Nota Ulasan/*Commentary Note*

The Long-Run Relationship between Nominal Interest Rates and Inflation of the Asian Development Countries: A Commentary

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There has been widespread concern among policymakers about the relationships or inter-effects between interest rate and inflation. The empirical testing on these relations is widely applied based on Fisher hypothesis. Fisher (1930) had hypothesized that the nominal rate of interest was equal to the sum of both the real rate of interest and the expected rate of inflation, and exist a one-to-one relationship between the rate of interest and expected inflation assuming the real rate being independent of the rate of inflation. The Fisher effect, commonly referred to the movements in short-term interest rates primarily reflects fluctuations in expected inflation and, as such, they have predictive ability for future inflation. The Fisher hypothesis predicts that the coefficient on the rate of inflation equals to one, and is a long-run relationship; therefore, inflation could affect real interest rates in the short run. During the adjustment process, the real rate will change so that the nominal rate reflects both changes in real rates and inflationary expectations. In the long run, when all adjustments have occurred, the increase in inflation is fully incorporated in nominal interest rates.

Does the Fisher effect hold in Asian developing countries? Rasidah and Hawati have empirically, that appeared in Jurnal Ekonomi Malaysia Vol. 35 (2001), investigated this question by applying cointegration approach on Malaysia, Thailand, Indonesia, South Korea, and Philippines. That is to find out the Fisherian link between inflation and long-term nominal interest rates. Their article provides a finding that no cointegration between inflation and long-term nominal interest rates for all the sample countries except Indonesia. Further, Rasidah and Hawati have concluded that Fisher effect does not hold for these sample countries except Indonesia. With application to Indonesia case, the Granger causality test shows bilateral causal relations between interest rate and inflation rate.

Much of my concerns on Rasidah and Hawati's work are the data and the time series techniques used e.g. unit root, cointegration, and causality tests. Rasidah and Hawati have used Consumer Prices Index (CPI) and 3 months Treasury bill rate (nominal interest rate) that available from International Momentary Fund's data set, *International Financial Statistics*. The CPI is a measure of price level and not inflation. The inflation can be derived from CPI viz. growth rate of CPI or first differenced of logs of CPI. In order to capture the "long-term" interest rate, 6 and 12 months Treasury bill rates have to been included in analysis separately, and to examine the different effects of various periods of Treasury bill rates used.

Rasidah and Hawati use Dickey-Fuller, DF (or Augmented DF) unit root tests to test the series stationarity, or its degree of integration, I(d). The results reported in Table 1 indicates that all series, interest rate and inflation rate are nonstationary, and are in I(1) process. However, the augmented lag, and unit root equation used in their study are unclear (not reported). The finding of series stationarity can affect the subsequent analysis, in particular cointegration analysis. Considering the empirical literature, the unit root equation may include constant and trend for the macroeconomic data in levels for testing the null of unit root versus the alternative of trend-stationary. Meanwhile, the trend variable has to been excluded from unit root equation for the data in fist differences under the null of a unit root against the alternative of differenced stationary. Based on these approaches, using the same data set from *International Financial Statistics*, I have re-run the unit root tests for "inflation" in Malaysia. The results of ADF and Phillip-Perron unit root tests show that CPI is I(1) at 5% significance level of MacKinnon's (1991) critical value. But the Malaysian inflation (growth rate of CPI) is, however, in I(0) process at 5% significance level. Therefore, I judge that the "inflation" variable used in Rasidah and Hawati is price level, which is proxied by CPI, and not inflation rate.

As noted, Fisher effect is long run phenomenon; using monthly data may not be sufficient to reflect the 'long run' effect between interest rate and inflation. For Malaysia case, I find that these rates are constant for substantial months. For example, the Treasury bill rate is 5% for January to April 1990; 6% for May to August 1990; and 7% for September 1990 to July 1991. Meanwhile, the CPI is 82 for February to September 1990; 83 for October to November 1990; and 84 for December 1990 to January 1991 (*International Financial Statistics*). Hence, quarterly data is more appropriate to capture the changes between interest rate and inflation.

It is important to understand that the recent developed approach of time series analysis, cointegration approach can be applied for testing the presence of a long run relationship between a set of involved variables accordance to economic theory. The presence of unit roots in the data allows the possibility that there is a long-run cointegrating relation between the variables viz. interest rate and inflation that is a long-run Fisher effect. It means a I(0) linear combination does exist from the I(1) inflation and interest rates in a cointegrating framework. If the involved series are in different order of integration say I(0) and I(1), no cointegration can be concluded. The stationarity of OLS (ordinary least squares) estimated residuals series is tested using unit root equations viz. DF or ADF (Engle and Granger's approach) as applied in Rasidah and Hawati. An appropriate DF or ADF equation for testing the null of no cointegration is without trend, but with constant term (see Davidson and MacKinnon, 1993, p.721). If the residuals series is I(0) than the null of no cointegration can be rejected and a long run relationship between the involved variables can be concluded. However, the critical values used for Engle and Granger's cointegration test is essentially concerned here. Be aware that the reported critical values by numerous statistical software, for example Eviews (MacKinnon's critical values) are for data series, and not applicable for estimated series like residuals. To address this issue, the asymptotic critical values documented in Davidson and MacKinnon, (1993, p. 722, Table 20.2) should be used for cointegration test. I find that the ADF statistic reported in Rasidah and Hawati for Indonesia (as in Table 2) is –2.625, However, the critical value reported by Davidson and MacKinnon (1993) is –3.04 at 10% significance level, thus no cointegration is expected.

Since Rasidah and Hawati's work has concentrated on the long run relationship between nominal interest rate and inflation, another cointegration techniques are suggested to test the robustness and consistency of the ADF's findings. With this concern, the Johansen's multivariate test can be used considering that this approach is found to be more efficient and is insensitive to the left-hand side variable of the cointegrating regression than Engle-Granger method.

Another concern can be raised here is that the inflation variable used in their study is in actual values and not in expected values. Considering this concern, to test the Fisher effect is to use expected inflation rate rather than actual inflation rate. The Fisher effect in the long run can be tested by using cointegration approach for the following cointegrating equation: $i_t = a + b\pi_{t+1} + e_t$, where i is nominal rate of interest; and π_{t+1} is the expected rate of inflation. A long run model for price level (CPI) can be estimated

(OLS estimator) with its determinants viz. money supply, real Gross National Product, import price, and exchange rate to obtain a rational expectations model incorporating the Fisher equation. Following the Granger Representation theorem, if these variables are cointegrated, an error-correction model can be established. Therefore, the forecast rates of inflation as proxy for inflationary expectations are computed from the estimated error-correction model. If the I(1) series are not cointegrated, a short run dynamic model is appropriate to forecast the inflation rates in order to test the validity of Fisher effect in the short run.

On the other hand, the short run Fisher effect indicates that a change in the interest rate is associated with an immediate change in the expected inflation rate. If a cointegrating relation does exit between expected inflation and interest rate, an error correction model can be established by adding an error correction term (lagged one period estimated residual from cointegrating equation) into a short run dynamic model with variables in first differences, to assume its stationary. The short run Fisher effect can be detected by testing the estimated coefficient of the change in the expected inflation rate is different from zero (t-test).

Rasidah and Hawati have documented that numerous empirical works proposed a positive relationship between interest rate and inflation under Fisher hypothesis. An interesting point here is that the estimated coefficients of the interested countries include Indonesia, show a negative signs (see Table 2 p. 9). It runs contrary with prior expectation. This indicates that expected rate of inflation has negative effect on interest rate. A possible explanation is the use of CPI rather than inflation rate in their analysis (Rasidah & Hawati 2001, p.6) as discussed early.

There has been widespread concern about the causal relationship between a pair of time series. According to Granger (1988), causality is based on two fundamental principles that are the cause occurs before the effect; and the causal series contains special information about he series being caused that is not available in the other available series. It is perhaps not surprising that Rasidah and Hawati have applied this approach in their study. In their study, the standard Granger-causality tests (Granger, 1969) has been applied for co-integrated I(1) interest rate and inflation as in Indonesia, and not for no cointegrated I(1) variables in another studies. The results indicate a bilateral causality between these series (in Indonesia). Unfortunately, the causality approach used in Rasidah and Hawati's study is 'incomplete'. For the cointegrated I(1) series, error correction term ($ECT_{t-1} = Y_{t-1} - b_0 - b_1 X_{t-1}$) must be included into standard Granger causality specification to avoid misspecification (the variables used are in

first differences to achieve its stationary) (Granger 1988). If the error correction term is different from zero even thought the sum of the coffefficients of lagged independent variables is insignificant, a conclusion of causality from X to Y can be established – long run causality. If the I(1) series are not cointegrated, or mixed of I(0) and I(1) variables, standard Granger causality test is used (Granger 1969) without the inclusion of error correction term (with first differencing I(1) variables once to achieve its stationary). Now, the Wald statistic (F-statistic) for joint significant test is applied for testing the null of X does not Granger-cause Y – short run causality. This approach is appropriate for Malaysia, Philippines, Thailand and South Korea which I(1) inflation and interest rates are not cointegrated. Another issue of causality test in Rasidah and Hawati is that the lag length used in Granger-causality equation is unclear. Akaike Information Criterion or Schwarz Bayesian Information Criterion can used to choose an optimum lag structures for causality test since the causality tests are sensitive to various lag structures.

In sum, Rasidah and Hawati have raised an interesting topic that trying to answer the question of the validity of Fisher effect for five Asian developing economies. I hope that the discussions appeared here, will add a dimension to this literature, and determine the extent to which the conclusions reached by Rasidah and Hawati may be confirmed by incorporating this commentary.

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