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Commodity prices, manufactured goods prices and inflation: evidence from Japan

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Abstract

Using the monthly Japanese data from January 1970 to December 2011, this paper analyzes the predictive power of commodity prices and manufactured goods prices for inflation. We split the full sample into the two sub-periods 1970M1-1990M12 and 1991M1-2011M12. By testing the causality at various frequencies, we provide some new insights on the informational roles of commodity prices and manufactured goods prices for forecasting inflation.

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1. Introduction

Commodity prices are generally considered to have more predictive power for inflation than do the manufactured goods prices. There are at least two reasons for this argument. First, since commodities are traded in continuous auction market, commodity prices react demand pressures or supply shocks more quickly than do the manufactured goods prices (Garner, 1989; Cody and Mills, 1991). Second, traders tend to sign short term contracts for primary commodities and long term contracts for manufactured goods, so commodity prices respond more rapidly than manufactured goods prices to economic fluctuations (Bordo, 1980).

However, some recent studies find that the predictive power of commodity prices for inflation has significantly decreased since the mid-1980s (Herrera and Pesavento, 2009; Verheyen, 2010). In this case, using the monthly Japanese data from January 1970 to December 2011, this article attempts to analyze the predictive power of commodity prices and manufactured goods prices for inflation. Because the Japanese economy suffers from structural changes in the early 1990s (Sato, 2002; Fang and Miller, 2009; Yamada and Jin, 2012), we split the full sample into the two sub-periods 1970M1-1990M12 and 1991M1-2011M12. Then we investigate the differences of the predictive power of commodity prices and manufactured goods prices for inflation in the two subperiods. This analysis is rather important because it might provide policymakers with additional insights on the informational roles of commodity prices and manufactured goods prices for inflation.

The method employed in this paper is the frequency domain causality test proposed by Breitung and Candelon (2006). Unlike the conventional Granger causality test, this test allows us to statistically test the causality at various frequencies. Consequently, using this test, we can easily find the differences of the predictive power of commodity prices and manufactured goods prices for inflation during the two sub-periods. We choose consumer price index (CPI) as a measure of inflation. Since the previous research fails to reach a consensus on its integration order (Cody and Mills, 1991; Beechey and Österholm, 2008; Verheyen, 2010), we employ the Toda and Yamamoto (1995) procedure to establish standard inference for the test, which makes us skip the unit root tests of the variables, including CPI. We believe that it makes us obtain the robust empirical results.

The remainder of this paper is organized as follows. Section 2 introduces the data and empirical methodology. Section 3 presents the empirical results and Section 4 concludes the paper.

2. Data and empirical methodology

As mentioned previously, we choose CPI to measure inflation, and we select NIKKEI commodity price index (NCP) and domestic corporate goods price index (DCGP) to represent commodity prices and manufactured goods prices respectively. The data are obtained from Thomson Datastream Database. The period covered is between January 1970 and December 2011. As mentioned above, we split the full sample into the two sub-periods 1970M1-1990M12 and 1991M1-2011M12, with 252 monthly observations in each sub-period.

The method applied in this research is the frequency domain causality test whose inference is established through the Toda and Yamamoto (1995) procedure. To illustrate this method, let us consider a two dimensional vector of time series $\boldsymbol{z}_t = [x_t, y_t]'$ observed at $t = 1, \ldots, T$. In the present paper, x_t will be CPI and y_t will be NCP or DCGP. We assume that k and d are the correct vector autoregressive (VAR) order and maximal integration order of the series. To apply the Toda and Yamamoto (1995) procedure, we artificially augment the correct VAR order k by the maximal integration order d. Then, let us consider the level VAR model of order $(k + d)$:

$$\boldsymbol{z}_t = \boldsymbol{\mu} + \boldsymbol{\Theta}_1 \boldsymbol{z}_{t-1} + \boldsymbol{\Theta}_2 \boldsymbol{z}_{t-2} + \cdots + \boldsymbol{\Theta}_k \boldsymbol{z}_{t-k} + \boldsymbol{\Theta}_{k+1} \boldsymbol{z}_{t-k-1} + \cdots + \boldsymbol{\Theta}_{k+d} \boldsymbol{z}_{t-k-d} + \boldsymbol{\varepsilon}_t, \quad (1)$$

where $\boldsymbol{\mu}$ is the constant term; $\boldsymbol{\Theta}_1, \boldsymbol{\Theta}_2, \ldots, \boldsymbol{\Theta}_{k+d}$ are coefficient matrices; and $\boldsymbol{\varepsilon}_t$ is the error vector.

Let $\theta_{12,i}$ denote the (1,2)-element of $\boldsymbol{\Theta}_i$ for $i = 1, \ldots, k$, $\boldsymbol{\beta} = [\theta_{12,1}, \theta_{12,2}, \ldots, \theta_{12,k}]'$ and

$$\boldsymbol{R} = \begin{bmatrix} \cos(\omega) & \cos(2\omega) & \cdots & \cos(k\omega) \\ \sin(\omega) & \sin(2\omega) & \cdots & \sin(k\omega) \end{bmatrix}.$$

Then, we can test the null hypothesis that y_t does not cause x_t at frequency ω by testing the linear restrictions on the (1,2)-elements of the first k coefficient matrices in Eq. (1), which can be expressed as

$$H_0 : \boldsymbol{R}\boldsymbol{\beta} = \boldsymbol{0}. \quad (2)$$

Note that if $\boldsymbol{R} = \boldsymbol{I}_k$, the above null hypothesis corresponds to the hypothesis of the conventional Granger causality test based on the Toda and Yamamoto (1995) procedure, and the Wald test statistic can be calculated the same as below.

Let $\boldsymbol{S}_1 = [1, 0]'$, $\boldsymbol{S}_2 = [0, 1]'$ and $\boldsymbol{S} = \boldsymbol{I}_k \otimes \boldsymbol{S}_2'$, then the Wald test statistic W for Eq. (2) can be written as

$$W = (T - k - d)\{\boldsymbol{R}(\boldsymbol{S} \otimes \boldsymbol{S}_1')\mathrm{vec}(\hat{\boldsymbol{\Theta}})\}'[\boldsymbol{R}(\boldsymbol{S} \otimes \boldsymbol{S}_1')\hat{\boldsymbol{\Sigma}}(\boldsymbol{R}(\boldsymbol{S} \otimes \boldsymbol{S}_1'))']^{-1}\{\boldsymbol{R}(\boldsymbol{S} \otimes \boldsymbol{S}_1')\mathrm{vec}(\hat{\boldsymbol{\Theta}})\}, \quad (3)$$

where $\hat{\boldsymbol{\Theta}}$ is the ordinary least squares estimator of $\boldsymbol{\Theta} = [\boldsymbol{\Theta}_1, \ldots, \boldsymbol{\Theta}_k]$ and $\hat{\boldsymbol{\Sigma}}$ is the consistent estimator of the covariance matrix of $\sqrt{T - k - d}\ \mathrm{vec}(\hat{\boldsymbol{\Theta}} - \boldsymbol{\Theta})$ based on Eq. (1).

The Wald test statistic W is asymptotically distributed as $\chi^2(2)$ for $\omega \in (0, \pi)$. To evaluate the significance of the causal relationship, the Wald test statistic is compared with the 5% critical value (5.99) of a chi-square distribution with two degrees of freedom in this study.

3. Empirical results

We employ Schwarz Information Criterion (SIC) to decide the correct VAR order k. For the value of d, because the order of integration of these macroeconomic variables is at most two, both $d = 1$ and $d = 2$ are considered.

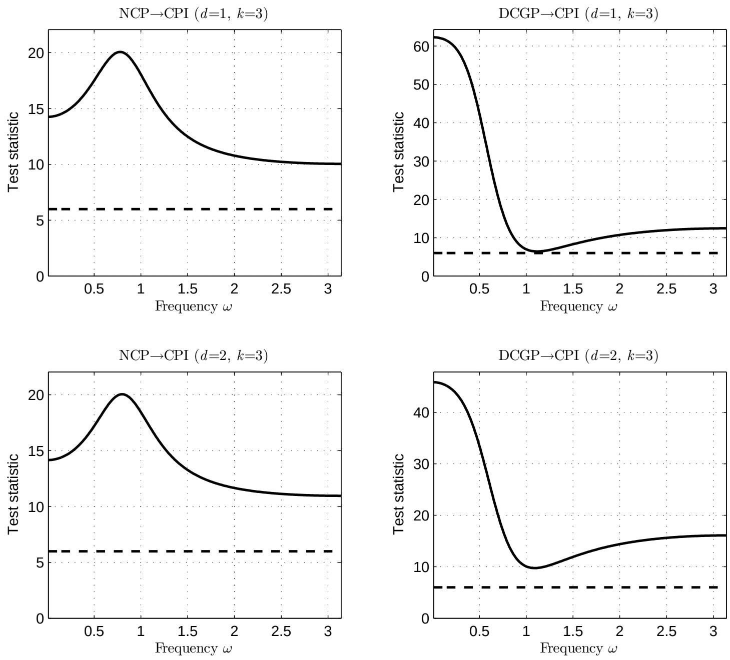

Figure 1: The results of the frequency domain causality tests for the first sub-period 1970M1-1990M12. Two top panels: causality measure from NCP and DCGP to CPI for d=1. Two bottom panels: causality measure from NCP and DCGP to CPI for d=2. The solid lines depict the Wald test statistics. The horizonal line represents the 5% critical value (5.99).

Fig. 1 and Fig. 2 present the results of the frequency domain causality tests for the respective sub-periods. As we can see the causality measure for $d = 1$ is qualitatively the same as the causality measure for $d = 2$, so we mainly focus on the results for $d = 1$. We notice that the empirical results differ substantially between the two sub-periods. In the first sub-period, the causality running from NCP and DCGP to CPI is detected in the frequency range $\omega \in (0, \pi)$, which indicates that NCP and DCGP can predict inflation in both the short- and long-term periods. However, in the second sub-period, the causality running from NCP to CPI is merely detected at frequencies less than 0.59, and the causality running from DCGP to CPI is found for frequencies below 0.69, between 0.78 and 1.38 and above 2.31. Consequently, both NCP and DCGP fail to forecast CPI at certain frequencies during the second sub-period. In particular, we notice that NCP fails to Granger cause CPI at the high frequencies. This implies that NCP can not forecast the short-term changes of inflation. Thus, in the second sub-period, NCP can only predict the long-term fluctuations of inflation, while DCGP is still significant in forecasting inflation in both the short- and long-term periods.

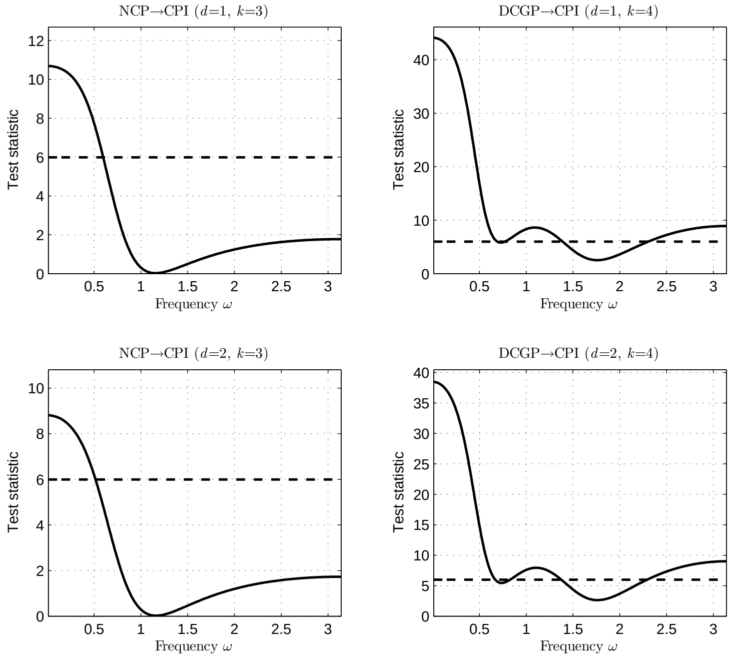

Figure 2: The results of the frequency domain causality tests for the second sub-period 1991M1-2011M12. Two top panels: causality measure from NCP and DCGP to CPI for d=1. Two bottom panels: causality measure from NCP and DCGP to CPI for d=2. The solid lines depict the Wald test statistics. The horizonal line represents the 5% critical value (5.99).

4. Conclusions

Using the monthly Japanese data from January 1970 to December 2011, we investigate the predictive power of commodity prices and manufactured goods prices for inflation. Because the Japanese economy suffers from some structural changes in the beginning of the 1990s, we split the full sample into the two sub-periods 1970M1-1990M12 and 1991M1-2011M12. In the first sub-period 1970M1-1990M12, we find commodity prices and manufactured goods prices Granger cause CPI in the frequency range $\omega \in (0, \pi)$. This indicates that commodity prices and manufactured goods prices can predict the short- and long-term fluctuations of inflation. In the second sub-period 1991M1-2011M12, however, the causality running from commodity prices and manufactured goods prices to CPI is merely detected at some small ranges of frequencies. In this sub-period, manufactured goods prices are still significant in forecasting inflation in both the short- and long-run periods, while commodity prices can only predict the long-run fluctuations of inflation. Thus, in recent years it is inappropriate to use the commodity prices to predict the short-term changes of inflation in Japan.

Before closing, we should note that the factors such as the exchange rate changes and money growth also have certain effects on inflation. For example, Assenmacher-Wesche *et al.* (2008) find that money growth can predict the inflation of Japan at the low frequencies. In this case, using the Hosoya (2001) procedure, we can eliminate the effects of money growth and test the partial causality running from commodity prices and manufactured goods prices to inflation at various frequencies, which would be a very interesting research topic in the future.

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