specific correlation of news impact curves and the asymmetric dynamics in correlation by Cappiello et al. [4]. The second approach draws upon on causality in mean and causality in variance tests. Many existing causality tests are based on the concept of Granger causality. In the context of stock market returns and volatility one can

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think that the information from one country's stock market might help the prediction of equity returns and/or volatility in other countries. A large number of studies have analyzed the volatility transmission between markets using causality in variance tests such as [5–7]. However, recently Dick et al. [8] show that causality in variance tests could lead to misleading results if the structural breaks in volatility are not taken into account. Therefore, many of the recent studies employ Hong's test [5] by allowing for the effects of structural breaks in the variance of the series, such as Korkmaz et al. [9]. For this reason in this study we carry out Kappa2 tests [10] to examine the existence of structural breaks in variance before proceeding to causality tests and DCC-GARCH estimations. It is important to note that under non-normality and the presence of ARCH effects the Kappa-2 ($\kappa 2$) statistic, which is developed by Sansó et al. [10], is best suited in these contexts. Our study differs from the existing studies in that existing studies on LA countries do not take into account breaks in variance and they are not informative about the pairwise causality. Our paper contributes to empirical literature by considering these points.
The paper is organized as follows: Section 2 reviews the most relevant literature on volatility spillovers in Latin American countries. Sections 3 and 4 describe the data and the methodology, respectively. Section 5 discusses the empirical findings of the paper and before the concluding remarks in Section 6.

2. Literature survey

Over the recent years there has been long-standing interest in analyzing the volatility spillovers between LA equity markets. Choudhry [11] investigates the long-run relationship between the stock indices of six LA countries and the United States. He conducts unit root tests, cointegration tests and error-correction models and his results provide the presence of a long-run relationship between the six LA indices (with and without the United States index) and significant causality among these indices.

In their study, Christofi and Pericli [12] examine the systematic relationships between the five LA stock markets of Argentina, Brazil, Chile, Colombia and Mexico. Using a VAR and E-GARCH model, they show the existence of asymmetric transmission of volatility innovations.
Using cointegration analysis and error correction Vector Autoregressions (VAR) techniques, Chen et al. [13] analyze the dynamic interdependence of the six stock markets in LA. They suggest that these countries' national stock price indices move together in the long-term. They further state that investing in various LA stock markets offers limited risk diversification up until 1999. However, they find evidence that for the period of 1999–June 2000 creating a portfolio from shares in different LA countries reduces portfolio risk compared to a portfolio made up of shares from a single country.

Morales [14] investigates the volatility spillovers between stock returns and exchange rate changes for six LA financial markets including Argentina, Brazil, Chile, Colombia, Mexico, and Venezuela and Spain. He focuses on the impact of the Euro in these markets. His results indicate that the volatility of stock prices affects the volatility of exchange rates; however, there is no evidence of volatility transmission in the opposite direction. Verma and Ozuna [15] examine price and volatility spillovers and response asymmetries between the equity markets of the United States and Brazil, Chile and Mexico. They employ a multivariate exponential generalized autoregressive conditionally heteroscedastic (M-EGARCH) model. They provide evidence that there are price and volatility spillovers from the United States to Mexico and Chile and but not to Brazil. They contend that openness of the country in terms of international trade plays crucial role for the spillovers.

Rivas et al. [16] analyze the volatility spillovers between European equity markets and the equity markets of Mexico, Brazil, and Chile. Reviewing the results of the E-GARCH and VAR models, Rivas et al. [16] conclude that the stock markets of Spain and Germany have stronger volatility spillover effects on LA markets than do Italy, the United Kingdom, and France. They further state that these spillover effects of Spain and Germany have a greater impact on Mexico and Brazil than on Chile. They assert that the more open the economies are the more likely they are affected by external shocks. Considering asymmetry, they provide evidence that negative innovations raise volatility more than positive innovations. Diamandis [17] investigates long-run relationships between four LA stock markets and that of the US. He employs the autoregressive and moving average representations of a VAR model. The analysis suggests that there is a long-run relationship among the five equity markets.

El Hedi et al. [18] analyze the time variations in the comovements of LA stock markets. Employing time-varying correlations from a multivariate DCC-GARCH (Dynamic Conditional Correlation GARCH) model they estimate conditional correlations. They test for structural breaks in the comovements with Bai and Perron's [19] structural break technique. Their results indicate that the comovements are subjected to various regime shifts, essentially due to major economic events. They assert that stock markets move much more together in times of a crisis.
Aloui [20] examines the volatility spillovers in LA emerging stock markets namely Argentina, Brazil, Chile and Mexico for the period (January 1995–September 2009). Using a multivariate fractionally integrated asymmetric power ARCH model with dynamic conditional correlations of Engle [21] with a Student-t distribution he provides strong evidence of long memory and asymmetry in emerging stock market dynamics which offers an insight into the transmission of volatility shocks. Moreover, the pairwise DCCs' impulse response functions bring out that the LA emerging stock markets are interrelated in terms of risk transmission.

Lahrech and Sylwester [22] investigate integration between the LA equity markets and the US equity market. Using a DCC multivariate GARCH model they find the dynamic conditional correlation (DCC) between each market and that of the US and as expected, they find a higher degree of co-movement between LA countries' equity returns and those in the US. In their paper, Adrangi et al. [23] employ an asymmetric bivariate EGARCH model in order to investigate the daily volatility spillovers