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The Stock Market and Macroeconomic Factors in Japan and Policy Implications

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Abstract

This paper finds that the Japanese stock market index is positively affected by industrial production, is negatively associated with the ratio of the government deficit to GDP, the domestic real interest rate and the expected inflation rate, and exhibits a nonlinear relationship with the ratio of M2 to GDP or the nominal effective exchange rate. Increased M2/GDP ratio would raise (reduce) the stock market index if the M2/GSP ratio is less (greater) than the critical value of 100.87%. An appreciation of the yen would increase (reduce) the stock market index if the nominal effective exchange rate is less (greater) than the critical value of 52.44. To promote a robust stock market, the authorities are expected to pursue economic growth, fiscal discipline, and a relatively low interest rate and expected inflation rate. Too much money supply relative to GDP or continual appreciation of the yen would impair the Japanese stock market index.

Keywords: Stock market index, government deficit, money supply, exchange rate, interest rate, foreign stock market

1. Introduction

Like many other economies suffering from substantial declining stock values during the global financial crisis, the Japanese Nikkei 225 index had dropped 61.37% from July 2007 to March 2009, compared with the 56.6% decline of the S&P 500 index during its recent worst-performing period. Although the index has shown an upward trend, as of March 4, 2011, it was still 41% below the all time high. The significant decrease in stock prices is expected to affect household consumption spending attributable to the wealth and liquidity effects and business investment spending owing to Tobin's q theory and the balance sheet effect. While individual stock prices may be subject to firm specific factors, the overall stock market index is expected to be influenced by the macroeconomic factors such as fiscal policy, monetary policy, the exchange rate, the inflation rate, the foreign stock market index, etc.

This paper attempts to examine the relationship between the Japanese stock market index and relevant macroeconomic variables and has several focuses. First, the exchange rate may affect the stock market index in different manners. A depreciation of the yen may help exports and stock prices whereas an appreciation of the yen may attract international investors, increase the

demand for stocks and other financial assets, reduce import costs, and lower domestic prices, which would help increase stock prices. Hence, whether the depreciation or appreciation of the yen would help or impair stock prices remains to be an empirical question. Second, it attempts to analyze whether the Japanese stock market index and the money supply may have a nonlinear relationship, suggesting that they have a positive (negative) relationship when the money supply is less (greater) than a certain critical value. Moderate increase in the money supply would enhance economic and business activities and increase stock prices. On the other hand, too much money supply would result in inflationary expectations, higher interest rates, and lower stock prices. Third, other relevant variables such as fiscal policy, the interest rate, the foreign stock market index and other relevant variables are considered in order to estimate their respective impacts on the Japanese stock market index.

2. Literature Survey

Many previous studies examining the impact of macroeconomic variables on the stock market focus on the U.S. (Fama, 1981, 1990; Campbell and Shiller, 1988; Fama and French, 1989; Chen, Roll and Ross, 1986; Darrat, 1990a, 1990b; Bulmash and Trivoli, 1991; Abdullah and Hayworth, 1993; Dhakal, Kandil and Sharma, 1993; Cheung and Ng, 1998; Kim, 2003; Ratanapakorn and Sharma, 2007; Humpe and Macmillan, 2009; and others). These studies have considered real GDP or industrial production, the money supply, interest rates, exchange rates, the consumer price indexes or inflation rates, foreign stock market indexes, and other related variables. Their findings suggest that most of these macroeconomic variables have significant impacts on the U.S. stock market index to varying degrees.

Several previous works analyze the subject for Japan and related countries. Applying the arbitrage pricing theory (APT) in the study of the Japanese equity market, Hamao (1988) reveals that the Japanese stock market index is significantly affected by a change in the expected inflation rate and an unanticipated change in the risk premium and the slope of the term structure, is weakly affected by industrial production and terms of trade, and is not affected by an unanticipated change in the exchange rate and a change in the oil price.

Stone and Ziemba (1993) study the stock and land prices in Japan. Their analysis is summarized as follows. Stock prices and land prices are highly corrected. Stock prices are more volatile than land prices. Stock returns lead land returns. Interest rates, earning growth, or dividend price ratios are major fundamental factors determining stock prices. Monetary easing in the mid-1980s caused rising stock prices whereas monetary tightening beginning in 1989 caused declining stock prices. Even though a fiscal stimulus program and a very low interest rate were initiated by August 1992, it was very difficult to obtain credit for financing stock or land transactions. There is lack of support for the speculative bubble in the stock and essential land markets whereas there is evidence of the speculative bubble in speculative land.

Choi (1995) finds that the relative stock price between Japan and the U.S. is positively affected by the U.S. dollar/Yen exchange rate, expected relative earnings, negatively influenced by the relative dividend payment. The effect of the relative cost of capital is weak.

Mukherjee and Naka (1995) reveal that the Tokyo stock exchange (TSE) index is positively associated with industrial production, the M1 money supply, the yen/USD exchange rate and the

call money rate and negatively affected by the consumer price index and the long-term government bond yield. They also show that these variables have more than one cointegrating vector. Mahmood and Dinniah (2009) show that the stock market index, the exchange rate, the inflation rate and industrial production in Japan are cointegrated in the long-run but do not have a cointegration relationship in the short run. Yeh and Chi (2009) report that real stock returns and inflation in Japan do not show a long-term relationship or negative co-movements in the short run.

A comparison of these previous studies suggests that some of the findings are inconclusive. For example, Choi (1995) finds that an appreciation of the yen would raise the stock price whereas Mukherjee and Naka (1995) show that a depreciation of the yen would increase the stock price. Mukherjee and Naka (1995) indicate that the consumer price index has a negative impact on the stock price in Japan whereas Yeh and Chi (2009) report that the stock price and the inflation rate in Japan do not exhibit a long-term relationship and do not show any co-movement in the short run. This paper attempts to examine the impact of selected macroeconomic variables on Japan's stock market index and focuses on the nonlinear relationship between the Japanese stock market index and the money supply or the exchange rate.

3. The Model

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

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

where

N = the Japanese stock market index,
E = the nominal effective exchange rate (An increase means an appreciation of the Japanese yen.),
D = the government deficit,
M = the money supply,
Y = real output,
R = the domestic real interest rate,
π^e = the expected inflation rate, and
S' = the foreign stock market index.

We expect that the Japanese stock market index is positively affected by real output and the foreign stock market index, is negatively influenced by the domestic real interest rate , and may be positively or negatively associated with the nominal effective exchange rate, the government deficit, the money supply or the expected inflation rate.

An appreciation of the Japanese yen would increase international capital inflows (F), reduce exports (X), and lower import costs (C) and domestic prices (P) (Choi, 1995; Ajayi and Mougoue, 1996; Abdalla and Murinde, 1997; Nieh and Lee, 2001; Ratanapakorn and Sharma, 2007):

$$\frac{\partial N}{\partial E}=\left(\frac{\partial N}{\partial F}\times\frac{\partial F}{\partial E}\right)+\left(\frac{\partial N}{\partial X}\times\frac{\partial X}{\partial E}\right)+\left(\frac{\partial N}{\partial C}\times\frac{\partial C}{\partial E}\right)+\left(\frac{\partial N}{\partial P}\times\frac{\partial P}{\partial E}\right)>\text{ or }<0, \qquad (2)$$

where

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

Decreased exports would reduce stock prices whereas increased international capital inflows and lower import costs and domestic prices would raise stock prices. Therefore, the net impact of currency appreciation is ambiguous.

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 the private spending (Darrat, 1990a, 1990b; Ardagna, 2009). In the long run, deficit-financed government spending may have a neutral effect on the economic and financial variables due to the Ricardian equivalence theorem (Barro, 1974). Hence, its net impact is uncertain.

Increased money supply is expected to change the nominal interest rate (r) and increase real output, the expected inflation rate and the demand for stocks (S) due to the portfolio adjustment in the short run (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):

$$\frac{\partial N}{\partial M}=\left(\frac{\partial N}{\partial r}\times\frac{\partial r}{\partial M}\right)+\left(\frac{\partial N}{\partial Y}\times\frac{\partial Y}{\partial M}\right)+\left(\frac{\partial N}{\partial \pi^{e}}\times\frac{\partial \pi^{e}}{\partial M}\right)+\left(\frac{\partial N}{\partial S}\times\frac{\partial S}{\partial M}\right)>\text{ or }<0. \qquad (3)$$

where

$$\frac{\partial r}{\partial M}>or<0,\frac{\partial Y}{\partial M}>0,\frac{\partial \pi^{e}}{\partial M}>0,\frac{\partial S}{\partial M}>0.$$

Increased money supply may reduce or increase the nominal interest rate, depending upon whether the liquidity effect would dominate other effects. A higher output and increased demand for stocks would raise stock prices whereas a higher expected inflation rate may increase or reduce stock prices. Therefore, its net impact is unclear.

A higher expected inflation rate may increase stock prices as stocks are a hedge against inflation or reduce stock prices due to the proxy hypothesis, the money illusion hypothesis, and the real after-tax hypothesis (Fisher, 1930; Modigliani and Cohn, 1979; Feldstein, 1980; Fama, 1981).

A preliminary analysis of the data shows that there seems to exist a nonlinear relationship between the stock market index and the nominal effective exchange rate or the money supply. Hence, we specify the following estimated equation:

$$N = h(E, E^2, D, M, M^2, Y, R, \pi^e, S'). \quad (4)$$

where E^2 is the squared nominal effective exchange rate and M^2 is the squared ratio of M2 to GDP. The partial derivative of N with respect to E is given by:

$$\frac{\partial N}{\partial E} = \alpha_1 + 2\alpha_2 E, \quad (5)$$

where α_1 and α_2 are the respective coefficients of E and E^2 in equation (4), $\alpha_1 > 0,$ and $\alpha_2 < 0.$ Solving for the first-order condition, we find the critical value of E that maximizes N:

$$\overline{E} = -\frac{\alpha_1}{2\alpha_2}. \quad (6)$$

Similarly, taking the partial derivative of N with respect to M and solving for the first-order condition, we find the critical value of M that maximizes N:

$$\overline{M} = -\frac{\alpha_4}{2\alpha_5} \quad (7)$$

where α_4 and α_5 are the respective coefficients for M and M^2 in equation (4), $\alpha_4 > 0,$ and $\alpha_5 < 0.$

4. Empirical Results

N is represented by the share price index with 2005 as the base year. E is measured by the trade-weighted nominal effective exchange rate. An increase means an appreciation of the Japanese yen. The choice of the nominal effective exchange rate is an appropriate measure because Japan has many trading partners. D is measured by the ratio of the government deficit to nominal GDP. M is represented by the ratio of M2 money supply to nominal GDP as M2 is a broader measure of the monetary aggregate. Y is represented by industrial production with 2005 as the base year. The choice of industrial production over real GDP is because the correlation coefficient between the Japanese stock market index and industrial production is 0.772 whereas the correlation coefficient between the Japanese stock market index and real GDP is 0.602. R is measured by the

lending rate minus the expected inflation rate, which is estimated as the average inflation rate of the last four quarters. The U.S. S&P500 index is selected to represent the foreign stock market index. The government deficit was taken from Japan's Ministry of Finance, the U.S. S&P500 index was collected from Standard & Poor's, and all other variables were obtained from the *International Financial Statistics* published by the International Monetary Fund. Except for the expected inflation rate, the domestic real interest rate and the government deficit/DGP ratio with negative values before or after a logarithmic transformation, other variables are measured in the logarithmic scale. The annual sample ranges from 1975 to 2009. The data for the nominal effective exchange rate are not available before 1975.

Graph 1 presents the scatter diagrams for the Japanese stock market index and selected explanatory variables. As shown, except for a few outliers, the Japanese stock market index generally has a positive correlation with industrial production and a negative correlation with the ratio of the government deficit to GDP or the expected inflation rate.The correlation between the Japanese stock market index and the U.S. S&P500 index is not as clear as expected and needs to be tested empirically. The scatter diagram for the Japanese stock market index and the nominal effective exchange rate suggests that an initial appreciation of the Japanese yen would cause the stock market index to rise whereas a further appreciation of the Japanese yen beyond a certain critical value would reduce the Japanese stock market index. According to the scatter diagram for the Japanese stock market index and the ratio of M2 to GDP, if the M2/GDP ratio is below (above) a certain critical value, a higher M2/GDP ratio will increase (reduce) the Japanese stock market index.

Table 1 presents the estimated regressions and related statistics. Figures in the parenthesis are z-statistics. The EGARCH model is employed in empirical work. The base model is reported in Version I. Approximately 90.5% of the change in the Japanese stock market index can be explained by the explanatory variables with significant coefficients. Except for the coefficient of the U.S. S&P500 index, all other coefficients are significant at the 1%, 5% or 10% level. The Japanese stock market index is positively affected by industrial production, is negatively influenced by the ratio of the government deficit to GDP, the domestic real interest rate, and the expected inflation rate, and has a nonlinear relationship with the nominal effective exchange rate or the ratio of M2 to GDP. Based on equation (6), the critical value of the nominal effective exchange rate is estimated to be 52.44, suggesting that the Japanese stock market index and the nominal effective exchange rate exhibit a positive

Graph 1. Scatter Diagrams

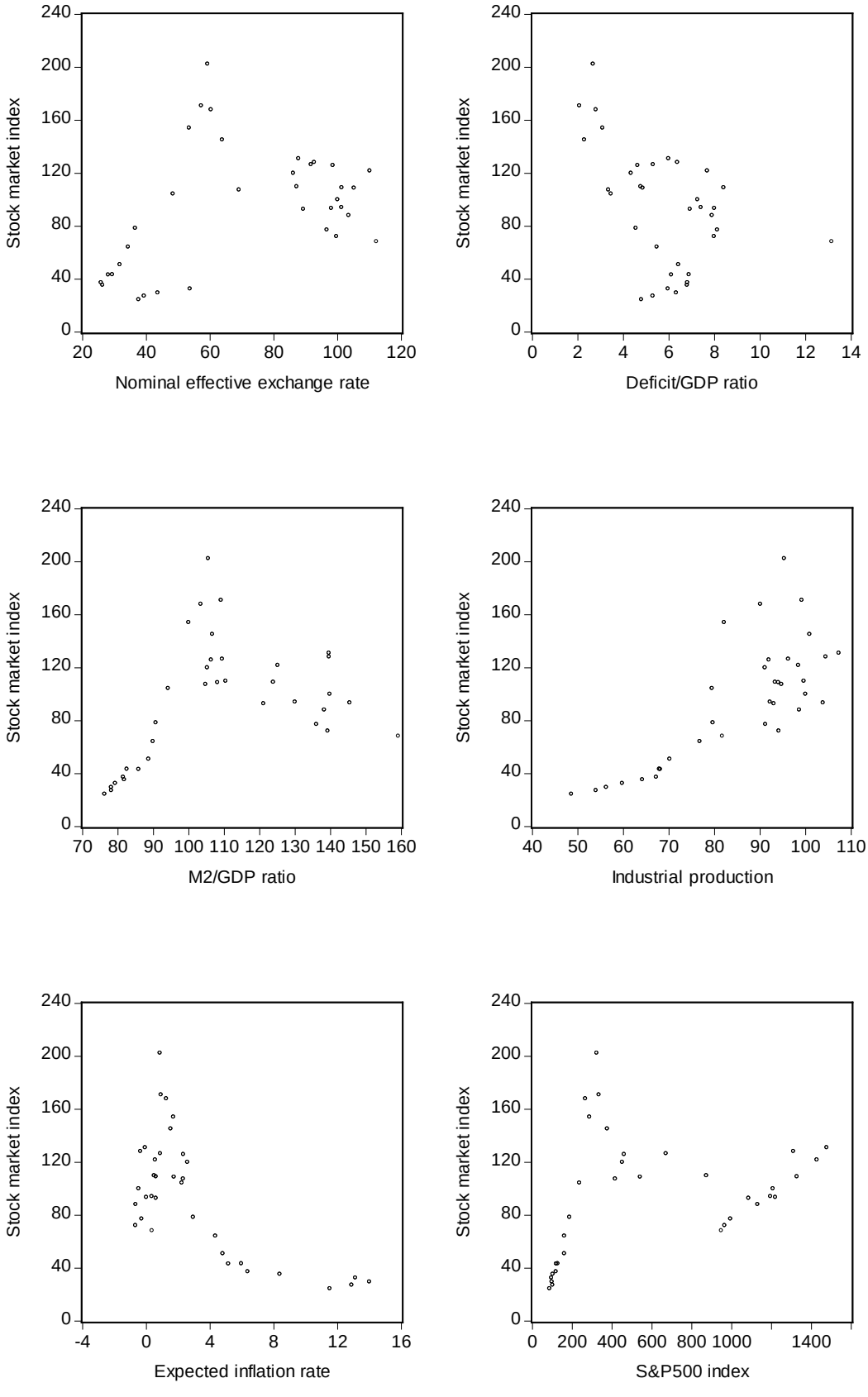

Table 1. Estimated Regressions of the Japanese Stock Market Index

	I	II	III
Log(NEER)	4.047* (3.169)	0.140* (2.693)	4.242* (2.977)
Log(NEER)^2	-0.511* (-3.140)		-0.518* (-2.866)
Government deficit/GDP ratio	-0.077* (-3.325)	-0.072* (-7.579)	-0.080* (-2.962)
Log(M2/GDP ratio)	25.131*** (1.849)	34.428* (145.171)	-0.926 (-1.500)
Log(M2/GDP ratio)^2	-2.723** (-1.931)	-3.526* (-4446.593)	
Log(Industrial production)	1.249* (3.622)	0.733* (6.800)	1.624* (6.542)
Domestic real interest rate	-0.043*** (-1.824)	-0.022** (-2.319)	-0.051** (-2.050)
Expected inflation rate	-0.076** (-2.362)	-0.045* (-5.537)	-0.108* (-3.724)
Log(U.S. stock market index)	0.082 (0.639)	-0.198* (-2.975)	-0.005 (-0.033)
Constant	-66.594** (-2.095)	-81.369* (-98.694)	-6.130** (-2.148)
R-squared	0.905	0.921	0.918
Adjusted R-squared	0.847	0.879	0.874
Akaike information criterion	-0.721	-0.633	-0.657
Schwarz information criterion	-0.098	-0.056	-0.079
F-statistic	15.432	21.501	20.584
Sample period	1975-2009	1975-2009	1975-2009
Estimation method	EGARCH	EGARCH	EGARCH

Notes: The dependent variable is log(Japan's stock market index). NEER is the nominal effective exchange rate. *, ** and *** indicate that the coefficient is significant at the 1%, 5% and 10% levels, respectively.

(negative) relationship if the nominal effective exchange rate is less (greater) than the critical value of 52.44. The critical value of the M2/GDP ratio is estimated to be 100.87%, implying that the Japanese stock market index has a positive (negative) relationship with the M2/GDP ratio if the M2/GDP ratio is less (greater) than the critical value of 100.87%.

To determine whether the above regression results may be spurious, the Augmented Dickey-Fuller (ADF) test on the regression residuals is applied. Using the Schwarz information criterion, a lag length of zero is selected. The estimated test statistic of -3.591 is greater than the critical value of -2.635 in absolute values at the 1% level. Hence, the regression outcomes are not spurious, and these time series variables have a long-term equilibrium relationship.

If the squared nominal effective exchange rate is not included in the estimated regression

(Version II), the positive coefficient of the nominal effective exchange rate is significant at the 1% level, and the negative relationship found in Version I will be ignored. If the squared M2/GDP ratio is not included in the estimated regression (Version III), the negative coefficient of the M2/GDP ratio is insignificant at the 10% level, and a misleading conclusion that increased money supply does not affect the Japanese stock market index may be drawn.

5. Summary and Conclusions

This paper has examined the impact of selected macroeconomic variables on the Japanese stock market index based on a sample during 1975 - 2009. A lower government deficit/GDP ratio, a higher industrial production, or a lower domestic real interest rate or expected inflation rate would increase the Japanese stock market index. The Japanese stock market index and the nominal effective exchange rate also show a nonlinear relationship, being positive when the nominal exchange rate is relatively low and being negative when the nominal effective exchange rate is relatively high. The Japanese stock market index and the M2/GDP ratio exhibit a nonlinear relationship. A higher M2/GDP ratio would increase (reduce) the Japanese stock market index if it is less (greater) than the critical value of 100.87%.

In comparison, the results of an inverted-V relationship between the Japanese stock market index and the nominal effective exchange rate or the ratio of M2 to GDP are different from the findings of most previous studies. Mukherjee and Naka (1995) reveal that more M1 money supply increases Japanese stock prices. Choi (1995) and Ajayi and Mougoue (1996) demonstrate that an appreciation of the yen increases Japanese stock prices whereas Mukherjee and Naka (1995) show that a depreciation of the yen raises Japanese stock prices and Nieh and Lee (2001) find no evidence of a long-term relationship between the stock prices and the exchange rate.

There are several policy implications. To maintain a healthy stock market, the authorities need to depreciate the Japanese yen, reduce the M2/GDP ratio, and pursue economic growth, fiscal prudence and a relatively low interest rate or inflation rate. The nonlinear relationship between the Japanese stock market index and the nominal effective exchange rate suggests that a depreciation of the yen would work favorably to Japan as the positive impact of more exports would outweighs the negative impacts. The finding of a quadratic relationship between the Japanese stock market index and the M2/GDP ratio or the nominal effective exchange rate has significant policy implications. Increased money supply to accommodate increased economic and business activities would be conducive to the stock market as long as the M2/GDP ratio stays within the critical value of 100.87%. Too much money supply relative to GDP is expected to increase inflation expectations and harm the stock market.

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