

(論 説)

Relationship between Exchange Rate and Stock Prices during Quantitative Easing Policy in Japan

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ABSTRACT

Japan had experienced unprecedented recession and deflation for more than 10 years. The Bank of Japan enforced quantitative monetary easing at a level never seen before. One of the purposes of the policy is to influence stock prices for economic recovery. Recently, the Japanese economy is on a recovery track, and stock prices have been increasing greatly. However, there is much dispute over whether or not the quantitative easing has been effective. This paper investigates the relationship between macroeconomic variables and stock prices. Exchange rate is the main target variable among the macroeconomic variables. The results indicate that interest rates have not impacted Japanese stock prices but exchange rate and U.S. stock prices have. However, exchange rate is an endogenous variable. This paper takes this problem into account and finds that exchange rate has been a significant determinant of Japanese stock prices. Investors have carefully watched the stock market characteristics such as their international trade behavior and net foreign positions. Furthermore, the Bank of Japan's policy for overcoming recession and deflation has been effective. Japanese stock markets have responded to the policy.

JEL: F31, G15.

Keywords: Exchange Rate; Interest Rate; Japan; Stock market; U.S.A.

I INTRODUCTION

Japan experienced unprecedented recession and deflation for more than 10 years. During that period, Japan enforced very aggressive fiscal policies, and the Bank of Japan (BOJ) performed unprecedented quantitative monetary easing. Since 2001, the BOJ has conducted quantitative easing (Kurihara, 2006).

One of the purposes of BOJ's policy seems to be to influence stock prices, although BOJ has not admitted to this purpose. The governor of BOJ has reiterated again and again the importance of increasing the transfer of funds from 'safe' to 'risky' assets. The quantitative monetary easing policy is related to this purpose.

This paper analyzes the relationship between Japanese stock prices and macroeconomic factors. In most developed countries, the most important factor in determining stock prices has been interest rates. However, in Japan, interest rates have been close to zero since the quantitative monetary easing policy was implemented in 2001. The effect of interest rates changes on stock prices seems to have decreased to the point of being negligible. Other macroeconomic factors may affect stock prices. Exchange rates and U.S. stock prices are possibilities. However, it should be noted that exchange rate is an endogenous variable in many cases. This paper takes this problem into account and finds that exchange rates and U.S. stock prices have been significant determinants of Japanese stock prices.

This paper is structured as follows. The following section provides a theoretical exploration of the relationship between the stock market and other macroeconomic factors. Section 3 provides empirical analysis followed by the theoretical analysis. Finally, the paper concludes with a brief summary.

II RELATIONSHIP BETWEEN THE STOCK MARKET AND MACROECONOMIC FACTORS

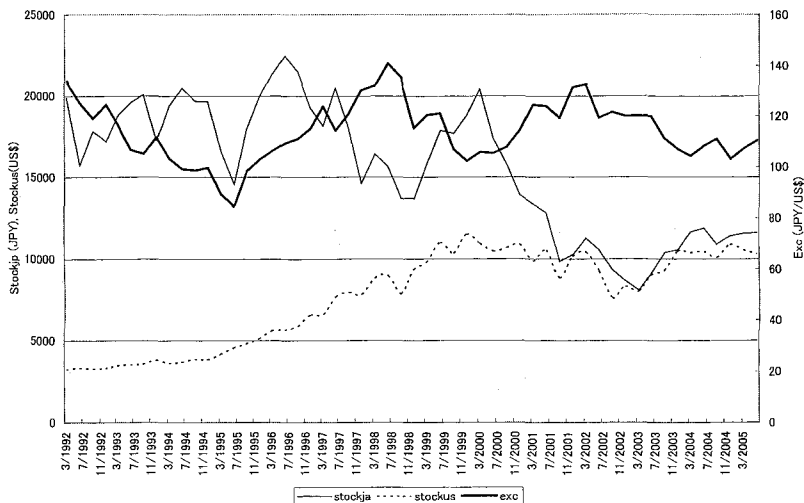
The relationship between stock prices and macroeconomic factors has been discussed all over the world. This paper considers the determinants of 'daily' stock prices in Japan. Daily stock prices are determined by many factors, including enterprise performance, dividends, stock prices of other countries, Gross Domestic Product (GDP), exchange rates, interest rates, current account, money supply, employment, and so on. Countless factors have an impact on stock prices. It should be also noted that previous studies have used 'monthly' or 'quarterly' data. Instead of such data, this paper relies on daily data.

The factors that influence stock prices change over time. For example, in the 1970s and early 1980s, inflation rates were high, which in turn affected stock prices. Since then, in general, interest rates have continued to have much influence on stock prices.

Many studies have investigated the relationship between stock prices and interest rates. Campbell (1987), Cutler et al. (1989), and Hodrick (1992) showed that short- and long-term interest rates have a modest degree of forecasting power for excess stock returns. Similarly, other studies, such as those of Campbell and Shiller (1991) and Fama (1984), have shown that the slope of the term structure of interest rates helps to forecast excess stock returns. Campbell and Ammer (1993) and Hamori and Honda (1996) also showed that short-term interest rates affect stock prices.

This study mainly analyzes the period since March 19, 2001, when quantitative monetary easing was implemented in Japan. One reason is that there is little recent study analyzing stock prices in Japan; however, the main reason is that it is uncertain whether the interest rate has had an effect on stock prices since then because the interest rates have been almost zero. Some important factors, such as

Figure 1. Japanese stock market, U.S. stock market, and exchange rate.



Note: Japanese stock market figures are from the Nikkei Stock Average, and the U.S. figures are the DOW Jones Industrial Average.

exchange rate and U.S. stock prices, should be noted in addition to domestic interest rates.

In the United States, the information technology (IT) boom contributed strongly to increasing stock prices. On the other hand, the Japanese economy has had many structural problems and has experienced recession. Stock prices in Japan decreased during the mid-1990s and after the bubble economy of the 1980s. However, as in Figure 1, movement of stock prices in the two countries seems similar after 2001, when quantitative monetary easing policy was implemented in Japan. Fluctuations in exchange rates seem to occur in parallel with Japanese stock prices.

Little research exists on the effect of the exchange rate on stock prices, which has been analyzed from the view of Arbitrage Pricing Theory (APT). Most studies examine whether the arbitrage condition can be explained when the exchange

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rate is considered. It is interesting that many studies deny the explanatory power of the exchange rate (Jorion, 1991). Hamao (1998) investigated this relationship and found that the effect of exchange rate fluctuation was insignificant for Japan, but Choi et al. (1998) reported that the exchange rate was an important factor. Since the 1980s, capital movement across countries has increased rapidly. In spite of the reduction in fluctuations of the exchange rate in the 1990s compared to the 1980s, this movement should not be ignored along with the development of IT, especially in the field of financial instruments and payment systems (Kurihara and Ohtsuka, 2005). The target of investments has expanded greatly from domestic to world-wide. Because interest rates have been quite low, there must be other factors affecting stock prices. There is a high likelihood that exchange rate has been influencing the Japanese stock prices.

III EMPIRICAL ANALYSIS OF STOCK PRICES IN JAPAN

As mentioned above, one purpose of this study is to analyze stock prices in Japan since the quantitative monetary easing policy was implemented on March 19, 2001. The main analysis spans from then to now; however, the sample period includes 1992. In 1991, the 'bubble economy', which heavily increased stock, land, and other asset prices, ended. To compare the sample period of quantitative monetary easing period to other periods, other sample periods are included.

In the analysis, unit root tests of each macroeconomic variable related to stock prices are conducted before analyzing the determinant factors of stock prices. The variables estimated are Japanese stock prices (Jstock), U.S. stock prices (Ustock), exchange rate (yen / U.S. dollar; EX), the Japanese call (interest) rate (Call), and the FF rate (FF). The test method is ADF. The sample period for Table 1 is divided into three sample cases. One is between March 19, 2001 and September 30,

Table 1 Unit Root Tests of Each Variable

Variable	t value	Rate of Each Variable	T value
Jstock	-1.42	RJstock	-33.19***
	-1.55		-50.55***
	-1.47		-40.28***
Ustock	-1.96	RUstock	-33.71***
	-2.07		-39.26***
	-1.99		-40.08***
EX	-1.46	REX	-31.70***
	-1.22		-40.31***
	-1.39		-38.66***
Call	-8.87***	RCall	-17.25***
	-9.03***		-25.62***
	-5.62**		-20.77***
FF	-2.83**	RFF	-18.48***
	-2.65**		-20.63***
	-2.78**		-20.15***

Note. *** is significant at 1%, ** is at 5%.

2005 (upper), another is between January 1, 1992 and March 18, 2001 (middle), and the other is between January 1, 1992 to September 30, 2005 (lower).

As shown in the table, some interest rates (Call and FF) are significant (at 1% and 5%); however, the other variables are not significant. All of the rates of variables are significant at 1%.

It is interesting that little research has been presented on the effect of the exchange rate on stock prices. Because interest rates have been quite low, other factors are affecting stock prices. There is a distinct possibility that exchange rates have been influencing Japanese stock prices.

In a modern world, international trade among countries is significant. Exchange rates are very important elements of enterprises' profitability and stock prices. Not only trade but financial aspects are important elements that influence

exchange rates. For enterprises that have assets and liabilities that are measured in foreign currency, the exchange rate determines the value of their operations and affects their stock prices. The amount of trade and the foreign asset position is the type of public information that a stock investor should watch carefully. The situation is not different from the one in 1980s and 1990s.

However, the exchange rate is usually endogenous. A fundamental assumption of regression is that the right-hand variables are and should be uncorrelated with the disturbance term. The standard approach in such a case in which the right-hand variables are correlated with the residuals is to estimate the equation using instrumental variables regression.

From this view, we can see that Japanese stock prices regressed as a result of changes in the U.S. stock price, exchange rate, and interest rates. The variables used in this calculation are TOPIX, DOW, yen-dollar exchange rate, call rate, and FF rate. TOPIX is the stock price index of Tokyo Stock Exchanges, which represents the market price in Japan.

Among the variables, domestic interest rate is a good candidate as a determinant of stock prices. A rise in the domestic interest rate will raise the expectation of the future interest rates, resulting in falling the stock prices.

Exchange rate is an important variable representing foreign phenomena that affect the stock prices; however, it should be noted that the exchange rate is an endogenous variable in many cases as mentioned above. This paper uses 2-stage least squares (TSLS) for this special case of instrumental variables regression.

This paper emphasizes whether a firm exports its products and whether it has foreign assets or liabilities. The instrument lists are 'trade' for representing the international trade aspect and 'asset' for representing the international financial aspect. For the variable 'trade', a country (Japan) tends to export easily and is expected to gain profit when a depreciation of the yen occurs. 'Trade' is a change rate

of trade balance (export minus import). The data are monthly¹. For the variable, ‘asset’, depreciation of the yen implies a rise in the yen value of the foreign assets and liabilities denominated by the dollar. If an enterprise has more foreign assets than liabilities, the result is large depreciation of the yen. The value is estimated by the change rate of the net value.

Table 2 provides the variables of the estimation equations and the estimated results.

Table 2 Deterministic Elements of the Japanese Stock Prices (TSLS)

Equation	(1)	(2)	(3)
Sample period	March 19, 2001– September 30, 2005	January 1, 1992– March 18, 2001	January 1, 1992– September 30, 2005
C	0.001 (0.888)	0.051 (0.628)	– 0.001 (– 0.092)
RJstock(–1)	– 0.083 (– 2.813)	– 0.052 (– 2.269)	– 0.052 (– 2.805)
RUstock(–1)	0.439 (12.295)	– 0.052 (– 2.269)	0.531 (0.934)
RREX	0.139 (1.867)	– 0.293 (– 0.249)	– 0.215 (– 0.255)
RFF(–1)	– 0.049 (– 0.996)	– 0.671 (– 0.475)	– 0.154 (– 0.304)
Rcall	3.642 (0.698)	– 0.696 (– 0.689)	0.209 (0.607)
D.W.	1.992	2.001	2.000
adj.R ²	0.136	0.003	0.001

Note. Parenthetical figures in the table are t values.

The results of equations (1), (2), and (3) are clear and show some interesting points. The coefficient for the exchange rate is positive and significant only in equation (1). It has been said that the Japanese economy is export-oriented. Depreciation of the domestic currency promotes exports and leads to increasing stock prices.

U.S. stock prices in the equation (1) positively affect Japanese stock prices.

The coefficient is significant. This shows the existence of interdependence between Japanese and U.S. stock prices.

It is interesting to see that the Japanese interest rate has no effect on the Japanese stock market. The Japanese interest rate has been quite low, so it has not had much effect on the Japanese stock market. Further, the coefficients are not significant².

BOJ enforced unprecedented monetary easing, which reduced interbank interest rates to almost zero. However, because that policy was not enough to end deflation, since 2001, the BOJ has implemented quantitative easing. That is, on March 19, 2001, the BOJ decided to increase the outstanding balance of the current accounts by one trillion yen to around five trillion yen. This is called *quantitative easing*. In this scheme, the main operating target for money market operations changed from the uncollateralized overnight call rate to the outstanding balance of current accounts at the BOJ. The target of the current account balance has been increased several times since then, and the current upper limit level is 30–35 trillion yen.

Taking this into account, Table 3 presents an additional calculation that adds one policy-related dummy variable (BOJ in the table). If quantitative monetary easing is in effect on that day, the dummy variable is one, and the other cases are zero. The empirical method is the same as in Table 2.

The results are clear. Quantitative monetary easing has influenced stock price

Table 3 Quantitative Monetary Easing Policy and Stock Price (TSLs)

Variable	C	RJstock a (-1)	RUstock (-1)	REX	RFF	Rcall	BOJ
coefficient	0.0005 (0.538)	-0.081 (-2.780)	0.442 (12.491)	0.128 (1.739)	-0.037 (-0.760)	1.189 (0.228)	0.015 (4.031)

Note. D.W.: 1.991; adjR²: 0.144. Parenthetical figures in the table are t values.

es. Stock traders and policy authorities should take this into account in addition to the movement of exchange rate³.

IV CONCLUSION

This study performed an empirical examination of the relationship between the Japanese stock prices and macro variables. It focuses on the endogeneity of the variables, especially, exchange rates.

From the results, we can conclude that interest rates do not influence Japanese stock prices. This finding is counter to traditional economic theory and some existing studies. We might also conclude that the exchange rate influences Japanese stock prices. Investors adequately consider the characteristics of the enterprises such as their international trade behavior and net foreign positions. U.S. stock prices have also influenced Japanese stock prices, suggesting an interdependent relationship between them.

NOTES

1. The same data are used for all the period of the same month. There seem other good variables to use for instrumental variables' however, the data are quarterly or yearly. Among them, monthly data are more suitable because this paper's relies mainly on daily data.
2. Along with the previous analysis, we estimated the equations using the logarithm and difference; however, the results were not significantly different from the results obtained by this method.
3. Consideration of the other exchange rate, such as yen-euro, is a necessary future task.

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