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Asymmetric causality in-mean and in-variance among equity markets indexes

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ABSTRACT

The aim of this study is to research asymmetric causality in-mean and variance among financial markets. The methodology used has several advantages: the estimation is jointly and not by pairs of variables, it identifies whether the causality is asymmetric (different effects from positive and negative returns), and, in the case of bidirectional relationships, it allows us to test whether the effect is the same in both directions. This study provides evidence of causality in-mean and variance among the daily returns of stock markets indexes from January 1, 1997 to December 31, 2014. The indexes are grouped by geographical areas to avoid problems of asynchrony with partially overlapping markets. The main results show that the causalities in-mean and in-variance are asymmetric with a different effect from positive and negative returns. Notably, by geographical areas, the Indian index SENSEX (symmetric) and the Chinese Shanghai Stock Exchange (asymmetric) are causatives in-mean for Asia, The Italian MIB 30 (asymmetric) is causative in-variance for Europe, and the USA DOW JONES 100 (symmetric) and STANDARD&POORS 500 (asymmetric) indexes are causatives in-mean and in-variance for America. Also, the bidirectional relationships between the DOW JONES 100 and STANDARD&POORS 500 in-mean and in-variance have the same effect in both directions.

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1. Introduction

During recent years there has been a growing interest among portfolio managers in the contagion effects of financial markets. These effects have caused portfolio managers and institutional investors to become more cautious in their investment decisions. As a consequence, there is an increased need for a more intensive study of the relationships among the aspects of the stock markets that promote volatilities. A relevant question is whether the positive events have the same effects as the negative events, since the absence of asymmetry of the effects should be considered for appropriate portfolio management.

In the context of the financial markets, the relationships among the movements of different stock indexes are studied from two different perspectives. First, we study the contemporaneous correlation or co-movements; that is, the contemporary movements of economic and financial variables as in the work of Qadan and Yagil (2015). This work, using quarterly data of economic and financial variables, found a link between international equity co-movements and international economic output movements; that is, if two economies move together in terms of real activity variables, we should see corresponding movements in terms of financial variables. Second, the realized movements (past) in one market might influence the decisions of participants (future) in another (causal spillover). The latter is the focus of our work; that is, we focus on the causality relationships that involve one action (cause) and the subsequent (not contemporary) reaction (effect) among economic and financial variables. In the literature such relationships are called cause–effect.

One approach to evaluating causal relations between two time series is to examine if the prediction of one series could be improved by incorporating information from the other. Specifically, if the variance of the prediction error of the second time series at the present time is reduced by the inclusion of past measurements from the first time series in the linear regression model, then the first time series is said to have a causal (in-mean) influence on the second time series (Granger, 1969); this methodology is known as the Granger approach.

But also, as our field of study relates to financial assets, we have to consider the specific characteristics of the behavior of the return on financial assets with respect to other economic variables, which are known as stylized facts (Cont, 2001). These properties determine the relevance of methodologies for any empirical study on financial data series. Among them, in this work we emphasize the following: heavy tails, leverage effect, clustering volatility, and conditional volatility.

A number of studies have taken into account the properties of the returns of financial assets and focus on analyzing the causality in-variance; that is, they check whether the quadratic shocks have any effect on the future conditional volatility of others. These works are grouped into two types depending on their methodology. First, those using multivariate vector autoregressive (mean equation) with generalized autoregressive conditional heteroskedasticity (variance equation) models (VAR-GARCH). This methodology was used by Caporale, Spittis, and Spagnolo (2002), Cheung and Ng (2000), Doong and Yang (2004), Hafner and Herwartz (2008), Rigobon (2003), Sentana and Fiorentini (2001), Weber (2010) and Pavlidis, Paya, and Peel (2013). Others use the cross correlation function (CCF) to analyze whether the shocks have significant effects on subsequent shocks corresponding to other variables. The main studies using this methodology are Bhar (2003), Cheung and Ng (1996), Hong (2001), Kanas and Kouretas (2002) and Qadan and Yagil (2012).

Although this work is not a survey on the state of the art from the works cited above, we note that although both methods are based on the same assumptions about the behavior of financial asset returns and have the same objective, they differ in the procedure used. The VAR-GARCH methodology allows us to jointly estimate the causality in-mean and variance for a set of assets where the statistically significant parameters are not located on the main diagonal of the parameters matrix and to show the causality in-mean (VAR) and in-variance (GARCH). Instead, the CCF methodology, in a first step, gets the variable shocks as standardized residuals of the univariate AR-GARCH models and then it estimates for them and their square the causality in-mean and in-variance, respectively.

The VAR-GARCH methodology has some drawbacks, such as computational complexity, when the number of assets increases. Also, the difficulty of estimating when returns have a univariate heteroskedastic behavior is different, and the multivariate GARCH process does not guarantee a stationary