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IMPACTS OF MACROECONOMIC VARIABLES ON THE STOCK MARKET IN BULGARIA AND POLICY IMPLICATIONS

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ABSTRACT: Applying the GARCH model, this paper finds that the Bulgarian stock market index is positively associated with real GDP, the M2/GDP ratio and the U.S. stock market index and is negatively influenced by the ratio of the government deficit to GDP, the domestic real interest rate, the BGN/USD exchange rate, the expected inflation rate and the euro area government bond yield. Hence, to promote a robust stock market, the authorities are expected to pursue or maintain economic growth, fiscal discipline, moderate increase in the money supply, currency appreciation, and a relatively low interest rate or expected inflation rate.

KEYWORDS: Stock market index, Government deficit, Money supply, Interest rates, Exchange rates, World stock market

JEL Classification: E44, E52, E62, G15

Introduction

Like many other countries experiencing declining stock values during the recent global financial crisis, the Bulgarian stock market index (SOFIX) had plunged 86.7% from October 2007 to February 2009. Although the index has risen from the

trough, as of June 3, 2011, it was still 78.5% below the all time high. The significant decline in stock values is expected to affect consumption spending owing to the household wealth and liquidity effects and investment spending because of the balance sheet effect and Tobin's q theory.

This paper attempts to examine the behavior of the Bulgarian stock market index by specifying a model incorporating fiscal policy, monetary policy, the exchange rate, the world stock market index, the world interest rate and other related variables in order to estimate their respective impacts on the Bulgarian stock market index. Theoretical analysis of the signs of the partial derivative of the Bulgarian stock market index with respect to each of selected explanatory variables is presented. Advanced econometric techniques are employed in empirical work so that parameter estimates would be unbiased, consistent, and more efficient.

Most of the previous works examining the relationship between macroeconomic variables and the stock market are for the U.S. or other advanced countries (Fama, 1981, 1990; Campbell and Shiller, 1988; Fama and French, 1989; Chen, Roll and Ross, 1986; Bulmash and Trivoli, 1991; Abdullah and Hayworth, 1993; Dhakal, Kandil and Sharma, 1993; Mukherjee and Naka, 1995; Ajayi and Mougoue, 1996; Cheung and Ng, 1998; Nieh and Lee, 2001; Kim, 2003; Chaudhuri and Smiles, 2004; Ratanapakorn and Sharma, 2007; Humpe and Macmillan, 2009).

Several recent studies examine the behavior of the stock markets for Bulgaria and other related countries. Cajueiro and Tabak (2006) show that out of the nine selected European transition economies, stock market returns in Bulgaria and Ukraine do not show predictability in the short run, and all stock returns including Bulgaria exhibit strong time-varying dependence in the long run. Hasanov and Omay (2007) reveal that out of eight transition stock markets, only four stock markets including Bulgaria show weak form efficiency and exhibit unit root. Mateev and Videv (2008) find that country risk, trade deficits and unexpected inflation are important factors in affecting stock market movements in Bulgaria.

Gklezakou and Mylonakis (2009) examine the correlation among seven stock markets in Southern Europe including Bulgaria and reveal that the correlation was stronger during 2007-2009 than during 2000-2009. For example, the respective correlation coefficients between SOFIX and ATHEX and between SOFIX and DAX were 0.14 and 0.11 during 2000-2009 and were 0.32 and 0.28 during 2007-2009. Syriopoulos (2011) indicates that the stock market between six Balkan countries including Bulgaria and the U.S. and German stock markets exhibit two cointegrating vectors, suggesting that there is a long-term equilibrium relationship and that unexploited stock returns may be limited.

These previous studies have made significant contribution to the understanding of the behavior of the Bulgarian and other related stock markets. This paper attempts to formulate a comprehensive model examining the relationship between the Bulgarian stock market index and relevant macroeconomic variables.

The Model

Extending previous studies, we can express the Bulgarian stock market index as:

$$B = f(Y, D, M, R, E, \pi^e, S', R') \qquad (1)$$
$$+ \; ? \; ? \; - \; ? \; - \; + \; ?$$

where

B = the Bulgarian stock market index,
Y = real output,
D = the government deficit,
M = the money supply,
R = the domestic real interest rate,
E = the BGN/USD exchange rate (An increase means the depreciation of the lev.),
π^e = the expected inflation rate,
S' = the world stock market index, and
R' = the world interest rate.

We expect that the Bulgarian stock market index is positively affected by real output and the world stock market index, is negatively influenced by the domestic real interest rate and the expected inflation rate, and may be positively or negatively impacted by the government deficit, the money supply, the exchange rate or the world interest rate.

In the short run, increased government deficit-financed spending would increase aggregate demand, business opportunities, the interest rate and the price level and crowd out some of private spending (Darrat, 1990a, 1990b; Ardagna, 2009). In the long run, deficit- or debt-financed government spending may have a neutral effect on the stock market index and real GDP due to the Ricardian equivalence theorem (Barro, 1974). Hence, its net impact is uncertain.

The effect of increased money supply on the stock market index is unclear because it is expected to increase the expected inflation rate (π^e) and real output (Y), reduce the interest rate (R), and increase the demand for stocks (S) due to the portfolio adjustment (Dhakal, Kandil and Sharma, 1993; Abdullah and Hayworth, 1993; Mukherjee and Naka, 1995; Cheung and Lai, 1999; Chaudhuri and Smiles, 2004; Ratanapakorn and Shamar, 2007; Humpe, 2009):

$$\frac{\partial B}{\partial M} = \left(\frac{\partial B}{\partial \pi^e} \times \frac{\partial \pi^e}{\partial M}\right) + \left(\frac{\partial B}{\partial Y} \times \frac{\partial Y}{\partial M}\right) + \left(\frac{\partial B}{\partial R} \times \frac{\partial R}{\partial M}\right) + \left(\frac{\partial B}{\partial S} \times \frac{\partial S}{\partial M}\right)$$

> or < 0 (2)

The depreciation of the Bulgarian lev is expected to help exports (EX), raise import costs (IC) or domestic prices (PR), and reduce international capital inflows (CF) because domestic assets are less attractive to international investors. Increased exports would help raise stock prices whereas increased import costs or domestic prices and decreased international capital inflows would reduce business profits or the demand for stocks and the price of stocks. Thus, its net impact is unclear (Choi, 1995; Abdalla and Murinde, 1997; Nieh and Lee, 2001; Ratanapakorn and Sharma, 2007):

$$\frac{\partial B}{\partial E} = \left(\frac{\partial B}{\partial CF} \times \frac{\partial CF}{\partial E}\right) + \left(\frac{\partial B}{\partial XP} \times \frac{\partial EX}{\partial E}\right) + \left(\frac{\partial B}{\partial IM} \times \frac{\partial IC}{\partial E}\right) + \left(\frac{\partial B}{\partial PR} \times \frac{\partial PR}{\partial E}\right)$$

> or < 0 (3)

where

$$\frac{\partial CF}{\partial E} < 0, \frac{\partial EX}{\partial E} > 0, \frac{\partial IC}{\partial E} > 0, \frac{\partial PR}{\partial E} > 0$$

.

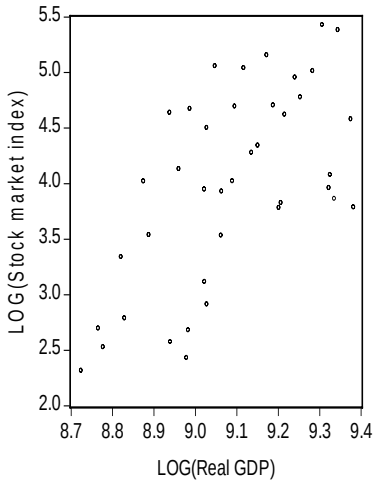
A higher world interest rate relative to the domestic interest rate would reduce international capital inflows and the demand for stocks but may cause the depreciation of the Bulgarian lev and help net exports. Therefore, its net impact is ambiguous.

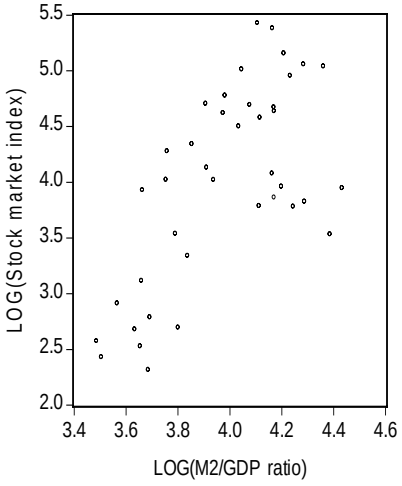
Empirical Results

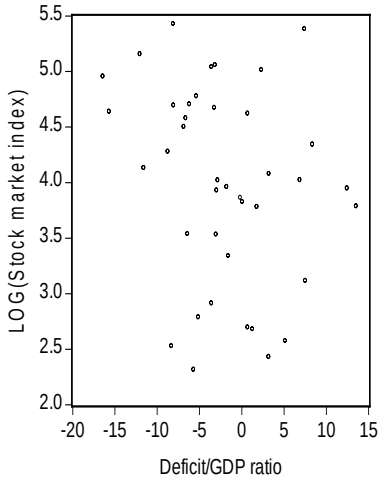
All the data were collected from the *International Financial Statistics* published by the International Monetary Fund. B is measured by the share price index with 2005 as the base year. Y is represented by the real gross domestic product in millions at the 2000 constant price. D is represented by the ratio of the government deficit to nominal GDP. M is measured by the ratio of M2 money supply to nominal GDP. R is measured by the lending rate minus the expected inflation rate, which is the average inflation rate of the past four quarters. E is measured by the BGN/USD exchange rate. An increase in the BGN/USD exchange rate means the depreciation of the Bulgarian lev. The choice of the BGN/USD exchange rate is because the absolute value of the correlation coefficient of -0.661 between the BGN/USD exchange rate and the Bulgarian stock market index is greater than the correlation coefficient of 0.423 between the nominal effective exchange rate and the Bulgarian stock market index. The U.S. share price index with 2005 as the base year is selected to represent the world stock market index mainly because the correlation coefficient of 0.835 between the Bulgarian stock market index and the U.S. stock market index is greater than the correlation coefficient of 0.698 between the Bulgarian stock market index and the German stock market index. The euro area government bond yield is chosen to represent the world interest rate because Bulgaria has become an EU member since 2007 and is required to follow the EU guidelines for the interest rate policy. Except for the expected inflation rate and the domestic real interest rate with negative values, other variables are measured in the logarithmic scale. Hence, for the variables measured in the logarithmic scale, the estimated coefficient is the elasticity or the percent change in the Bulgarian stock market index due to a 1% change in an explanatory variable. The quarterly sample ranges from 2000.Q4 to 2010.Q3. The data for the share price index are not available before 2000.Q4.

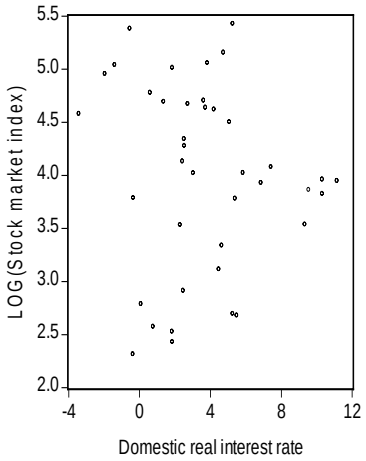
Graph 1 presents the scatter diagrams between the Bulgarian stock market index and the explanatory variables. As shown, the Bulgarian stock market index generally has a positive correlation with real GDP, the M2/GDP ratio, and the U.S. stock market index and a negative correlation with the government deficit/GDP ratio, the BGN/USD exchange rate and the euro area government bond yield. The scatter diagram for the correlation between the Bulgarian stock market index and the U.S. stock market index exhibits some outliers in early years mainly because the U.S. bearish stock market during most of 2001-2003 was not transmitted to the Bulgarian stock market. The graphical relationship between the Bulgarian stock market index and the domestic real interest rate or the expected inflation rate is not as clear as other relationships and will be determined by hypothesis tests.

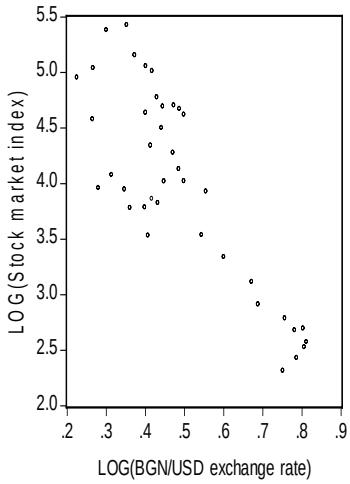
Graph 1: Scatter Diagrams

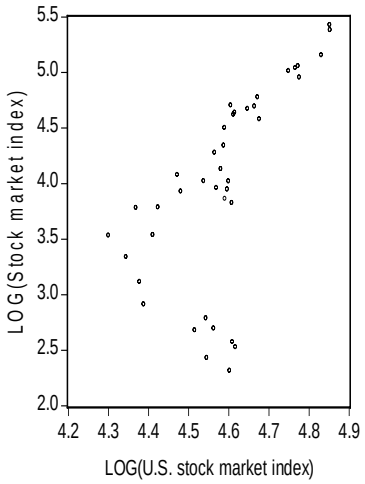


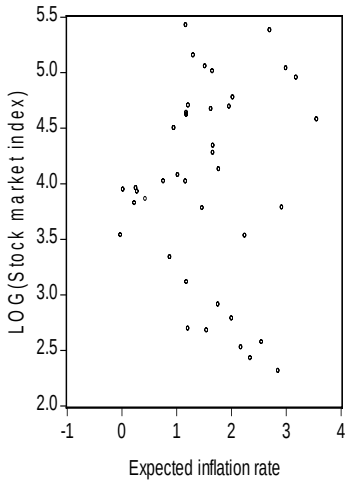







LOG(Stock market index)
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
.2
.3
.4
.5
.6
.7
.8
.9
LOG(BGN/USD exchange rate)


LOG(Stock market index)
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
4.2
4.3
4.4
4.5
4.6
4.7
4.8
4.9
LOG(U.S. stock market index)


LOG(Stock market index)
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
-1
0
1
2
3
4
Expected inflation rate

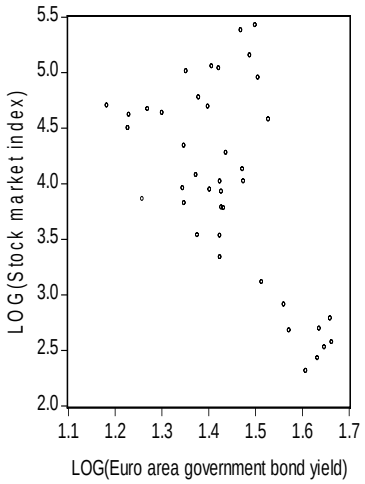

LOG(Stock market index)
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
LOG(Euro area government bond yield)

Table 1 presents the estimated regressions and related statistics. Figures in the parenthesis are t-statistics. The GARCH (Engle, 1982, 2001; Bollerslev, 1986) model is employed in empirical work as the error variance is a function of the lagged squared error and the lagged error variance. The base model is reported in Version I. Approximately 90.2% of the variation in the Bulgarian stock market index can be explained by the eight right-hand side variables. All the estimated coefficients are significant at the 1% level. The Bulgarian stock market index is positively impacted by real GDP, the M2/GDP ratio and the U.S. stock market index and is negatively influenced by the government deficit/GDP ratio, the real interest rate, the BGN/USD exchange rate, the expected inflation rate, and the euro area government bond yield.

Table 1: Estimated Regressions of the Bulgarian Stock Market Index: 2000.Q4 - 2010.Q3

	I	II	III	IV
Real GDP	0.999 (28.736)	1.202 (10.845)	1.110 (14.630)	0.792 (8.238)
Government deficit/GDP ratio	-0.006 (-5.947)		-0.001 (-1.086)	-0.007 (-9.164)
Government borrowing/GDP ratio		-0.006 (-4.779)		
M2/GDP ratio	0.490 (17.681)	0.391 (4.543)		-0.035 (-0.429)
Real interest rate	-0.274 (-18.802)	-0.252 (-14.117)	-0.273 (-16.310)	-0.353 (-21.040)
BGN/USD exchange rate	-2.318 (-28.204)	-1.950 (-15.705)		-3.603 (-23.746)
Nominal effective exchange rate			5.785 (15.872)	
Expected inflation rate	-1.054 (-14.984)	-1.003 (-14.597)	-0.102 (-15.407)	-1.360 (-24.649)
U.S. stock market index	2.393 (65.207)	2.524 (25.539)	2.963 (35.761)	
German stock market index				1.190 (35.078)
Euro area government bond yield	-0.464 (-4.766)	-0.766 (-4.007)	-0.576 (-4.960)	0.012 (0.107)
Constant	-13.493	-15.451	-45.820	-3.366

	(-38.272)	(-15.378)	(-34.012)	(-3.150)
Adjusted R-squared	0.902	0.920	0.901	0.891
AIC	-0.454	-0.254	0.079	-0.136
SC	0.085	0.301	0.628	0.413
F-statistic	31.081	37.468	30.692	27.482
Estimation method	GARCH	GARCH	GARCH	GARCH

Notes: Figures in the parenthesis are t-statistics. AIC is Akaike information criterion. SC is Schwarz information criterion.

According to estimated coefficients, the Bulgarian stock market index is more sensitive to a percent change in real GDP, the exchange rate or the U.S. stock market index than other variables. For example, a 1% change in the U.S. stock market index, the BGN/USD exchange rate and real GDP would change the Bulgarian stock market index by +2.393%, -2.318%, +0.999%, respectively. In comparison, a 1% increase in the M2/GDP ratio would result in 0.490% increase in the Bulgarian stock market index; and if the euro area government bond yield rises 1%, the Bulgarian stock market index would decline by 0.464%.

To determine whether the above regression results may be spurious, the ADF test on the regression residuals is applied. Based on the Schwarz information criterion, a lag length of zero is selected. The value of the test statistic is estimated to be -4.723, which is greater than the critical value of -2.626 in absolute values at the 1% level. Hence, the regression outcomes are not spurious, and these time series variables have a long-term stable relationship.

Several different versions are estimated. If the ratio of government borrowing to GDP is selected in lieu of the ratio of the government deficit to GDP (Version II), its negative coefficient is significant at the 1% level, and other results remain similar. When the nominal effective exchange rate replaces the BGN/USD exchange rate (Version III), its positive coefficient is significant at the 1% level, but the negative coefficient of the government deficit/GDP ratio becomes insignificant at the 10% level. If the German stock market index replaces the U.S. stock market index (Version IV), its positive coefficient is significant at the 1% level. However, the coefficients of the M2/GDP ratio and the euro area government bond yield become insignificant at the 10% level. The estimated coefficient suggests that if the German stock market rises 1%, the Bulgarian stock market

index will increase 1.190%, which is smaller than the 2.393% increase in response to a 1% increase in the U.S. stock market as shown in Version I.

Summary and Conclusions

This paper has examined the relationship between the Bulgarian stock market index and selected macroeconomic variables based on a sample during 2000.Q4 – 2010.Q3. More real GDP, a lower government defict/GDP ratio, a higher M2/GDP ratio, a lower real interest rate or expected inflation rate, a higher U.S. stock market index, or a lower euro area government bond yield would increase the Bulgarian stock market index. When fiscal policy is represented by the ratio of government borrowing to GDP, similar results are obtained. If the nominal effective exchange rate is used to represent the exchange rate, its positive coefficient is significant at the 1% level, but the coefficient of the ratio of the government deficit to GDP becomes insignificant. If the German stock market index is used to represent the world stock market index, its positive coefficient is significant at the 1% level, but the coefficients of the ratio of M2 to GDP and the euro area government bond yield will become insignificant at the 10% level. Therefore, the choice of the variable to represent the exchange rate or the world stock market index may affect the outcomes.

There are several policy implications. To maintain a healthy stock market, the authorities would need to pursue economic growth, fiscal discipline, moderate increase in the money supply, a relatively low interest rate or inflation rate, and the appreciation of the Bulgarian lev. While increased money supply to accommodate increased economic activities would be conducive to the stock market, too much money supply would cause higher inflation expectations and be harmful to the stock market. Although the empirical finding shows that the appreciation of the Bulgarian lev would help the stock market, it is possible that further appreciation of the Bulgarian lev may hurt the Bulgarian stock market index because its negative impact on reduced exports may outweigh its positive impacts on increased international capital inflows, lower import costs and lower prices. It appears that the impact of the U.S. stock market index on the Bulgarian stock market index is greater than the impact of the German stock market index on the Bulgarian stock market index. Hence, any study which does not include the U.S. stock market index would miss a key variable in regression analysis. The authorities need to monitor the external factors such as the U.S. stock market index, the German stock market index, and the euro area government bond yield in order to forecast their potential impacts when any change occurs.

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