

Yu Hsing¹

UDK 336.761.5(497.5)

Preliminary paper
Prethodno priopćenje

MACROECONOMIC VARIABLES AND THE STOCK MARKET: THE CASE OF CROATIA

ABSTRACT

This paper examines the relationship between the Croatian stock market index and relevant macroeconomic variables. Applying the GARCH model, this paper finds that the Croatian stock market index is positively associated with real GDP, the M1/GDP ratio, the German stock market index and the euro area government bond yield and is negatively influenced by the ratio of the government deficit to GDP, the domestic real interest rate, the HRK/USD exchange rate, and the expected inflation rate. Hence, to promote a healthy stock market, the authorities are expected to pursue economic growth, fiscal discipline, moderate increase in the money supply, the appreciation of the kuna, and a relatively low interest rate or expected inflation rate.

Keywords: CROBEX, government deficits, money supply, interest rates, exchange rates, world stock markets

JEL Classification: E44, E52, E62, G15

1. INTRODUCTION

Like other transition economies suffering declining stock values due to the recent global financial crisis, the Croatian stock market index (CROBEX) had plunged 76.5% from October 2007 to March 2009, which was greater than the decline of 56.6% of the U.S. S&P 500 index. Although the index has shown an upward trend, as of June 20, 2011, it was still 58.6% below the all time high. The substantial decrease in stock prices would reduce 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 Croatian 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 macroeconomic variables in order to estimate their respective impacts on the Croatian stock market index. Theoretical analysis of the sign of the partial derivative of the Croatian stock market index with respect to the money supply, the HRK/USD exchange rate or the world interest rate is presented. Advanced econometric techniques are employed in empirical work so that parameter estimates would be unbiased, consistent, and more efficient.

¹ Professor of Economics, Department of Management & Business Administration, College of Business, Southeastern Louisiana University, Hammond, Louisiana 70402, USA. E-mail: yhsing@selu.edu.

Most previous studies of the relationship between the stock market performance and macroeconomic variables focus on 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; and others). Among the macroeconomic variables used by these authors are industrial production or real GDP, the money supply, the consumer price index or the inflation rate, interest rates, exchange rates, foreign interest rates, and/or foreign stock market indexes. They find that these macroeconomic variables have significant impacts of on stock market indexes in the U.S. and other advanced countries to varying degrees.

Several recent studies examine the behavior of the stock markets for Croatian and other related countries. Erjavec and Cota (2007) find that returns on the DJIA and the NASDAQ have more impacts on the returns on the CROBEX index than the returns on the German DAX and the British FTSE, that the past return of the CROBEX index does not affect the current return, and that the lagged volume of trading reduces the returns on CROBEX. Ivanov and Lovrinović (2008) show that CROBEX is negatively affected by the money supply, the interest rate and the allocated required reserves and positively influenced by the household loans. Gklezakou and Mylonakis (2009) examine the correlation among seven stock markets in Southern Europe including Croatia and reveal that the correlation was weaker during 2000-2009 than that during the global financial crisis in 2007-2009. For example, the respective correlation coefficients between CROBEX and ATHEX and between CROBEX and DAX were 0.29 and 0.29 during 2000-2009 and were 0.44 and 0.62 during 2007-2009. Benaković and Posedel (2010) examine 14 major stocks in Croatia and indicate that CROBEX has the largest impact on individual stock prices and that stock prices are positively affected by industrial production, interest rates, and oil prices and negatively influenced by the inflation rate. They also show that CROBEX has a positive risk premium and that the inflation rate has a negative risk premium in 2004 and a positive risk premium in 2008. Morales and Andreosso-O'Callaghan (2010) study the contagion effect for many countries including Croatia and find that there is evidence of the contagion effect from the DJIA or the S&P500 index to the CORBEX index.

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

2. THE MODEL

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

$$S = f(Y, B, M, R, \varepsilon, \pi^e, S^*, R^*) \quad (1)$$

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where

- S = the Croatian stock market index,
- Y = real output,
- B = the government budget deficit,
- M = the money supply,
- R = the domestic real interest rate,
- ε = the HRK/USD exchange rate (An increase means the depreciation of the kuna.),
- π^e = the expected inflation rate,

S^* = the world stock market index, and

R^* = the world interest rate.

We expect that the Croatian 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 (D) and stock prices (S) due to the portfolio adjustment (Dhokal, Kandil and Sharma, 1993; Abdullah and Hayworth, 1993; Mukherjee and Naka, 1995; Cheung and Lai, 1999; Chaudhuri and Smiles, 2004; Ratanapakorn and Sharma, 2007; Humpe, 2009):

$$\frac{\partial S}{\partial M} = \left(\frac{\partial S}{\partial \pi^e} \times \frac{\partial \pi^e}{\partial M} \right) + \left(\frac{\partial S}{\partial Y} \times \frac{\partial Y}{\partial M} \right) + \left(\frac{\partial S}{\partial R} \times \frac{\partial R}{\partial M} \right) + \left(\frac{\partial S}{\partial D} \times \frac{\partial D}{\partial M} \right) > \text{ or } < 0, \quad (2)$$

where

$$\frac{\partial \pi^e}{\partial M} > 0, \frac{\partial Y}{\partial M} > 0, \frac{\partial R}{\partial M} < 0, \frac{\partial D}{\partial M} > 0.$$

The depreciation of the Croatian kuna is expected to reduce international capital inflows (F) because domestic assets are less attractive to international investors, help exports (X), and raise import costs (C) or domestic prices (P):

$$\frac{\partial S}{\partial \varepsilon} = \left(\frac{\partial S}{\partial F} \times \frac{\partial F}{\partial \varepsilon} \right) + \left(\frac{\partial S}{\partial X} \times \frac{\partial X}{\partial \varepsilon} \right) + \left(\frac{\partial S}{\partial C} \times \frac{\partial C}{\partial \varepsilon} \right) + \left(\frac{\partial S}{\partial P} \times \frac{\partial P}{\partial \varepsilon} \right) > \text{ or } < 0, \quad (3)$$

where

$$\frac{\partial F}{\partial \varepsilon} < 0, \frac{\partial X}{\partial \varepsilon} > 0, \frac{\partial C}{\partial \varepsilon} > 0, \frac{\partial P}{\partial \varepsilon} > 0.$$

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).

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 Croatian kuna and help net exports. Therefore, its net impact is ambiguous.

$$\frac{\partial S}{\partial R^*} = \left(\frac{\partial S}{\partial F} \times \frac{\partial F}{\partial R^*} \right) + \left(\frac{\partial S}{\partial \varepsilon} \times \frac{\partial \varepsilon}{\partial R^*} \right) > \text{ or } < 0, \quad (4)$$

where

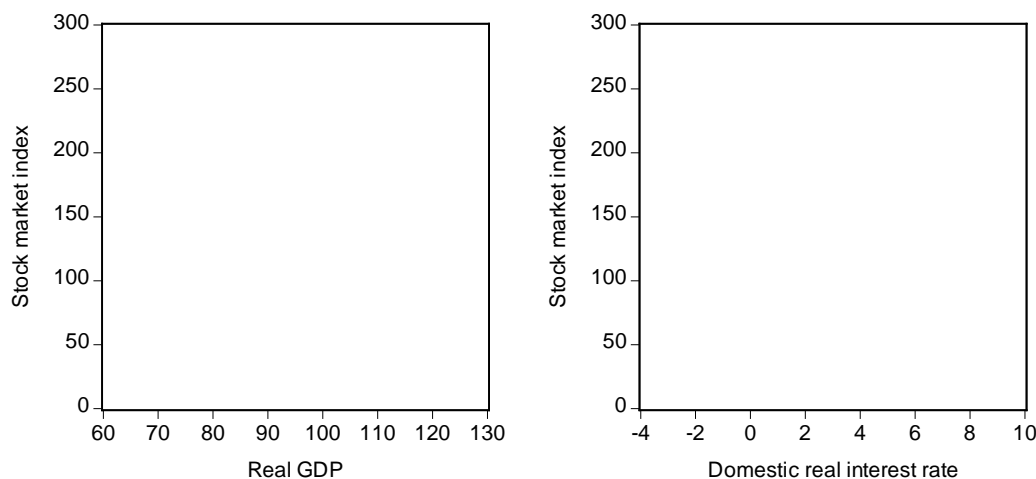
$$\frac{\partial F}{\partial R^*} < 0, \frac{\partial \varepsilon}{\partial R^*} > 0$$

3. EMPIRICAL RESULTS

The source of the data came from the *International Financial Statistics*, which is published by the International Monetary Fund, and the Croatian National Bank. S is measured by the share price index with 2005 as the base year. Y is represented by the lagged real GDP index with 2005 as the base year. B is measured by the ratio of the government deficit to nominal GDP. M is measured by the ratio of M1 money supply to nominal GDP. The data for M2 are not published by the *International Financial Statistics*. R is measured by the money market rate minus the expected inflation rate, which is the average inflation rate of the past four quarters. ε is measured by the HRK/USD exchange rate. An increase in the HRK/USD exchange rate means the depreciation of the Croatian kuna. The choice of the HRK/USD exchange rate is because the absolute value of the correlation coefficient between the HRK/USD exchange rate and the Croatian stock market index is greater than the correlation coefficient between the nominal effective exchange rate and the Croatian stock market index. The German share price index with 2005 as the base year is selected to represent the world stock market index mainly because of the closer economic and financial ties between Croatia and Germany. The euro area government bond yield is chosen to represent the world interest rate because Croatia is a candidate for an EU member and is expected 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 Croatian stock market index due to a 1% change in an explanatory variable. The quarterly sample ranges from 1997.Q3 to 2010.Q1 with 51 observations. The data for the share price index before 1997.Q3 are not available.

Graph 1 presents the scatter diagrams between the Croatian stock market index and the explanatory variables. Except for some outliers, the Croatian stock market index generally has a positive correlation with real GDP, the M1/GDP ratio, and the German stock market index and a negative correlation with the government deficit/GDP ratio, the domestic real interest rate, the HRK/USD exchange rate, and the expected inflation rate. Note that the flat portion in the scatter diagram between the Croatian stock market index and the German stock market index suggests that the linkage or co-movement between these two stock markets was not as strong as that in recent years.

Graph 1. Scatter Diagrams



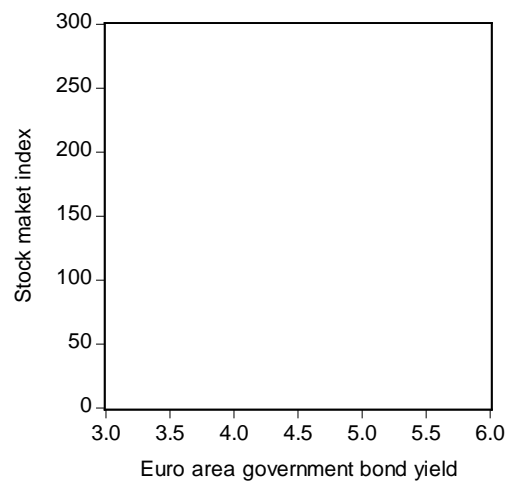
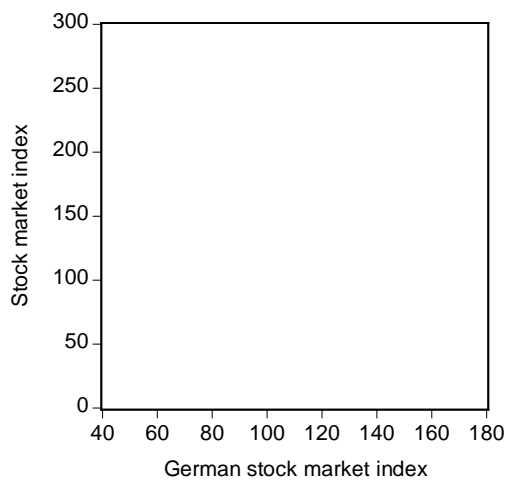
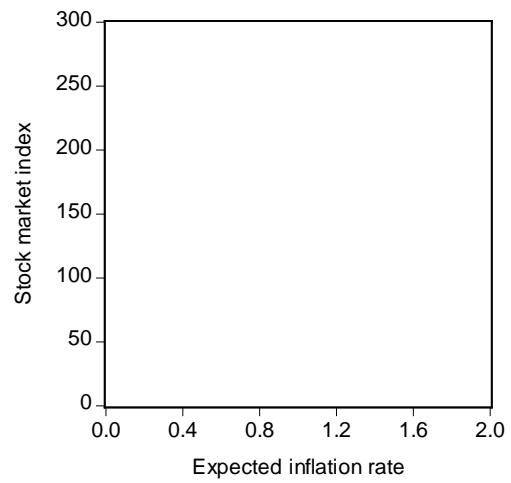
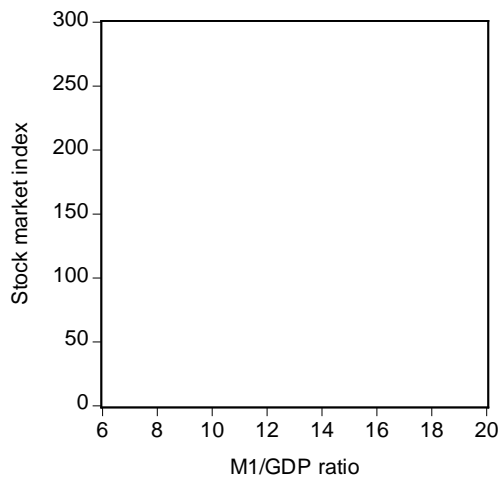
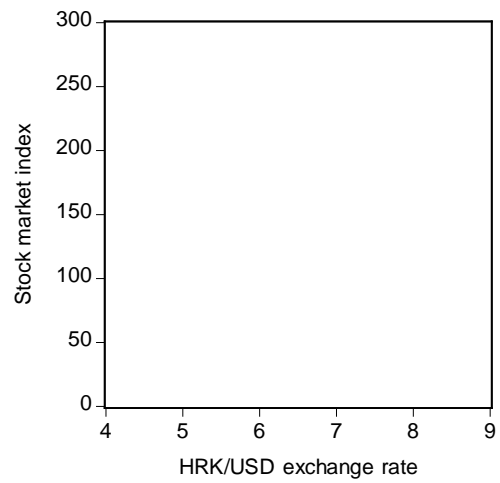
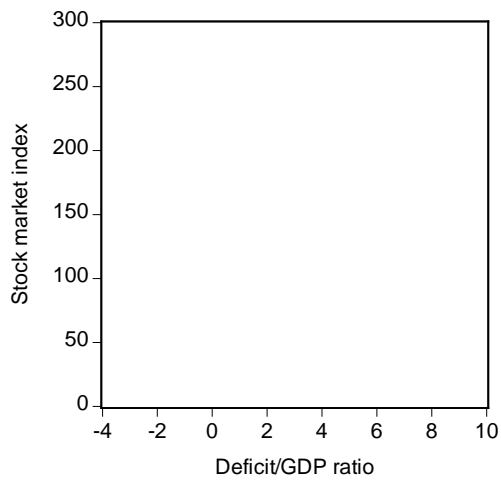


Table 1. Estimated Regressions of the Croatian Stock Market Index: 1997.Q3-2010.Q1

	I	II	III	IV
Real GDP	0.629 (9.823)	0.729 (8.280)	0.640 (9.713)	0.758 (5.282)
Government deficit/GDP ratio	-0.007 (-2.188)	-0.008 (-4.079)	-0.008 (-2.712)	-0.011 (-3.411)
M1/GDP ratio	1.280 (18.539)	1.140 (17.175)	1.309 (14.929)	1.311 (12.632)
Domestic real interest rate	-0.009 (-3.274)	-0.012 (-4.193)	-0.016 (-5.864)	-0.017 (-5.160)
HRK/USD exchange rate	-1.208 (-12.797)		-1.224 (-17.371)	-1.089 (-9.027)
Nominal effective exchange rate		4.982 (77.592)		
Expected inflation rate	-0.203 (-10.971)	-0.212 (-15.805)	-0.188 (-8.240)	-0.070 (-1.991)
German stock market index	0.948 (34.474)	1.050 (51.392)	1.050 (17.905)	0.826 (12.522)
U.S. stock market index			-0.213 (-2.055)	
Euro area government bond yield	0.373 (7.276)	0.198 (5.346)	0.375 (7.448)	
U.S. government bond yield				0.308 (1.968)
Constant	-4.282 (-9.328)	-29.655 (-414.755)	-3.886 (-20.878)	-4.599 (-8.302)
Adjusted R-squared	0.902	0.910	0.906	0.905
AIC	-0.731	-0.802	-0.725	-0.682
SC	-0.238	-0.347	-0.195	-0.190
F-statistic	39.465	47.021	38.005	40.603
Estimation method	EGARCH	EGARCH	EGARCH	EGARCH

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

The correlation between the Croatian stock market index and the euro area government bond yield is not as clear as other correlations and will be determined by the hypothesis test.

Table 1 presents the estimated regressions and related statistics. Figures in the parenthesis are z-statistics. The EGARCH (Engle, 1982, 2001; Nelson, 1991) 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 Croatian stock market index can be explained by the eight right-hand side variables. All the estimated coefficients are significant at the 1% or 5% level. The Croatian stock market index is positively impacted by real GDP, the M1/GDP ratio, the German stock market index and the euro area government bond yield and is negatively influenced by the government deficit/GDP ratio, the domestic real interest rate, the HRK/USD exchange rate, and the expected inflation rate.

According to estimated coefficients, the Croatian stock market index is more sensitive to a percent change in real GDP, the M1/GDP ratio, the exchange rate or the German stock market index than other variables. For example, a 1% change in real GDP, the M1/GDP ratio, the HRK/USD exchange rate, and the German stock market index would change the Croatian stock market index by +0.629%, +1.280%, -1.208%, and +0.948%, respectively.

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 -5.840, which is greater than the critical value of -2.612 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. When the HRK/USD exchange rate is substituted by the nominal effective exchange rate (Version II), its positive coefficient is significant at the 1% level, and other results are similar. If the U.S. stock market index is added to the estimated regression (Version III), its negative significant coefficient is inconsistent with the expected sign mainly due to a high degree of multicollinearity. If the U.S. government bond yield is in lieu of the euro area government bond yield (Version IV), its positive coefficient is significant at the 5% level. Therefore, the choice of the variables or measurements may affect the outcomes.

4. SUMMARY AND CONCLUSIONS

This paper has examined the relationship between the Croatian stock market index and selected macroeconomic variables based on a sample during 1997.Q3 – 2010.Q1. More real GDP, a lower government deficit/GDP ratio, a higher M1/GDP ratio, a lower real interest rate or expected inflation rate, a higher German stock market index, or a higher euro area government bond yield would increase the Croatian stock market index. If the nominal effective exchange rate, the U.S. stock market index or the U.S. government bond yield is used or included in the estimated regression, empirical outcomes may change.

There are several policy implications. To maintain a healthy stock market, the authorities would need to pursue economic growth, fiscal prudence, moderate increase in the money supply, a relatively low interest rate or inflation rate, and the appreciation of the Croatian kuna. While increased money supply to accommodate increased economic activities would be conducive to the stock market, too much money supply would cause inflation expectations to rise and be harmful to the stock market. Although the empirical finding shows that the appreciation of the Croatian kuna would help the stock market, it is possible that further appreciation of the Croatian kuna may hurt the Croatian 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 German stock market index is more appropriate than the U.S. stock market index. Hence, any study which does not include the German stock market index would miss a key variable in regression analysis. The authorities need to monitor the external factors in order to forecast their potential impacts when any change occurs.

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MAKROEKONOMSKE VARIJABLE I TRŽIŠTE DIONICA: SLUČAJ HRVATSKE

SAŽETAK

Ovaj rad istražuje odnos između hrvatskog burzovnog indeksa i relevantnih makroekonomskih varijabli. Koristeći GARCH model, zaključujemo da je hrvatski burzovni indeks pozitivno povezan s realnim BDP-om, omjerom M1/BDP, njemačkim burzovnim indeksom i prinosom državnih obveznica euro zone, dok negativno na njega utječu omjer državnog deficita i BDP-a, domaća stvarna kamatna stopa, tečaj HRK/USD i očekivana stopa inflacije. Stoga, kako bi se promoviralo zdravo tržište dionica, vlada mora težiti ekonomskom rastu, fiskalnoj disciplini, blagom porastu opskrbe novcem, aprecijaciji kune i relativno niskoj kamatnoj stopi ili očekivanoj stopi inflacije.

Ključne riječi: CROBEX, vladin deficit, opskrba novcem, kamatne stope, tečaj, svjetska tržišta dionica

JEL klasifikacija: E44, E52, E62, G15