ISSN 1822-6515

STOCK MARKET AND MACROECONOMIC VARIABLES: EVIDENCES FROM LITHUANIA

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Abstract

The stock market has been historically viewed as a reliable instrument to indicate economic processes. However, contemporary papers reveal the controversy of the issue. A clear understanding of stock market determinants is vital for investors, regulators, and academic researchers. Therefore, future researches are required to further explore this issue.

The present paper analyzes relationships between a group of macroeconomic variables and the Lithuanian stock market index, i.e. OMX Vilnius index. The objective of this paper is to investigate whether stock prices may serve as a leading indicator for macroeconomic variables in Lithuanian economy or a group of macroeconomic variables may serve as a leading indicator for stock returns in Lithuania. Granger causality tests have been employed to estimate the relationship between the OMXV index and 40 macroeconomic variables depicting the health of Lithuanian economy from December 1999 to March 2008.

The research reveals that some macroeconomic variables (e.g., GDP deflator, net export, foreign direct investment, etc.) lead Lithuanian stock market returns, some macroeconomic variables (e.g., GDP, material investment, construction volume index, etc.) are led by the OMXV index and, finally, some macroeconomic indices (e.g., money supply, payment balance, etc.) and the stock market returns Granger-cause each other.

Keywords: Lithuanian economy, stock market, Granger causality, macroeconomic variables.

Introduction

The relationship between stock markets and macroeconomic forces has been widely debated in the finance and macroeconomic literature (Fama, 1981; Friedman, 1988; Keran, 1971, Nelson, 1976). Most of such studies suggest that financial and macroeconomic variables influence stock prices across a variety of markets and time horizons (Been *et al.*, 1990; Bulmash & Trivoli, 1991; Campbell, 1987; Cochrane, 1991; Fama & French, 1989; Golsten *et al.*, 1993, Ibrahim, 1999; Maysami & Koh, 2000; Mukherjee & Naka, 1995; Poon & Taylor, 1991). A number of studies, for example, modelled relationships between US stock prices and real economic activity (Abdullah & Hayworth, 1993; Chen *et. al.*, 1986; Fama, 1981; Geske & Roll, 1983; Lee, 1992), some studies focused on investigating the relationship between the UK stock market and macroeconomic factors (Cheng, 1995; Poon & Taylor, 1991), other researchers attempted to find the relationships in Canada (Darrat, 1990), in Japan (Hamao, 1988; Mukherjee & Naka, 1995), in Singapore (Maysami & Koh, 2000; Maysami *et. al.*, 2004; Ta & Teo, 1985), in India (Agrawalla & Tuteja, 2007; Padhan, 2007), in Malaysia (Ibrahim, 1999), in European countries (Ansotegui & Esteban, 2002; Asprem, 1989; Dritsaki & Adamopoulos, 2005; Gjerde & Saettem, 1999; Panetta, 2002; Tsoukalas, 2003; Wasserfallen, 1989). The outcomes of all these studies suggest that, with minor degrees of variation, fundamental macroeconomic dynamics are indeed influential factors for stock market returns.

However, several studies debate the existence of any significant relationships between stock market performance and macroeconomic variables, for example, efforts of Culter, Poterba, and Summers (1989) to relate the value of specific macroeconomic variables to stock returns generally failed to identify robust effects; studies of Martinez and Rubio (1989) as well as of Gjerde and Saettem (1999) have not implied a significant relation between stock returns and macroeconomic factors; Schwert (1989) tested the effect of domestic (the United States) macroeconomic variables on stock volatility and found weak evidence that such factors could predict stock market returns which are inherently volatile; Fung and Lie (1990) argued that macroeconomic factors can not be reliable indicators for stock market price movements in the Asian markets because of the inability of stock markets to fully capture information about the change in macroeconomic fundamentals; Richards (1996) detected little indication of increased short-term predictability and volatility in stock returns; Allen and Jagtianti (1997) pointed out that interest rate sensitivity to stock returns has decreased dramatically since the late 1980's and the early 1990's because of the invention of interest rate derivative contracts used for hedging purposes.

The controversy of the issue requires further exploring the subject. Thus, the objective of this paper is to evaluate whether stock prices may serve as a leading indicator in a small open economy taking into consideration evidences from Lithuania. The research methods applied in this paper embrace the logical

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analysis and synthesis of scientific literature, the systematic analysis of statistical data, the statistical grouping method, the comparison and generalization method, and the Granger Causality tests.

Theoretical underpinnings

The relationship between stock prices and macroeconomic variables has been the topic for academic researchers and practitioners. The literature is very rich in developed, more material markets such as the US, UK, Japan, Singapore and others (Abdullah & Hayworth, 1993; Chen *et. al.*, 1986; Cheng, 1995; Fama, 1981; Geske & Roll, 1983; Hamao, 1988; Lee, 1992; Maysami & Koh, 2000; Maysami *et. al.*, 2004; Mukherjee & Naka, 1995; Poon & Taylor, 1991; Ta & Teo, 1985). Much of the related research that addresses the empirical link between the stock market prices and the real economy, which is measured either by the real industrial production or the real gross domestic product (GDP), has been done focusing either only on the US economy (Abdullah & Hayworth, 1993; Chen *et. al.*, 1986; Fama, 1981; Geske & Roll, 1983; Lee, 1992; Schwert, 1990) or on a group of several countries (Asprem, 1989; Binswanger, 2001; Cheung & Ng, 1998; Choi *et. al.*, 1999; El-Wassal, 2005; Lin *et. al.*, 2007; Peiro, 1996; Siliverstovs & Doung, 2006; Wasserfallen, 1989). Emerging stock markets have been identified as being at least partially segmented from global capital markets. As a consequence, it has been argued that local risk factors rather than world risk factors are the primary source of equity variations in these markets (Bilson *et. al.*, 1999). They found moderate evidence to support this hypothesis. After investigating the degree of commonality in exposure across emerging stock market returns using a principal components approach Bilson, Brailsford, & Hooper (1999) detected little evidence of commonality when emerging markets are considered collectively. At the regional level, however, considerable commonality was proven to exist.

Through the employment of Hendry's (1986) approach, Maysami & Sim (2001a, 2001b, 2002) analyzed the influence of interest rates, inflation, money supply, exchange rate and real activity, along with a dummy variable to capture the impact of the 1997 Asian financial crisis. The results confirmed the influence of macroeconomic variables on the stock market indices in Hong Kong and Singapore, Malaysia and Thailand, Japan and South Korea, though the type and magnitude of the associations differed depending on the country's financial structure.

Mukherjee & Naka (1995) applied Johansen's (1998) vector error correction model to analyze the relationship between the Japanese stock market and exchange rate, inflation, money supply, real economic activity, long-term government bond rate, and call money rate. They concluded that a cointegration relation indeed existed and the stock prices contributed to this relation. Maysami & Koh (2000) examined such relationship in Singapore and found that inflation, money supply growth, changes in short- and long-term interest rate and variations in exchange rate formed a cointegrating relation with changes in Singapore's stock market levels. Islam & Watanapalachaikul (2003) showed a strong, significant long-run relationship between stock prices and macroeconomic factors (interest rate, bonds price, foreign exchange rate, price-earning ratio, market capitalisation and consumer price index) during 1992-2001 in Thailand.

There are some studies negating the existence of any significant relationships between stock market performance and macroeconomic variables (Culter *et. al,* 1989; Martinez & Rubio, 1989; Gjerde & Saettem, 1999; Schwert, 1989; Fung & Lie, 1990; Richards, 1996; Allen and Jagtianti, 1997). Pearce (1983) noticed that the stock market has previously generated 'false signals' about the economy and should not be relied on as an economic indicator. The stock market crash could be an example in which stock prices falsely predicted the direction of the economy: instead of entering into a recession which many were expecting, the economy continued to grow for several years (Pearce, 1983).

Disagreements in theory inspire to continue the research in this field. This paper will analyse evidences from Lithuania expecting the findings to give some more significant insights despite of one limitation, i.e. the analysis has been carried out only for one country. However, the strength of the present paper lies in the fact that it is attempted at finding the relation between the stock market returns and even 40 macroeconomic variables while all previous studies have mainly focused on less then 10 macroeconomic fundamentals. This will help to grasp a better overall understanding and it will contribute to a more in-depth investigation of the current issue.

Data and research methodology

Seeking to identify the relationship between stock prices and macroeconomic variables, a focus has been laid on evidences from Lithuania. The data are monthly and extend from the December of 1999 to the

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March of 2008. The variable which is used to represent stock price movements is a value of the OMX Vilnius (OMXV) index on the last business day of the month. This index indicates stocks which are quoting in the securities exchange of Vilnius, market prices standards and dynamics. The largest Lithuanian enterprises, such as "TEO LT", "City Service", "Klaipedos Nafta", "Ukio bankas" and many others, have great influence on its variations. Thus, it may be assumed that dynamics of OMXV index reflect the overall country's economical situation quite reasonably.

The macroeconomic variables incorporated in the empirical analysis together with their abbreviations in the brackets are as follows: gross external debt (GED), gross domestic product (GDP), gross domestic product deflator (GDPd), index of energy products (IEP), export volumes (Ex), producer price index of industrial production (PPI), index of capital goods (ICG), harmonised consumer price index (HCPI), import volumes (Im), index of durable consumer goods (IDCG), granted permits for new residential buildings (GP), money supply in a narrow sense (M1), money supply in a broader sense (M2), balance of payments (BP), investment in tangible fixed assets (ITFA), retail trade index (RTI), unemployment rate (UR), final consumption expenditure (FCE), changes in prices of industrial production (CPIP), index of own-account construction work carried out within the country (IOCW), construction price index (CPI), index of non-durable consumer goods (INCG), foreign direct investment (FDI), index of intermediate goods (IIG), employment rate (ER), manufacturing index (MI), exchange rate of the Litas against the US dollar (ExR), average number of hours actually worked per employee per month (AHW), government final consumption expenditure (GFCE), overnight Vilnius interbank offered rate (VILIBOR1N), one month Vilnius interbank offered rate (VILIBOR1M), three months Vilnius interbank offered rate (VILIBOR3M), six months Vilnius interbank offered rate (VILIBOR6M), one year Vilnius interbank offered rate(VILIBOR1Y), the difference between one year and overnight Vilnius interbank offered rates(VILIBOR1Y_1N), general government financial balance (GGFB), general government revenue (GGR), general government expenditure (GGE), general government debt (GGD), net export (NEx).

The procedure employed for testing the relationship or statistical causality between stock prices and the macroeconomic factors is the direct Granger-causality test proposed by C.J. Granger (1969). It is a technique for determining whether one time series is useful in forecasting another. He argued that there is an interpretation of a set of tests as revealing something about causality. In our case we will attempt to measure if fluctuations of OMXV index might be reasonable in forecasting changes in real economic activity expressed by the above listed variables and vice versa.

The Granger causality method has been carried out by employing the software package of EVIEWS, which can quickly and efficiently manage the data, perform econometric and statistical analysis, generate forecasts or model simulations, etc. After selecting the Granger-causality view in EVIEWS software it is required to select the number of lags to use in the test regressions. In general, it is better to use more rather than fewer lags, since the theory is couched in terms of relevance of all past information. In order to have a more detail result, we will conduct our analysis by picking different lag lengths varying from 2 to 24, i.e. from 2 months to 2 years.

Empirical findings: application of Granger causality tests

Before undertaking the Granger-causality procedure it is relevant to determine whether there is a trend in our time-series data. Time series analysis must be based on stationary data series for drawing useful inferences. Broadly speaking a data series is said to be stationary if its mean and variance are constant (non-changing) over time and the value of covariance between two time periods depends only on the distance or lag between the two time periods and not on the actual time at which the covariance is computed. The correlation between a series and its lagged values are assumed to depend only on the length of the lag and not when the series started. This property is known as stationarity and any series obeying this is called a stationary time series. Figure 1 demonstrates that the assumption of stationary data would be violated if we analyzed OMXV index values as they are since there is a clear trend in the data series.

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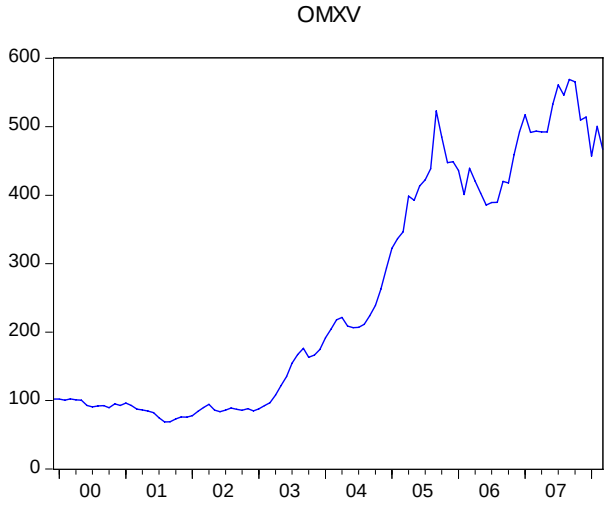

Figure 1. OMXV index values from 1999:12 to 2008:03

In order to have the data stationary we will apply differentiation for all time series (OMXV index and macroeconomic variables). Since the differentiation at the first level is not enough for some data series we differentiate all data at the second level and convert all non-stationary data to stationary. Figure 2 displays how OMXV index values have changed after differentiating them at the second level. The converted data is now acceptable for accomplishing the Granger-causality tests.

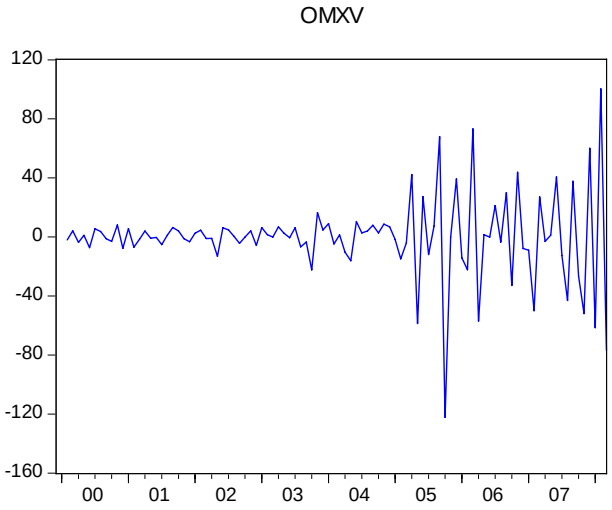

Figure 2. OMXV index values differentiated at the second level

The final results of the Granger-causality tests have been summed up in Table 1 (lag lengths vary from 2 to 24). Arrows pointing to the upper part of the table (↑) indicate which macroeconomic variable Granger-causes the OMXV index, arrows pointing to the bottom of the table (↓) indicate that a particular macroeconomic variable is Granger-caused by the OMXV index, and, finally, two-ended arrows (↕) reflect bi-directional Granger-causality. The accepted significance level is 95%.

Arrows in Table 1 indicate there is a causality relationship between a number of macroeconomic variables and stock market returns in Lithuania. It is consistent with most studies where Granger-causality tests have been applied (Agrawalla & Tuteja, 2007; Comincioli, 1995; Dritsaki & Adamopoulos, 2005; Fifield *et. al.*, 2000; Ibrahim, 1999; Karamustafa & Kucukkale, 2003; Lee, 1992; Mahdavi & Sohrabian, 1991; Nasseh & Strauss, 2000; Nishat & Shaheen, 2004; Tsoukalas, 2003; Vuyyuri, 2005). We see that some macroeconomic variables Granger-cause stock market prices (for example, gross external debt, gross

domestic product deflator, index of capital goods, import volumes, etc.), some macroeconomic variables are Granger-caused by OMX Vilnius index (for example, gross domestic product, index of own-account construction work carried out within the country, index of intermediate goods, average number of hours actually worked per employee per months, etc.), there is a bi-directional causality in some cases (for example, index of durable consumer goods, money supply (M1 & M2), balance of payments, etc.), and some macroeconomic variables under the investigation have no Granger-causality relations with stock market returns in Lithuania (index of energy products, export volumes, harmonised consumer price index, investment in tangible fixed assets, unemployment rate, construction price index, employment rate, exchange rate of the Litas against the US dollar, Vilnius interbank offered rates at different time periods, general government debt).

Table 1. Results of the Granger-causality tests: lag lengths vary from 2 to 24

Variable	OMXV																						
	Lags																						
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
GED	↑	↑	↑					↑	↑	↑	↑	↓	↑	↑	↑	↑	↑	↑					↑
GDP														↓	↓		↓	↓					
GDPd			↑	↑	↕	↑	↕	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
PPI		↓	↓			↑			↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
ICG		↑	↕	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↕	↕
Im								↑	↑	↑	↑	↑	↑	↑	↑	↕	↕	↑	↑	↑	↑	↑	↑
IDCG	↑	↑	↑	↑	↕	↕	↕	↕	↕	↑	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕
GP					↓	↓	↓		↑	↑	↑	↑	↑	↑	↑	↑	↓	↓	↕	↕	↕	↕	↕
M1	↓	↓	↓	↓	↓	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↑	↑	↑
M2	↓	↓	↓	↓	↓	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↑	↕	↑
BP		↓	↕	↕				↓												↑	↑		
RTI	↓	↓	↓	↓	↓	↕	↕	↕		↑	↑	↑	↑	↑	↑	↑	↑	↕	↑	↑	↑	↕	↕
FCE		↓																					
CPIP			↑																			↑	
IOCW					↓	↓	↓																
INCG			↑	↑		↑	↑			↑	↑	↑	↑	↑									
FDI	↑	↕	↕	↑	↓	↓	↓	↓	↕	↕	↑	↕	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
IIG		↑	↑		↓	↓	↓		↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
MI		↑	↕	↓		↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑			↓	↓
AHW								↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
GFCE		↓	↕	↓	↓	↓			↓				↓	↓	↕	↕	↕	↕	↓	↕	↓	↓	↓
GGFB											↓	↓		↕	↕	↓	↓	↓	↓	↓	↓	↓	↓
GGR								↓	↕	↕	↑	↑	↑	↑	↑	↕	↑	↑	↑	↑	↑	↑	↑
GGE										↓	↓	↓	↓	↕	↕	↕	↓			↓			
NEx																	↑	↕	↑	↑	↑	↑	↑

Our empirical findings are different compared to those studies where only unidirectional relations have been proved (Hussain & Mahmood, 2001; Nishat & Saghir, 1991; Saunders & Tress, 1981; Vuyyuri, 2005) and they support those studies where bi-directional relationships have been detected (El-Wassal, 2005; Padhan, 2007). The variety of causality relations may be explained by the fact that our analysis incorporates 40 macroeconomic variables while other studies usually take only few, most relevant macroeconomic factors (Binswanger. 2001; Ibrahim, 1999; Mukherjee & Naka, 1995; Tsoukalas, 2003; Vuyyuri, 2005).

Referring back to Table 1, we see that lag lengths have some influence on the Granger-causality relations. For example, gross external debt Granger-causes OMXV index in different lag lengths except for lag 13 where OMXV index Granger-causes gross external debt according to the empirical testing results. In such a case, it is worth accepting the predominant relationship, i.e. gross external debt Granger-causes OMXV index, and rejecting other accidental relations.

To sum up our results, we see that such macroeconomic variables as GED, GDPd, PPI, ICG, Im, GP, RTI, CPIP, INCG, FDI, MI, GGR, NEx Granger-cause stock market returns in Lithuania, i.e. they can be used to predict stock market price fluctuations, while a group of other macroeconomic factors such as GDP, FCE, IOCW, IIG, AHW, GFCE, GGFB, GGE are Granger-caused by OMXV index, i.e. stock market returns

ISSN 1822-6515
ECONOMICS & MANAGEMENT: 2009. 14

may serve as a valuable instrument to predict future tendencies for these macroeconomic factors. Some macroeconomic variables such as IDCG, M1, M2 have bidirectional causality relations with OMXV index, i.e. they are of a coincident nature, and may stand for a good instrument to testify the present tendencies both for the macroeconomic variables and for stock market returns in Lithuania.

Conclusions

The analysis carried out in this paper reveals that scholars and practitioners do not fully agree whether macroeconomic variables and stock market returns are related and influence each other even though most of the scientists have proved that either macroeconomic variables influence stock market prices or stock market prices influence macroeconomic variables. The issue has been widely debated across a variety of markets and time horizons. Besides, as some authors point out, sensitivity of stock returns has decreased drastically during the last decade.

The controversy of the subject requires a deeper analysis of the issue and the present paper puts some light to the subject by taking into consideration evidences from Lithuania. The analysis embraces 40 different macroeconomic variables and OMX Vilnius stock index reflecting stock price dynamics of Lithuanian companies and, consequently, indicating the overall country's economical situation. The Granger causality tests have been applied as the procedure to verify if there is a relationship or statistical causality between stock prices and macroeconomic variables.

The Granger causality tests reveal that some macroeconomic variables may serve as a leading indicator for stock market returns in Lithuania while OMX Vilnius stock market index may serve as a leading indicator for a group of macroeconomic variables. According to the empirical findings, bidirectional causality relationships exist between OMXV index and index of durable consumer goods and money supply (M1 & M2). Therefore, the present paper confirms the existence of relationships between stock market returns and most macroeconomic variables in Lithuania.

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