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Frequency domain causality analysis of stock market and economic activity in India

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ABSTRACT

In this study, we analyze the Granger-causality in frequency domain between stock prices and economic growth in India, in order to identify the direction of the causality at different frequencies. For this purpose we use in the first step different seasonal and structural breaks unit root tests. In the second step we use a conditional VAR model as benchmark, and we focus on the conditional and non-conditional frequency domain causality tests. We find evidence of unidirectional causal relationship between stock prices and industrial production in the long-run, running from stock prices to industrial production. When using the non-conditional model, we find evidence of insignificant business cycle causality from both directions. Our study shows that stock prices are a leading indicator for growth in the industrial production in India. In this case, in order to adjust the industrial production in the long-term, the Indian economic policies should be focused with predilection on the stock market environment.

1. Introduction

One of the most sticking concerns for policy makers in economics is the relationship between financial development and economic growth. Starting with Schumpeter (1912), and continuing with Gurley and Shaw (1955), Goldsmith (1969) and Schwarz (1978), a fierce debate appears, both at theoretical and policy levels, regarding whether the economic activity increases the financial development or vice-versa. A more difficult question is related to the forward-looking nature of stock prices, which can serve as evidence for the causality between stock markets and the economic growth. At the same time, general savings, and an efficient allocation of capital for productive investments, are facilitated by a well-developed stock market, which in turn will promote the economic growth. Therefore, a bidirectional causal relationship between stock markets and the economic activity might exist.

There are several possible explanations for the strong association between stock prices and the real economic activity (see Antonios, 2010; Fama, 1990; Schwert, 1990). First, information about the future economic growth may be reflected in stock prices. In this case, stock prices are a leading indicator for the well-being of the economy. This idea is explored for example by the Economic Tracking Portfolios (ETP) theory, which connects asset prices with news about economic variables (Lamont, 2001). Thus, investors who wish to insure against economic growth fluctuations could take a position in the economic growth tracking portfolio. Second,

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changes in discount rates may affect stock prices and real investments in the same time, but the output generated by investments appears only after a certain period. Finally, changes in stock prices are associated with changes in wealth. In this case, the demand for consumption and investment goods is affected, and influences the economic growth level.

A considerable number of studies investigate the stock prices — economic activity nexus, in both developed and emerging markets. While for developed markets the researches document in general the causality between macroeconomic variables and stock markets (Choi, Hauser, & Kopecky, 1999; Hassapis & Kalyvitis, 2002; Henry, Olekalns, & Shields, 2010; Panopoulou, 2009; Reboredo & Rivera-Castro, 2014), for the emerging markets the findings are inconclusive (Naifar & Al Dohaiman, 2013; Tsouma, 2009; Zhu, Li, & Li, 2014).

This is also the case of the Indian context, where an appreciable number of studies report contradictory results. If the causality between the stock market and the economic activity is not found by Pethe and Karnik (2000) or Bhattachary and Mukherjee (2006), it is highlighted by Naka, Mukherjee, and Tufte (1998), Padhan (2007), Ahmed (2008), Singh (2010), Srivastava (2010), Tripathy (2011), Pal and Mittal (2011), Ray (2012), Naik and Padhi (2012), Kalra (2012), Dasgupta (2013), Kumar (2013), Fang and You (2014) or Ray and Sarkar (2014). Only few papers focus on the stock prices — economic growth relation, and none of these researches employ the Granger causality in the frequency domain.

As far as we know, our paper is the first study addressing the link between stock prices and the economic growth in India, in a frequency domain framework. Croux and Reusens (2013) investigate the predictive power of stock prices for the future domestic economic activity in a frequency domain framework, but with a focus on G7 countries and within a bivariate framework only. Against this background, we bring forward several contributions to the literature, including Croux and Reusens (2013), by relying on conditional frequency domain framework.

First we test the short- and long-run Granger causality using the conditional and unconditional frequency domain approach of Breitung and Candelon (2006). In the frequency domain, a stationary process can be expressed as a weighted sum of sinusoidal components with a certain frequency. These frequency components can be analyzed separately and are often put in two heads, namely quickly and slowly fluctuating components, associated with the short- and long-run respectively (Lemmens, Croux, & Dekimpe, 2008). Hence, the Granger causality analysis will help in finding out the concentration of the predictive power in the two fluctuating components i.e., whether the predictive power is concentrated at the quickly fluctuating components, or at the slowly fluctuating components. A priori, it is believed that the stock market can forecast the slowly fluctuating components of the future economic activity more accurately than the quickly fluctuating components (Croux & Reusens, 2013; Rua, 2010). Therefore, we assume that the Granger causality from the stock prices to the economic activity is significant for the slowly fluctuating components, but insignificant for the quickly fluctuating components. However, the causality from the economic activity to the stock prices can manifest both in the short- and long-terms, due to the theoretical reasons underlined above.

Second, we use a conditional vector autoregression (VAR) model as benchmark for comparing the results of the Granger causality in the frequency domain analysis, and to reveal the advantages of the proposed methodology. Because our primary focus is on the economic growth, only this variable is considered as endogenous in the conditional VAR model (similar to the conditional frequency domain model). Other macroeconomic variables frequently employed in the literature, as the exchange rate, trade balance, international reserve or inflation, are treated as exogenous. This assumption is made in order to facilitate the comparison between the benchmark and the frequency domain analysis.

Third, different from previous studies which use linear unit root tests for establishing the stationarity or non-stationarity of the series, we use different seasonal and structural breaks unit root tests. More precisely, we start with the HEGY seasonal unit root test of Hylleberg, Engle, Granger, and Yoo (1990). We continue with the seasonal unit root test proposed by Dickey and Zhang (2010), and we then compare the reported results with the findings of the Zivot and Andrews (1992) unit root tests with a structural break. We use these tests to see if our series are stationary and if it is recommended to proceed with the frequency domain analysis.

Finally, we focus on the Indian context which is particularly appealing because the Indian stock market is an emerging market, prone to fluctuations and vulnerable to the international context, and because the previous results are rather contradictory. In this context, our purpose is to add additional clarifications to the fact that the relation between stock prices and the economic growth is non-linear and the causality changes at different frequencies. Moreover, we want to see if similarities appear between developed and emerging countries when studying the stock prices — economic activity nexus in the frequency domain.

The remaining part of the study is organized as follows: the second section briefly presents the review of literature on the relation between the stock market and the economic activity in India; the third section shortly discusses the data source and the methodology employed; the fourth section presents the results of our analysis, while the fifth section offers conclusions and draws policy implications.

2. Literature review

The literature regarding the relationship between the stock market and the economic activity in India is prolific. Using different investigation tools, a first strand of researches does not identify any causality between stock prices and the economic activity, while the second group reveals a significant causal relationship.

Pethe and Karnik (2000) and Bhattachary and Mukherjee (2006) are the main exponents of the first group. Pethe and Karnik (2000) use monthly data and investigate the period 1992–1997. Their cointegration and error correction model show that there is no long-run relationship between the stock price and the state of the economy. In the same line, Bhattachary and Mukherjee (2006) employ both a VAR and Toda and Yamamoto non-Granger causality techniques (Toda & Yamamoto, 1995), using a monthly sample, for the time-span 1992–2001. No causal connection is found between stock returns and macroeconomic variables (i.e. money supply, index of industrial production, GNP, real effective exchange rate, foreign exchange reserve and trade balance). At the same time, they found significant evidence of a bidirectional causality between stock returns and the rate of inflation.