Stock Market Prices and the Reaction of Monetary Policy in Japan*

Kurihara, Yutaka

Abstract

This paper considers arguments about the conduct of monetary policy relative to asset bubbles and econometric and simulation evidence. Movements in the stock market can have a significant impact on the macro-economy and therefore should be an important factor in the determination of monetary policy. The evidence regarding the reaction of the central banks to asset price inflation is more mixed. The results of the simulation exercises are inconclusive and reflect the exact nature of the assumptions embedded in the model. The econometric evidence also is not clear cut. However, this work has found that for Japan, monetary policy does not react to asset price changes. Asset price booms and bursts can cause adverse effects on the real economy and the question is whether the central bank should attempt to prick the bubble before it develops. Moreover, interest rates are a very blunt instrument by which to accomplish this. If the aim is to prevent asset price bubbles, other controls might be more efficient.

Keywords : Central Bank; Macroeconomic Variables; Monetary Policy; Stock Price; VAR

1. Introduction

Japan experienced unprecedented recession and deflation for more than

* I thank you Akihiro Amano (Hyogo Prefecture University) and Eiji Nezu (Aichi Gakuin University) for their comments and suggestions.

10 years. Japan conducted very aggressive fiscal policy under severe budget constraints, however; the debt ratio to gross domestic product (GDP) has been quite high. Further fiscal expansion would be impossible. The Bank of Japan (BOJ) enforced unprecedented monetary easing. However, because these policies were not enough to end deflation, since 2001, the BOJ has implemented quantitative easing. The interest rates have been almost zero, so there has been no room for traditional interest-based policy. There is much dispute over whether quantitative easing has been effective and whether it achieved the current economic recovery (Kurihara, 2006).

One of the purposes of BOJ's policy seems to raise stock prices. BOJ has not admitted this purpose; however, the chairman of the Bank of Japan has reiterated again that it is important to increase the transfer of funds from "safe" to "risky" assets. The quantitative easing policy is strongly related to this purpose. BOJ's monetary policy, especially quantitative easing, has not yet been fully examined. Moreover, the effect of the policy on stock prices has not been discussed. Analyzing this effect is important because of its impact on the Japanese economic recovery, which has prevailed for more than 10 years. Movements in the stock market can have a significant impact on the macro-economy and therefore are likely to be an important factor in the determination of monetary policy.

This short paper considers arguments regarding that notice that the conduct of monetary policy should take of stock prices. The main purpose of this paper is to analyze whether the BOJ should react to changes in asset prices. In spite of the need to analyze how to react to asset price changes, this has not been fully performed. This paper uses an identification technique based on the heteroskedasticity of stock market returns to measure the reaction of monetary policy to the stock market.

2. Historical Background

The impact of stock market bubbles has been examined in the World Economic Outlook (2003), which identified 52 equity price bursts in 19 countries between 1959 and 2002. This is equal to one burst per country every 13 years. The 1970s were the greatest period of instability with more than half of the crashes occurring in this decade. For stock market prices, there was an average decline of 60% in 1973/1974. This decline followed the collapse of the fixed exchange rate system and in conjunction with the quadrupling of oil prices.

It is notable, however, that an equity boom does not invariably lead to a bust (Mishkin and White, 2003). This occurred in one-quarter of the sample. Bordo and Jeanne (2002) examined 24 equity price booms during 1970 to 2000 and found that only three were followed by a burst.[1]

This raises an important issue regarding monetary policy.[2] It is not clear whether it is possible to discriminate ex ante between booms that do and those that do not lead to a burst. Similarly, this problem is an important issue for the central bank.

Do asset price bursts have real effects? The evidence shows that most circumstances they do (Allington and McCombie, 2005). World Economic Outlook (2003) showed that, on average, the output level three years after an equity price bust was about 4% below the level that it would have prevailed with the average growth rate during the three years prior to the bust.

The monetary transmission mechanism largely remains a black box. The traditional Keynes effect and the interest rate channel appear empirically unimportant. The second mechanism that relates the impact of interest rates on exchange rates to the Harrod foreign trade multiplier has proven to be more robust in the short run.

If interest rates fall because of an expansionary monetary policy, stocks are thought to become more attractive to investors than bonds and the market value of firms increases.[3] The credit channel shows the impact on output of changes in stock prices. First, interest rates can affect the financial positions of firms. If stock market prices rise, the value of firms' assets increase. This effect enables them to borrow and then to invest on better terms and conditions. Second, the bank lending channel stresses the role of banks in financing enterprises. Finally, the balance sheet channel can operate on households' balance sheets and their spending like the Modigliani life cycle model.

Because of their potential impact on the economy, stock market movements are likely to be an important determinant of monetary policy decisions. Despite this potential importance, there has been little empirical study measuring the magnitude of the BOJ's reaction to the stock market.

3. Models

Should the central bank react to changes in asset prices? Answering this question is difficult, however, one way is to use a macroeconomic model to simulate the effects of asset prices.

Bernanke and Gerler (1999) adopted the standard dynamic model and incorporated credit channel effects. They also used asset prices to be driven by changes in fundamentals. Filardo (2000) used a simulation model to compute the benefit to a central bank, which is equally opposed to inflation and output variability and relatively averse to inflation. Mishkin (2001) used an IS relationship, a Phillips curve, and a Taylor rule relationship. For asset prices to affect the real economy, these variable is added to the model. Cecchetti et al. (2002) argued that the disagreement turns largely on whether a central bank distinguishes between financial and technology shocks; however, they agree that a central bank should react to asset prices.

Movements in stock prices are likely to have an impact on monetary policy; however, the empirical evidence is hard to find because the stock market responds endogenously to monetary policy. Allington and McCombie (2005b) utilized an identification technique developed by Rigobon (1999) to overcome this problem.[4] They developed a method for solving the identification problem that arises in simultaneous equation models based on the heteroskedasticity of structural shocks. Rigobon and Sack (2003) used the heteroskedasticity of stock market shocks relative to monetary policy shocks to affect the covariance between interest rates and stock prices that depend on the responsiveness of the interest rate to stock prices.

This paper, following Allington and McCombie (2005a), structures a model in the two equations below for interest rates and stock market prices. If empirical results are contradictory regarding the question of whether the central banks should intervene, what does the econometric evidence say about what they actually do in practice?

4. Econometric Evidence and Further Analysis

Few studies have analyzed the reaction of the BOJ or central banks to stock prices. The primary reason is that it is difficult to estimate empirically the monetary policy reaction due to the simultaneous response of the stock market to policy decisions. Policy reaction cannot be identified using traditional approaches for addressing the simultaneity problem. These approaches include exclusion restrictions or instruments that would affect the stock market without being correlated with interest rate movements. This paper instead uses an identification procedure based on the heteroskedasticity of stock market returns.

This paper characterizes the dynamic interaction between the stock market and interest rates using a vector autoregression (VAR). The dynamics of the short term interest rates and the stock market returns are written as follows:

$$i_t = \alpha s_t + \delta x_t + \varepsilon_t \quad (1)$$
$$s_t = \beta i_t + \phi x_t + \lambda s_t^* + \eta_t \quad (2)$$

where i_t is the 3-month interbank rate and s_t is the daily return on TOPIX (Tokyo Stock Exchange Market Index). S_t^* is the daily return on U.S. stock prices (DOW JONES). The regressions also include five lags of the stock market return and the interest rate, which are not shown for notational simplicity. The data are daily, and the sample period is from 2001 to 2005 and from 1992 to 2005. In 1992, the bubble burst. Also, in 2001, the quantitative easing policy was implemented.

The variable x_t represents macroeconomic shocks that might influence stock prices and interest rates. VAR accounts for as much of the impact of macroeconomic shocks as possible. To that end, the variable xt includes the monthly releases of major macroeconomic variables, including the core price index (CPI) and the core producer price index (PPI). Each of these variables is measured by the difference between the released value and the expected value, and HP method was used as the expected value. The specification also includes a common shock to both equations, z_t, which enters in the same manner as x_t[5].

According to the interpretations offered, the policy response to stock prices, measured by the parameter α in equation (1) arises strictly from the impact of stock prices on economic activity. The short-term interest rate does not react to shifts in investment willingness to bear risk (η) beyond the impact on stock prices in determining monetary policy.

It is known that equations (1) and (2) cannot be directly estimated due

Table 1a ***Equation for Daily Changes in Interest Rate (1992-2005)***

Variable	Impact of 1 Std. Dev. Change	T-statistic of Coefficient
CPI	1.08	1.80
PPI	0.06	-0.48
GDP	0.07	0.15
TOPIX	-0.26	-1.98

Std. dev. of dep. Var.: 1.55; R^2: 0.98; Std. error of estimate: 0.04; D.W.: 2.04

Table 1b ***Equation for Daily Changes in Interest Rate (1992-2005)***

Variable	Impact of 1 Std. Dev. Change	T-statistic of Coefficient
CPI	1.12	1.98
PPI	0.02	-0.30
GDP	0.18	0.64
TOPIX	-0.30	-2.53

Std. dev. of dep. Var.: 1.45; R^2: 0.99; Std. error of estimate: 0.03; D.W.: 2.03

to the endogeneity of the regressors. If it is assumed that the stock market has no contemporaneous response to the interest rate ($\beta = 0$), the policy reaction function (1) can be estimated directly. The results from that estimation are shown in Tables 1a and 1b.

Note that the estimated response to the shock market, α, is negative. The most likely explanation for the perverse sign of this coefficient is the endogeneity of the stock market response.

A general approach to addressing this problem is using instrumental variables. However, because the stock prices are likely influenced by the interest rate shock, it is not a valid instrument. It is difficult to conceive of any instrumental variables that would affect the stock market without affecting the path of interest rates.

Table 2 *Variance Matrix of Reduced Form Shocks*

	Variance of Interest Rate shocks	Variance of Stock Market Shocks	Covariance	Frequency (%)
System a	0.00208	0.5292	-0.00198	89.2
System b	0.00398	2.8935	0.01982	2.9
System c	0.02104	5.0235	0.02999	2.2
System d	0.01284	0.3296	-0.01893	6.3

The sample period is from 1992 to 2005. Following Rigobon and Sack (2003), this paper defines four systems: one in which both interest rates and stock returns have low variance, one in which they both high variance, and two in which one has high and the other low variance. Periods of high variance defined as when the 1-month rolling variance of the variance of the residuals is more than one standard deviation above its average. The computed results are shown in Table 2.

The results show that the covariance between these variables tends to fluctuate with the movements in their variances. They often become positive as the variance of the stock market increases. The slope of the reaction function can be determined from changes in the covariance of monetary policy and asset prices over time.

In Japan, inflation targeting has been discussed. The chairman of the Bank of Japan has not admitted yet that it does and will introduce inflation targeting; however, the situation now has been partly introduced. The overall consensus at present is that asset prices should not be included in the target price index. This is partly because of their volatility and lack of predictive power; however, there is also the pragmatic reason that the present targets are established and understood in some countries by the public. If there is no overwhelming case for introducing asset prices in inflation targeting, should the central banks react to asset prices? There may be a conflict in the policy response demanded by a movement in stock prices compared with that required by the output and inflation components of the Taylor rule. Some papers invoke an earlier wisdom that by reacting to stock prices the central banks would be staring into a mirror. This point should be also researched.

5. Conclusions

This paper considered arguments about what notice the conduct of monetary policy should take of asset bubbles and the econometric and simulation evidence. The evidence about whether the BOJ (or central banks) should take notice of asset price inflation is more mixed. The results of the simulation exercises are inconclusive and reflect the exact nature of the assumptions embedded in the model. The econometric evidence is not clear-cut. However, this work has found that for Japan, monetary policy does not react to asset price changes. Asset price booms and bursts can cause adverse effects on the real economy, and the question is whether the central bank should attempt to prick the bubble before it has developed. Moreover, interest rate is a very blunt instrument by which to accomplish this. If the aim is to prevent asset price bubbles, other controls might be more efficient. Cyclical or economic recovery and recession may affect stock prices. There is some possibility that using daily data could cause a loss of such effects.

Further research is needed in the near future. Central banks should tackle this problem.

Notes

1. Japan's case was in 1989 (it is the last year of the burst).
2. Nevertheless, housing and stock market crashes tend to overlap and were associated with downturns in the economy. See Bordo and Jeanne (2002).

3. However, Bernanke and Gerler (1995) found that the supporting evidence is far from robust.
4. This estimates the Bank of England's monetary policy response to UK stock prices. Kurihara and Nezu showed the relationship between Japanese stock prices and the Bank of Japan's quantitative easing policy since 2001.
5. Equation (1) from the VAR can be interpreted as a high frequency monetary policy reaction function. It is more common to estimate such reaction functions using lower frequency data. Although other variables such as company profits, dividends, and future prospects of the stock prices are more important factors in determining stock prices, this paper focuses on macroeconomic variables. Another reason is data availability.

References

Allington, N.F.B. and McCombie, J.S.L., "Measuring the Reaction of United Kingdom Monetary Policy to the Stock Market: A Heteroskedastic Approach," in press.

Allington, N.F.B. and McCombie, J.S.L. (2005), "Stock Market Prices and Monetary Policy," in P. Arestis, M. Baddeley, and J. McCombie (Eds.), *The New Monetary Policy,* London: Edward Elgar, pp. 68-87.

Bernanke, B. and Gerler, M. (1995), "Inside the Black Box: The Credit Channel of Monetary Policy Transmission", *Journal of Economic Perspective, Vol. 9,* pp. 27-48.

Bernanke, B. and Gerler, M. (1999), "Monetary Policy and Asset Price Volatility," in New Challenges for Monetary Policy, Proceedings of the Symposium Sponsored by the *Federal Reserve of Kansas City Economic Review, Vol. 84,* pp. 17-51.

Bordo, M.D. and Jeanne, O. (2002), "Boom-Busts in Asset Prices, Economic Instability and Monetary Policy," NBER Working Paper 8966.

Cecchetti S.G.., Chu, R.S. and Steidal, C. (2002), "Asset Prices in a Flexible Inflation Targeting Framework," NBER Working Paper 8970.

Filardo, A.J. (2000), "Monetary Policy and Asset Prices," *Federal Reserve Bank of Kansas City Review, Vol. 85,* pp. 11-37.

Kurihara, Y. (2006), "Recent Japanese Monetary Policy: An Evaluation of the Quantitative Easing," *International Journal of Business, Vol. 11,* pp. 81-88.

Kurihara Y. and Nezu, E., "Recent Stock Price Relationships between Japanese and U.S. Stock Markets," forthcoming.

Mishkin, F.S. (2001), "The Transmission Mechanism and the Role of Asset Prices in Monetary Policy," NBER Working Paper 8617.

Mishkin, F.S. and White, E.N. (2003), "US Stock market Crashes and Their Aftermath: Implications for Monetary Policy," in W.C. Hunter, G.C. Kaufman and M. Pomerleano (Eds.), Asset Price Bubbles, Cambridge, MA: MIT Press, pp. 53-80.

Rigobon, R. and Sack, B. (2003), "Measuring the Reaction Function of Monetary Policy to the Stock Market," *Quarterly Journal of Economics, Vol. 118,* pp. 639-669.

World Economic Outlook (2003), Chapter 2, pp. 61-94.