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The Impact of Anticipated and Unanticipated Money on Real Income in Thailand

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ABSTRACT

In this paper we test the impact of anticipated and unanticipated money on real income in Thailand. We found that anticipated money matters in Thailand, but unanticipated money does not.

INTRODUCTION

The rational expectation hypothesis was first introduced by John F. Muth in 1961, but its importance developed only after this concept was applied to neo-classical models in the 1970's. The earliest application of the rational expectation hypothesis to macroeconomic stabilization policy issues was made by Robert E. Lucas, Jr. in his highly influential paper, "Expectation and the Neutrality of Money," (1972).

Subsequently, Lucas (1972), and Sargent and Wallace (1975) argued that anticipated changes in aggregate demand policy will have already been taken into account by economic agents and will evoke no output or employment response. Therefore, feedback policy rules will have no impact on output fluctuations in the economy. Only unanticipated policies can cause changes in real output.

The proposition of the rational expectation hypothesis that anticipated short-run monetary stabilization policies do not influence real economic variables has been named the Macro Rational Expectations (MRE) hypothesis by Modigliani (1977). The empirical validity of MRE has been a central issue in modern stabilization theory. Barro (1977,1978,1981), Barro and Rush (1980), and Leiderman (1980) tested the neutrality implication of the MRE hypothesis that anticipated monetary policy does not matter by using a two-step procedure where the money growth equation was estimated by ordinary least squares with the residuals from this equation representing unanticipated movements in money growth, and the fitted values, anticipated money. A measure of real output was then regressed on antici-

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pated and unanticipated money. For the United States, they found unanticipated money growth variables had significant explanatory power. However, anticipated money was insignificant.

Mishkin (1982) applied a somewhat different procedure and jointly tested both the neutrality and rationality implications of the MRE hypothesis. His work cast doubt on previous findings that only unanticipated monetary policy is relevant to the business cycle. Employing Mishkin's methodology to a group of industrial countries, Hoffman and Schlagenhauf (1982) also found anticipated policy non-neutral.[1]

Recently McGee and Stasiak (MS-1985) presented another methodology for examining the Lucas-Sargent-Wallace proposition of policy ineffectiveness. Their results supported the findings of Hoffman and Schlagenhauf and Mishkin that anticipated monetary policy actions influence output in the short run. What makes their procedure appealing is that anticipated components do not have to be estimated (as they do in Mishkin) to test the policy ineffectiveness proposition (McGee and Stasiak,MS,P.19)

In this paper we apply MS's procedure to Thailand. Though Thailand is a developing country, compared to other developing countries, "Thailand's financial sector is quite advanced, open and deep," (Hanson and Neal, 1985, p. 135). Thus, we believe it is appropriate to test the effects of money on output.

While the Thai economy is predominantly money using, currency dominates checkable money. In 1984, currency represented over sixty-eight precent of M1,[2] a percentage only slightly lower than in 1955 (72%)

The ratio of currency to M1 itself has been highly variable falling to just under fifty-nine percent in 1961 and rising to a high of seventy-three percent in 1983. This high and variable currency ratio may be the result of periodic polical instability compounded by the lack of explicit insurance on checkable accounts.[3] In addition. a substantial part of the checkable money may represent savings instead of transactions accounts and may not be closely related to output. Since our tests are to determine if the monetary authorities can influence real output with monetary policy, the monetary variable used in this study is the monetary base, obstensibly a variable directly under control of the Central Bank. For completeness, an extensive set of tests were also performed using M1. The results of these tests are briefly alluded to in the concluding section of the paper.

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1. The exception was Canada.
2. M_1 = Currency Held by Public and Demand Deposite of Commercial Bank
3 Over the period we tested, Thailand experienced numerous actual and attempted coups.

THE MODEL

While McGee and Stasiak (MS) limited their model to a three variable, three equation system, we add variables and equations representing government

$$\begin{bmatrix} RGDP_t \\ MONEY_t \\ INF_t \\ GOVT_t \\ NFA_t \end{bmatrix} = \begin{bmatrix} a_{11}(L) & a_{12}(L) & a_{13}(L) & a_{14}(L) & a_{15}(L) \\ a_{21}(L) & a_{22}(L) & a_{23}(L) & a_{24}(L) & a_{25}(L) \\ a_{31}(L) & a_{32}(L) & a_{33}(L) & a_{34}(L) & a_{35}(L) \\ a_{41}(L) & a_{42}(L) & a_{43}(L) & a_{44}(L) & a_{45}(L) \\ a_{51}(L) & a_{52}(L) & a_{53}(L) & a_{54}(L) & a_{55}(L) \end{bmatrix} \cdot \begin{bmatrix} RGDP_t \\ MONEY_t \\ INF_t \\ GOVT_t \\ NFA_t \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \\ e_{4t} \\ e_{5t} \end{bmatrix}$$

spending and the balance of payments in an attempt to discover the effects of anticipated and unanticipated policies on real output in Thailand. The model is as follows:

RGDP is real gross domestic product. Money, INF, and GOVT are the nominal monetary base, rate of inflation (measured by the GDP deflator), and nominal government expenditures respectively. NFA is the net foreign assets held by the Bank of Thailand and the Exchange Fund.[4] (L) is a lag operator. All variables are entered as stationary series.

Since the coefficients on contemporaneous values of the variables on the right hand side of (1) are a priori restricted to zero, equation (1) states that the current value of any variable in the model can be expressed as a function of its own past history and the past history of the other variables in the model. Because of error the relationship is not exact. It is not assumed that all variables enter into all equations.

If the lag strcuture in (1) embodies information occurring sufficiently far in the past that this information has had sufficient time to be processed, then past values of the variables represent the effect of currently known (anticipated) variables on current variables, (MS, pp. 18-19). Since our data are yearly, we assume this to be the case. As a result, if the a_{1x}, x = 2 to 5, in the GDP equation are all equal to zero then neither past, and consequently anticipated money or any other anticipated variable has any impact on current real GDP.

The residuals in (1) represent innovations in the processes generating the left hand side variables. McGee and Stasiak (MS) argue that significant correlations between the current innovation in the RGDP regression and the current innovations in the other series

[4] Since Thailand's exchange rate has exhibited little variation over the time period tested, the monetary approach to the Balance of Payments suggests NFA as the relevant measure of the balance of payments.

represent the effects of currently unanticipated policies of events on real GDP.[5]

If anticipated (past) variables are found to be insignificant and significant correlations are obtained between the current innovation in RGDP and the current innovation in MONEY and/or one or more of the other variables, this result would lend strong support to the proposition that only unanticipated policy matters. Anticipated policy would be ineffective in influencing real GDP.

Finally, while past growth of money and other variables in the GDP equation represent currently available information, because of forecasting error, they were initially partially unanticipated. Though our data are yearly, adjustment costs could result in past innovations having an effect that persists beyond one period. But these effects on the current period will be captured in the lags of RGDP on its own past history, $a_{11}(L)$, (MS, pp. 18-19).

PROCEDURES

Unlike the procedure followed by McGee and Stasiak (MS) where the lag structure and variables entering the estimating equations were chosen, variables and lag lengths for each equation were determined empirically using the Final Prediction Error (FPE) criterion developed by Akaike (1969).[6]

The procedure used to estimate the models tested in this paper derives primarily from work by McMillan and Fackler (1984). Briefly, all variables were first transformed to obtain stationary series. The first difference of logarithms sufficed for RGDP, GOVT, and NFA. INF, already expressed as the first difference of the log of price, and MONEY required an additional differencing to induce stationarity.[7]

Next, the FPF criterion was used to determine the optimal own lag length for each variable. Again, using the FPE criterion, a series of sequential tests were then implemented to determine which additional variables and at what lag lengths these variables should enter into each estimating equation. Because of limiting degrees of freedom, the maximum lag length was restricted to three. In no case did all variables enter into and finally selected equation. The single equation models were then treated as a system and re-estimated using Zellner's technique for seemingly unrelated regressions. Since the results of systems estimation may differ from single equation results, additional speci-

[5] Care must be taken with this interpretation. Reverse causality between unanticipated RGDP and MONEY can not be ruled out.

[6] The FPE procedure appears to be fairly robust in determining lag lengths in a bivariate model, (see Thornton and Batten, 1985).

[7] To determine if a series was stationary both the autocorrelation functions and the graphs of the first and second differences of the series were examined.

fication tests were performed. In these tests, the system results were the maintained hypothesis. For each equation, taken one at a time, any variables which were not initially included by the FPE criterion were re-tested for significance by including two lags of these variables and reestimating the system.

All data (yearly) were obtained from International Financial Statistics, 1984 and 1985 Yearbooks. The data covers the period 1955 to and including 1984. After differencing and lagging, the dependent variable takes on values over the period 1960 to 1984.

EMPIRICAL RESULTS

The results obtained from the final systems estimation are found in Table 1. The main differences between these results and those obtained from the Ordinary Least Squares (OLS) regressions were the additions of INF and NFA to the MONEY equation and NFA to the RGDP equation. (Details of the OLS equations are available on request.)

The X^2 reported below the individual regressions are tests of the hypotheses that the lags of a given variable are equal to each other and equal to zero. T-scores for individual coefficients are also reported.

Autocorrelation does not appear to be a problem. For each equation the first eighteen autocorrelations of the residuals were computed. The Bartlett test indicated that only lag eleven of the residuals from the INF equation was significantly different from zero, and then only at ten percent.[8,9]

The results indicate the anticipated money matters as a determinant of RGDP.[10] The only other significant determinant of RGDP is the percentage change in net foreign assets (NFA) which affects RGDP directly, and indirectly as a determinant of MONEY. These results do not support the extreme monetarist view that only unanticipated money matters. However, the results from the inflation regression support the monetarist proposition that inflation is a monetary phenomenon. MONEY is the only significant (other than own lags

[8] For white noise residuals the approximate large sample standard error for the individual autocorrelations is $1/\sqrt{n}$, where n is the number of observations.

[9] For the OLS equations used prior to the initial systems regression, autocorrelation also does not appear to be a problem. Evidence of serial correlation was found at the 10% level for the seventh lag of the MONEY residuals and at the 10% level for the eleventh lag of the INF residuals. No other autocorrelations were significant

[10] Since the single coefficient on MONEY is positive and not offset by other negative coefficients, the results appear to be at odds with long run money neutrality. The system reported in Table 1 was respecified to include additional lags of MONEY in the RGDP equation. The additional lags (up to two more) were always insignificant and lowered the adjusted R^2 of the RGDP equation. Because we limited our tests to a maximum of three lags, it is possible that even longer lags could both improve the fit and be consistent with long run money neutrality.

of INF) determinant of inflation.

The results in Table 2 indicate that there is no significant correlation between the residuals from the MONEY and RGDP equations. It does not appear that unanticipated money or any other unanticipated variable, including the unanticipated component of government spending, affects real output in Thailand.[11]

CONCLUSIONS

In this paper we have presented and tested a model to determine if either or both anticipated or unanticipated money affect real output in Thailand. We find evidence that anticipated money, measured by the monetary base, matters while unanticipated money does not. Thus, our tests provide no confirmation, and in fact contradict, the hypothesis that only unanticipated money causes changes in real output. However, we find no evidence that government expenditure, whether anticipated or unanticipated has any effect on Thai output.

For reasons mentioned in the text there are reasons for believing that M1 may not perform well in explaining Thai real output. This was confirmed when M1 replaced MBASE as the monetary variable. We found no evidence that either anticipated or unanticipated M1 mattered.

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Table 1. Estimated Equations

1 $RGDP = \underset{(5.33)***}{0.07} - \underset{(0.09)}{0.17RGDP_{t-1}} + \underset{(2.03)*}{0.16MBASE_{t-1}} + \underset{(0.30)}{0.01NFA_{t-1}} + \underset{(1.74)*}{0.05NFA_{t-2}}$

$X^2_{NFA} = 4.40 \quad R^2 = 0.22$

2 $MBASE = \underset{(0.94)}{0.01} - \underset{(2.20)**}{0.37MBASE_{t-1}} - \underset{(1.39)}{0.28MBASE_{t-2}} - \underset{(4.06)***}{0.58MBASE_{t-3}} - \underset{(0.57)}{0.04GOVT_{t-1}} \underset{(1.15)}{-0.16INF_{t-1}} \underset{(2.73)**}{+0.34INF_{t-2}}$

$+ \underset{(2.07)*}{0.08\ NFA_{t-1}} - \underset{(2.43)**}{0.11NFA_{t-2}}$

$X^2_{MBASE} = 26.88*** \quad X^2_{INF} = 9.08** \quad X^2_{NFA} = 7.66** \quad R^2 = 0.42$

3 $INF = \underset{(0.50)}{0.00} - \underset{(1.02)}{0.19INF_{t-1}} - \underset{(2.69)**}{0.39\ INF_{t-2}} + \underset{(3.30)***}{0.73MBASE_{t-1}} + \underset{(1.72)}{0.41MBASE_{t-2}}$

$X^2_{INF} = 8.70** \quad X^2_{MBASE} = 11.08*** \quad \bar{R}^2 = 0.46$

4 $GOVT = \underset{(1.45)}{0.08} + \underset{(0.18)}{0.03GOVT_{t-1}} + \underset{(0.42)}{0.03NFA_{t-1}} + \underset{(3.00)***}{0.24NFA_{t-2}} - \underset{(1.33)}{0.68RGDP_{t-1}} + \underset{(2.42)**}{1.18RGDP_{t-2}}$

$X^2_{NFA} = 11.59*** \quad X^2_{RGDP} = 7.98** \quad R^2 = 0.51$

5 $NFA = \underset{(1.16)}{0.12} + \underset{(1.04)}{0.15NFA_{t-1}} + \underset{(1.04)}{0.16NFA_{t-2}} - \underset{(3.72)***}{0.61NFA_{t-3}} + \underset{(3.29)***}{3.22RGDP_{t-1}} \underset{(2.47)**}{-2.26RGDP_{t-2}} \underset{(1.99)*}{-0.67GOVT_{t-1}}$

$X^2_{NFA} = 16.88*** \quad X^2_{RGDP} = 18.69*** \quad R^2 = 0.63$

*Significant at 0.10 level; ** Significant at 0.05 level; ***Significant at 0.01 level.

[11] The correlation of the residuals from the MONEY and RGDP regressions are significant .16. At .11 the RGDP and NFA residuals are significant.

Table 2. Significant Residual Correlations

Variables	Correlation
MONEY and INF	0.76***
MONEY and NFA	0.51***
INF and NFA	0.37*

*Significant at .10 level

***Significant at .01 level

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