E C O N O M I C S B U L L E T I N

The information role of commodity prices in formulating monetary policy: some evidence from Japan

Shigeyuki Hamori
Kobe University

Abstract

This paper uses the BOJ index published by the Bank of Japan to empirically analyze the relationship between the commodity price index and macroeconomic variables in Japan. The BOJ index was found to be valid as a leading indicator of the consumer price index before the zero interest policy was introduced. Afterwards, however, this relationship ceased to exist.

The author would like to thank to a referee and Naoko Hamori for their many helpful comments and suggestions. This research was supported by the Sawamura Masaka Research Fund.
Citation: Hamori, Shigeyuki, (2007) "The information role of commodity prices in formulating monetary policy: some evidence from Japan." *Economics Bulletin*, Vol. 5, No. 13 pp. 1-7
Submitted: April 27, 2006. **Accepted:** August 14, 2007.
URL: http://economicsbulletin.vanderbilt.edu/2007/volume5/EB-06E30010A.pdf

1. Introduction

Many studies have debated whether the commodity price index serves as a leading indicator of future economic conditions. Studies by Garner (1989), Marquis and Cunningham (1990), Cody and Mills (1991), Sephton (1991), and Hua (1998), for example, have applied time series analysis to investigate how this index relates to macroeconomic variables. Specifically, they applied Granger causality tests to analyze the validity of the commodity price index as a leading indicator of prices in general. If the commodity price index is valid as a leading indicator of prices or other macroeconomic variables, policymakers need to recognize the importance of the index as a policymaking variable. A rise in the index, for example, could be seen as a portent of future inflation. As such, trends in the index would come to have a certain influence in the management of monetary policy.

Awokuse and Yang (2003), among others, applied the LA-VAR (lag-augmented vector autoregression) model developed by Toda and Yamamoto (1995) to analyze the relationship between the commodity price index and macroeconomic variables in the United States. They found a causal relationship from the commodity price index to the consumer price index and the industrial production index.

This paper empirically analyzes the role of commodity prices in Japan as a leading indicator of macroeconomic variables, especially the CPI (consumer price index), over the period following the collapse of the bubble. We apply the approach of Awokuse and Yang (2003) using the LA-VAR model to empirically analyze the relationship between the Bank of Japan international commodity price index (BOJ index) and macroeconomic variables. The BOJ index is a weighted average (geometric mean) of prices (US dollar base) of 16 selected goods in international commodity markets, produced and published by the central bank since 1990. The goods covered in the index are crude oil, gold, copper, zinc, aluminum, nickel, cotton, wool, lumber, natural rubber, wheat, soybeans, corn, sugar, coffee, and live cattle. The index is calibrated so that the average for the year 2000 equals 100.

In this paper we take two steps. First, we apply an analysis based on a system of five variables (commodity price index, money supply, interest rates, consumer price index and industrial production index) to Japanese data, emulating the study performed earlier by Awokuse and Yang (2003) using data from the United States. In doing so, we split the sample into two periods, before and after the zero interest rate policy was introduced, in order to investigate whether the role of the commodity price index changed. The Bank of Japan introduced the zero interest rate policy in February 1999 as a prescription for the lingering financial crisis arising from mounting bad loans and severely depressed corporate performance.[1] Under this policy, the Bank of Japan kept the unsecured overnight call rate, the rate which banks charge each other, at almost zero. It would be meaningful to examine the effects of this policy in our empirical analysis, given that no such policy had ever before been attempted in Japan or anyone else in the world. Our second step in this paper is to expand the model to a six-variable system by introducing the exchange rate as an additional variable, in order to check the robustness of the empirical results obtained under the five-variable system. Considering that the BOJ index is calculated on a US dollar basis, it is

[1] The policy was suspended in the summer of 2000 but reinstated only six months later.

important to consider impact of exchange rates (i.e., the JPY/USD rate).

2. Data and Empirical Techniques

This paper applies six macroeconomic variables for Japan: the BOJ commodity index (BOJ), consumer price index (CPI), industrial production index (IP), money supply (M), interest rate (R), and exchange rate (EX). The monthly data cover the period between January 1990 and December 2005. All series except the interest rate are measured in natural logarithms.[2] The paper uses two sample periods, before and after the Bank of Japan introduced the zero interest policy in February 1999:

[Sample A]: January 1990 - January 1999,
[Sample B]: February 1999 - December 2005.

Japanese monetary policy has been hard pressed to cope with the lingering financial crisis arising from mounting bad loans and severely depressed corporate performance since the middle of the 1990's. The most ambitious solution attempted was the zero interest rate policy introduced in February 1999. It would be meaningful to split the sample into two periods, before and after the introduction of this policy, given that no such policy has ever been introduced in Japan or anywhere else in the world.

We carry out the Granger causality test using the LA-VAR technique developed by Toda and Yamamoto (1995). This technique allows the testing of coefficient restrictions in a level VAR when the variables are of unknown integration or cointegration order. The construction of the standard VAR or VECM (vector error correction model) relies on the prior test of integration or cointegration order. If there are flaws in these conclusions, the coefficient restrictions test based on the VAR or VECM will presumably be subject to pretest biases. The LA-VAR method eludes these biases by elaborating the Granger causality test and other tests of coefficient restriction, i.e., tests which are robust to the arbitrary integration and cointegration order of the variables.

The method proceeds, briefly, as follows. Let the following equation generate $\{y_t\}$, the n-dimensional vector constituting the level of the variables in the study:

$$y_t = g_0 + g_1 t + J_1 y_{t-1} + J_2 y_{t-2} + \ldots + J_k y_{t-k} + e_t, \quad t = 1,2,\ldots T, \tag{1}$$

where t is the time trend; k is the lag length; $g_0, g_1, J_1, J_2, \ldots, J_k$ are the vectors or matrices of coefficients; and ε_t is an i.i.d sequence of n-dimensional random vectors with zero mean and covariance matrix $\sum_{\varepsilon}$.

Suppose that our interest is to test restrictions on a subset of parameters in the

[2] The BOJ index is obtained from the homepage of the Bank of Japan http://www.boj.or.jp /type/stat/dlong/etc/index.htm). The other five series are taken from the CD-ROM of International Financial Statistics from the International Monetary Fund. M is M2 plus CDs (15859MBFZF), which is seasonally adjusted. R is the call money rate (15860BZF). CPI is 15864ZF and IP is 15866CZF, where IP is seasonally adjusted. EX is Japanese Yen per US Dollar (158AEZF).

model, formulated as:

$$H_0 : f(\phi) = 0 . \tag{2}$$

The test can be conducted with the following VAR model, in level form, estimated by ordinary least squares (OLS):

$$y_t = \hat{\gamma}_0 + \hat{\gamma}_1 t + \hat{J}_1 y_{t-1} + \hat{J}_2 y_{t-2} + \ldots + \hat{J}_p y_{t-p} + \hat{\varepsilon}_t , \tag{3}$$

where circumflex (^) indicates an estimation by OLS and $p = k + d_{\max}$ represents the true lag length k augmented by a suspected maximum integration order $d_{\max}$ ($k \geq d_{\max}$). Considering that the true values of $J_{k+1}, \ldots, J_p$ are zero, those parameters are not included in restriction (2). Toda and Yamamoto (1995) establish that the Wald statistic asymptotically has a chi-square distribution with degrees of freedom equal to the number of excluded lagged variables regardless of the integration order of the process or the existence of a cointegrating relation.

3. Empirical Results

The results of the Granger causality test from the BOJ index to each variable are shown in Table 1 and Table 2. Both tables report the Wald test statistic and corresponding *p*-value. Table 1 gives the results of the five-variable system and Table 2 gives the results of the six-variable system, i.e., the system including the exchange rate. The true order of the model (k) was selected using SBIC, and $k = 1$ was selected in both cases. The analysis was conducted using $d_{\max} = 1$ based on the $k \geq d_{\max}$ restriction.

First, as we see in Table 1, there is a causal relationship from the BOJ index to the consumer price index (CPI) before the zero interest rate policy was introduced. During the period after the introduction, however, this relationship ceases to exist. Awokuse and Yang (2003) found a causal relationship from the commodity price index to the industrial production index in the United States. In our study, however, we find no such relationship in Japan.

Next, as shown in Table 2, we find that the empirical results obtained in Table 1 remain unaffected even when we extend the model to include the exchange rate. We observe, for example, a causal relationship from the BOJ index to the CPI before the introduction of the zero interest rate policy, but not after the policy is in place. And as shown in Table 1, there is no causal relationship from the commodity price index to the industrial production index in either of the sampling periods. When we focus on the exchange rate, we find a causal relationship from the BOJ index to the exchange rate before the introduction of the zero interest rate policy, but not after the policy is in place.[3]

[3] We also estimate the five-variable system with the commodity price index in Japanese Yen. We found that the BOJ index does not cause CPI when the BOJ index is measured in Japanese Yen. This may be because the pass-through mechanism does not work out very well.

Table 1. Causality Test (5-variable System)

	Sample [A] Jan.1990-Jan.1999		Sample [B] Feb.1999-Dec.2005	
	Test Statistic	*p*-value	Test Statistic	*p*-value
BOJ	157.2008	(0.0000)	41.8416	(0.0000)
CPI	7.7876	(0.0053)	0.6120	(0.4340)
IP	2.2605	(0.1327)	2.3617	(0.1243)
M	0.0154	(0.9012)	1.4642	(0.2263)
R	0.0007	(0.9784)	0.1700	(0.6801)

Note:
The null hypothesis holds that the BOJ index does not Granger cause each variable.

Table 2. Causality Test (6-variable System)

	Sample [A] Jan.1990-Jan.1999		Sample [B] Feb.1999-Dec.2005	
	Test Statistic	*p*-value	Test Statistic	*p*-value
BOJ	155.3646	(0.0000)	40.3552	(0.0000)
CPI	7.4621	(0.0063)	0.5155	(0.4728)
IP	1.8324	(0.1758)	1.8531	(0.1734)
M	0.1068	(0.7438)	1.5704	(0.2102)
R	0.0124	(0.9112)	0.0732	(0.7867)
EX	6.8202	(0.0090)	0.4559	(0.4995)

Note:
The null hypothesis holds that the BOJ index does not Granger cause each variable.

Consumers or producers may directly respond to the change in commodity price index quoted in dollar, and thus CPI does. That is, the information of commodity price index in US dollar is more important than that in Japanese Yen.

4. Conclusion

This paper used the BOJ index published by the Bank of Japan to empirically analyze the relationship between the commodity price index and macroeconomic variables in Japan. The following results were obtained.

The causal relationship from the BOJ index to the consumer price index changed sharply when the Bank of Japan introduced its zero interest rate policy in February 1999. The BOJ index was valid as a leading indicator of the consumer price index before the policy was introduced, whereas the relationship ceased to exist thereafter. We found no causal relationship from the BOJ index to the industrial production index. Note that this relationship is unrelated to BOJ's introduction of the zero interest rate policy. We can therefore argue that the commodity price index has functioned less effectively as an information variable for monetary policy since the adoption of the zero interest rate policy.

Commodity prices and the general price level tend to be closely related, with movements in commodity prices leading movements in the general price level. Commodity prices are determined in auction markets, hence they reflect demand and supply shocks more rapidly than do the prices of manufactured goods. The change in commodity prices resulting from speculative purchases or sales of commodities can therefore be a leading indicator of change in the general price level. We can point out at least two reasons to explain the failure of the commodity price index as a leading indicator in the second sub-sample. First, the price mechanism of financial markets was presumably no longer working when the zero interest rate policy was introduced. This would make it impossible to consider the future movements of monetary policy, and thus the CPI, when commodity prices are determined in auction markets. Secondly, the Japanese economy was in a serious depression when the zero interest rate policy was introduced. The strong deflationary pressure impaired the response of the CPI to overseas shocks including the shocks on commodity prices. As a result, the link between commodity prices and CPI ceased to exist.

Appendix

It is important to see if our empirical results depend on a particular splitting point. We sequentially move the breakpoint by six months around February 1999 and perform causality tests from the BOJ index to the CPI using a five-variable system. The results are shown in Table A1. As is clear from the table, our empirical results are robust to the splitting point as long as we divide the sample around February 1999.

Table A1. Causality Test from BOJ to CPI (5-variable system)

Case 1	Jan.1990-Jul.1997		Aug.1997-Dec.2005	
	4.9542	(0.0260)	0.1873	(0.6652)
Case 2	Jan.1990-Jan.1998		Feb.1998- Dec.2005	
	5.6973	(0.0170)	0.4698	(0.4931)
Case 3	Jan.1990-Jul.1998		Aug.1998-Dec.2005	
	6.9023	(0.0086)	0.3454	(0.5568)
Case 4	Jan.1990-Jan.1999		Feb.1999-Dec.2005	
	7.7876	(0.0053)	0.6120	(0.4340)
Case 5	Jan.1990-Jul.1999		Aug.1999-Dec.2005	
	6.9816	(0.0082)	0.1457	(0.7027)
Case 6	Jan.1990-Jan.2000		Feb.2000-Dec.2005	
	3.6604	(0.0557)	0.4063	(0.5238)

Note:

The null hypothesis holds that the BOJ index does not Granger cause the CPI.
Numbers in parentheses are *p*-values.

References

Awokuse, T.O. and Yang, J., 2003. The Information Role of Commodity Prices in Formulating Monetary Policy: A Reexamination. *Economics Letters* **79**, 219-224.

Cody, B.J. and Mills, L.O., 1991. The Role of Commodity Prices in Formulating Monetary Policy. *Review of Economics and Statistics* **73**, 358-365.

Garner, A.C., 1989. Commodity Prices: Policy Target or Information Variables? *Journal of Money, Credit and Banking* **21**, 508-514.

Hua, P., 1998. On Primary Commodity Prices: The Impact of Macroeconomic/ Monetary Shocks. *Journal of Policy Modeling* **20**, 767-790.

Marquis, M.H. and Cunningham, S.R., 1990. Is There a Role of Commodity Prices in the Design of Monetary Policy? Some Empirical Evidence. *Southern Economic Journal* **57**, 394-412.

Sephton, P. S., 1991. Commodity Prices: Policy Target or Information Variables? A Comment. *Journal of Money, Credit and Banking* **23**, 260-266.

Toda, H.Y. and Yamamoto, T., 1995. Statistical Inference in Vector Autoregressions with Possibly Integrated Processes. *Journal of Econometrics* **66**, 225-250.