

## Monetary, fiscal and exchange rate policies and Philippine output: an application of IS-MP-AS model

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### Abstract

Extending Romer's model and applying Engle's ARCH/GARCH process, the study finds that real GDP in the Philippines is negatively influenced by the expected inflation rate and the US federal funds rate, and positively affected by the government deficit/GDP ratio, the domestic debt/GDP ratio, real peso depreciation, and stock market performance. Hence, more government deficit spending and debt as percent of GDP can be used to stimulate a weak economy. Although peso depreciation would help raise output, currency depreciation may have other negative effects such as the outflow of international investors, and currency substitution that may cause exchange rate instability.

*JEL classification:* E5, E6, F4

*Keywords:* Monetary policy, government deficits and debt, currency depreciation, stock prices

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### 1. Introduction

In recent years, the Philippines has experienced challenges and made progress. During the Asian financial crisis, partly because of the exchange rate crisis that originated in Thailand, the peso/dollar exchange rate rose by 60.8 percent from P26.38 in June 1997 to P42.41 in January 1998. To defend the peso, the *Bangko Sentral ng Pilipinas* (BSP), the central bank of the Philippines, raised the money market rate from 14.4 percent in June 1997 to 24.8 percent in July 1997 and a high of 33.9 percent in October 1997. To avoid potential high inflation that may be triggered by the peso depreciation, the BSP kept the growth rate of real M2 at -1.05 percent in 1998. As a result, the inflation rate rose 9.7 percent in 1998. Investors sold financial stocks to avoid further loss measured by the value of

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foreign currency and pushed the share stock index (2000=100) from 86.6 in June 1997 to 43.9 in September 1998. To handle the crisis, the central government pursued active discretionary fiscal policy to incur a budget deficit of 50 billion pesos in 1998 compared with a budget surplus of 1.6 billion pesos in 1997. The crisis led to a small decline in real GDP by 0.58 percent in 1998.

After the Asian financial crisis, the peso/dollar exchange rate has been on the rise and reached 55.57 in December 2003. Following the world interest rate such as the US federal funds rate, the money market rate dropped to a low of 6.9 percent by the end of 2003. The inflation rate also declined to 2.9 percent in 2002 and 3.1 percent in 2003, suggesting that the inflation targeting initiated in January 2002 had led to stable and low inflation. Government budget deficits continued after 1998, reaching 199.9 billion pesos in 2003. The stock market has not been doing well, declining to a low of 40.8 in 2003. The unemployment rate rose from 8.7 percent in 1997 to 10.1 percent in 1998 and remained relatively high at 11.4 percent in 2003. The continual depreciation of the peso has not led to the outcome as some had expected since there was still a trade deficit of 107.8 billion pesos in 2003 partly because of the higher cost of imports. Overall, real GDP had risen more than 3.0 percent since 1998 and grew at an annual rate of 4.9 percent in 2003.

This paper attempts to determine how government deficit spending, stock market performance, currency depreciation or appreciation, expected inflation and other related variables affect output. This study has several unique features. The author extends Romer's [2000] IS-MP-IA model, which replaces the conventional LM function with a Taylor [1993, 1998, 1999] rule-type monetary policy (MP) function. Romer [2000] indicated that many central banks target the interest rate instead of the real quantity of money. Hence, the MP function would be more appropriate than the LM function. This study considers more variables in the model, including financial stocks and government bonds in the IS function, the exchange rate and the world interest rate in the MP function, and the exchange rate in the inflation adjustment (IA) function. Hsing [2004a, 2004b] extended Romer's [2000] model to small open economies and found that the Romer model explained the relations between equilibrium output and some of the above-mentioned macroeconomic variables quite well. In this empirical work, Engle's [1982, 2001] ARCH/GARCH process is applied to test whether the error variance is determined by past squared errors and/or past error variances.

## **2. Literature survey**

Several recent empirical studies of output fluctuations, macroeconomic policies, and exchange rates are relevant to this paper. Bhattacharya [1997] examined the factors for output variations for five Asian countries, including the Philippines. According to his results, exports and real output were not

cointegrated. Exports and non-oil supply shocks were less important for the Philippines than for those outward-oriented nations such as South Korea, Singapore, and Malaysia. Instead, domestic shocks explained a large proportion of the variation in output. Baig and Goldfajn [2002] examined macroeconomic policies for the Philippines, South Korea, Thailand, Malaysia, India, and Indonesia, and found that Indonesia's macroeconomic situation was unsustainable, the remaining five nations were vulnerable to a currency crisis, and that all these countries had a contagion effect.

Using 1981-1991 data, Endriga [1993] explored the relative importance of targeting the interest rate or the quantity of money in order to maintain a stable and growing output. He found that the interest rate coefficient was insignificant and that targeting the quantity of money would be more appropriate in monitoring output growth. Using a sample before the Asian financial crisis, Hashimoto [2001] studied the impacts of interest rates on several selected macroeconomic variables for four Asian nations, including the Philippines. He showed that a higher interest rate or interest spread had long-term negative effects on output growth rates, exchange rates, and other related variables. Bautista [2003] showed that structural changes were found in the correlation between the interest rate and the exchange rate and that there was evidence that the interest rate was not an effective tool in defending the peso exchange rate.

Moreno [1999] analyzed the relation between depreciation and output fluctuations for six East Asian countries during the period 1975-1996. He found that there existed a negative relationship between real exchange rates and output and that banking crises worsened the negative impact of the depreciation on output. Faini and Gressani [1998] attempted to find the relationship between the exchange rate policy and the burden of external debt for the Philippines. They showed that to contain potential inflation and to avoid large amounts of foreign debt, the Philippine government was reluctant to pursue the devaluation of the peso in real terms. As a result, the overvalued peso hurt its exports. Upadhyaya [1999] found different short-run and long-run effects of devaluations on real output for six selected nations. In the short run, devaluations raised real output for the Philippines and India but reduced real GDP for Pakistan. In the long run, currency devaluation had a negative impact on real output for Thailand and Pakistan and no effect for India, Malaysia, the Philippines, and Sri Lanka. Based on a unit root test, Chou and Chao [2001] analyzed the impacts of devaluations for five Asian countries, including the Philippines. They indicated that currency devaluations hurt real output in the short and long run. Fujii [2002] investigated whether the Asian financial crisis had changed the behavior of real exchange rates for five countries, including the Philippines. For the Philippines, the purchasing power parity is still valid in the long run, and there was no structural change. He concluded that for the Philippines, the Asian financial crisis caused a transitory variation and not a fundamental change in real exchange rates.

### 3. The model

Extending Romer's [2000] IS-MP-IA model, we can write the IS, the MP, the IA, and the government bond yield functions, respectively, as follows:

$$Y = C(Y - T, R, B, S) + I(R, S) + G + NX \left[ e \left( P^f / P \right) \right] \quad (1)$$

$$R = R \left( \pi - \pi^*, Y - Y^*, e - e^*, R^W, R^B \right)$$

$$\pi = \pi^e + \beta \left( Y - Y^* \right) + \delta \left( e \right)$$

$$R^B = F \left( B \right)$$

where:

$Y$  = real GDP in the Philippines,

$C$  = the consumption function,

$T$  = government tax revenues,

$R$  = the real interest rate,

$B$  = government bonds,

$S$  = value of financial stocks,

$I$  = the investment function,

$G$  = real government spending,

$NX$  = real net exports,

$e$  = the nominal exchange rate (peso per US dollar),

$P^f$  = the foreign price level,

$P$  = the price level in the Philippines,

$\pi$  = the inflation rate,

$\pi^*$  = the inflation target,

$Y^*$  = potential output,

$e^*$  = the exchange rate target,

$R^W$  = the world interest rate,

$R^B$  = government bond yield, and

$\pi^e$  = the expected inflation rate.

Substituting the government bond yield function into the monetary policy function, we come up with a three-equation simultaneous system with three unknowns, namely,  $Y$ ,  $R$ , and  $\pi$ .

Let

$$C_Y > 0, \quad C_T < 0, \quad C_R < 0, \quad C_B > 0, \quad C_S > 0, \quad I_R < 0, \quad I_S > 0, \quad NX_e > 0, \\ R_\pi > 0, \quad R_Y > 0, \quad R_e > 0, \quad R_{R^w} > 0, \quad R_{R^B} > 0, \quad \pi_e = \delta > 0, \quad \pi_Y = \beta > 0, \\ R_B^B > 0$$

The endogenous-variable Jacobian can be expressed as

$$|J| = (1 - C_Y) - \beta R_\pi (C_R + I_R) - R_Y (C_R + I_R) > 0. \quad (2)$$

Assuming that equation (1) has continuous partial derivatives and because of the non-zero value of equation (2), the equilibrium output can be written as an implicit function of the parameters and the exogenous variables:

$$\bar{Y} = \bar{Y} \left[ \pi^e, G, T, B, S, e \left[ P^f / P \right]; \pi^*, Y^*, e^*, \beta, \delta \right]. \quad (3)$$

We expect equilibrium output to have a positive relationship with government spending and value of financial stocks; a negative relationship with the expected inflation rate and government taxes; and an ambiguous relationship with government bonds and currency depreciation. Theoretically, more government spending or less taxes would shift IS to the right and cause equilibrium output to rise. However, the Ricardian-equivalence hypothesis (Barro [1989]) suggests that deficit-financed spending may have a neutral effect in the long run. Taylor's [2000] findings have indicated that monetary policy has been employed as a major policy tool to pursue price stability and full employment; automatic stabilizers have predictable impacts; and the discretionary fiscal policy has not responded to business cycles as expected, thereby suggesting that it may be used to pursue long-term goals to improve the tax structure, the social security system, and budget balance. Auerbach [2002] reported that automatic stabilizers have mitigated the negative impact of economic fluctuations and the impact of discretionary fiscal policy was quite uncertain.

Households are expected to spend more when wealth, including government bonds, increases. Mehra [1997, 2001] argued that the Fed would respond to the long-term bond yield, which in turn is partially affected by the amount of government bonds issued to meet its fiscal needs. Better stock market performance is expected to increase consumption spending via the wealth effect (Mishkin [1995]; Kuttner and Mosser [2002]) and investment spending via Tobin's  $q$  theory and the balance-sheet channel (Mishkin [1995]; Bernanke and Gertler [1995]; Kuttner and Mosser [2002]). Bahmani-Oskooee and Miteza [2003] reviewed many studies and indicated that the impact of currency depreciation or devaluation was

unclear, depending upon model specifications, countries under study, methodologies used in empirical work, and sample periods.

Mathematically, the impact of a change in government bonds on equilibrium output can be expressed by equation (4). The net effect of more government bonds depends on whether increased consumption due to the wealth effect is greater or less than decreased consumption and investment spending due to a higher real interest rate.

$$\begin{aligned} \frac{\partial \bar{Y}}{\partial (B)} &= [C_B + R_B (C_R + I_R)] / |J| & (4) \\ &> 0 \text{ if } |C_B| > |R_B (C_R + I_R)| \\ &< 0 \text{ if } |C_B| < |R_B (C_R + I_R)|. \end{aligned}$$

The impact of higher stock values is given by equation (5). As shown, consumption spending would rise due to the wealth effect, and investment spending would increase through Tobin's  $q$  theory and the balance-sheet channel.

$$\frac{\partial \bar{Y}}{\partial (S)} = (C_S + I_S) / |J| > 0. \quad (5)$$

Equation (6) presents the effect of peso depreciation on equilibrium output. The direction and magnitude depend on the positive effect on net exports and negative effects on decreased consumption and investment spending caused by the increased interest rate.

$$\begin{aligned} \frac{\partial \bar{Y}}{\partial (e)} &= [NX_e (P^f / P) + \delta R_\pi (C_R + I_R) + R_e + (C_R + I_R)] / |J| & (6) \\ &> 0 \text{ if } |NX_e (P^f / P)| > |\delta R_\pi (C_R + I_R) + R_e + (C_R + I_R)| \\ &< 0 \text{ if } |NX_e (P^f / P)| < |\delta R_\pi (C_R + I_R) + R_e + (C_R + I_R)|. \end{aligned}$$

#### 4. Empirical results

The data used in this study came from the *International Financial Statistics* published by the International Monetary Fund and the Department of Finance in the Philippines. The sample consists of annual data for the period 1974 – 2003; quarterly data for government debt were unavailable for most of the years. Real GDP is measured in billion pesos at 1985 prices. Following Davidson and Mackinnon [1985], the expected inflation rate is a weighted average of the past four years. The government deficit/GDP ratio and the government bond/GDP ratio are used;

measuring these values relative to total output helps reduce multicollinearity. The real exchange rate is equal to the nominal exchange rate times the relative price in the US and the Philippines. Thus, an increase in the real exchange rate means a depreciation of the peso, and vice versa. Share stock price is an index number with year 2000 as the base year. The US federal funds rate is selected to represent the world interest rate due to its worldwide influence.

The estimated regression and related statistics are presented in Table 1. Both the ARCH and GARCH processes are tested. In the ARCH process, the coefficient for ARCH(1) is significant at the 1 percent level whereas in the GARCH(1,1) process, the coefficient for GARCH(1) is insignificant. As shown, 88 percent of the variation in equilibrium output in the Philippines can be explained by the six explanatory variables. Equilibrium output is negatively associated with the expected inflation rate and the US federal funds rate, and positively influenced by the government deficit/GDP ratio, the government bond/GDP ratio, real depreciation, and stock market performance.

Specifically, an increase in the expected inflation rate by 1 percentage point would reduce output by 20 billion or 2.8 percent at the mean. If the government deficit/GDP ratio rises 1 percentage point, output would increase by 29 billion or 4.1 percent. If the government bond/GDP ratio rises 1 percentage point, output would rise by 4.2 billion or 0.58 percent. Real depreciation of the peso by 1 unit would raise output by 3.3 billion or 0.46 percent. When the share stock index increases by 1, output would rise by 0.55 billion. If the Federal Reserve Bank raises the federal funds rate by 1 percentage point, output in the Philippines would drop by 5.6 billion or 0.79 percent.

To test whether the empirical results would change, several different measures for expected inflation rates and government deficit spending are considered. When the last year's inflation rate is used as the expected inflation rate, the explanatory power of the regression decreases to 68 percent. The government bond/GDP ratio and the US federal funds rate are insignificant at the 10 percent level. Hence, the choice of an appropriate expected inflation rate would affect the outcome. When the amount of real government deficit spending substitutes for the government deficit/GDP ratio, the sign of the coefficient for the real exchange rate changes to negative, and the coefficient of stock prices become insignificant at the 10 percent level because of a high degree of multicollinearity. Hence, the ratio of government deficit spending to GDP is a better measure.

## 5. Summary and conclusions

In this study, the author examined output determination in the Philippines based on the extended Romer [2000] model and the ARCH/GARCH process (Engle [1982, 2001]). The results show that a lower expected inflation rate, a higher

Table 1. Estimated ARCH regression for the Philippine real GDP

	Coefficient	Std. Error	z-Statistic	Prob.
C	694.726800	16.03231	43.33291	0.0000
Expected inflation rate	-20.013560	0.456479	-43.84336	0.0000
deficit/GDP ratio	29.026030	1.226447	23.66677	0.0000
government bond/GDP ratio	4.178376	0.932166	4.482435	0.0000
share stock price index	0.546171	0.160566	3.401546	0.0007
real exchange rate	3.302775	0.651203	5.071809	0.0000
US federal funds rate	-5.625188	0.902165	-6.235213	0.0000
Variance Equation				
C	18.761860	13.93389	1.346492	0.1781
ARCH(1)	2.625324	0.652446	4.02382	0.0001
R-squared	0.881915	Mean dependent var		714.3210
Adjusted R-squared	0.836930	S.D. dependent var		173.9190
S.E. of regression	70.23154	Akaike info criterion		10.7350
Sum squared resid	103581.8	Schwarz criterion		11.1554
Log likelihood	-152.0252	F-statistic		19.6048
Durbin-Watson stat	0.731037	Prob(F-statistic)		0.0000

Dependent Variable:  $\bar{Y}$  equilibrium GDP

Method: ML - ARCH (Marquardt)

Sample: 1974-2003

Included observations: 30

Failure to improve Likelihood after 46 iterations

Bollerslev-Wooldrige robust standard errors & covariance

Variance backcast: ON



government deficit/GDP ratio, a higher government bond/GDP ratio, real depreciation, better stock market performance, and a lower federal funds rate raise equilibrium output. There are several policy implications. The cost of a rising expected inflation is relatively high. Therefore, the central bank has made a good decision to pursue inflation targeting to show its determination to contain inflation. It is interesting to note that more deficit spending and more government bonds as a percent of GDP would help the economy. Therefore, the Ricardian-equivalence hypothesis does not apply, and the central government may engage in expansionary fiscal policy to stimulate a slow economy. However, the positive impacts may change if government deficit and bonds reach beyond certain levels. Although real currency depreciation would help raise output, there are some other side-effects such as higher import or domestic prices, lesser imports, flows of capital out of the country, lower real income, and lower real wealth. A large depreciation may cause international investors to sell the peso, and thus trigger a currency crisis. Clearly, the government needs to study the overall picture to evaluate the costs and benefits of currency depreciation. Although higher stock prices would help the economy, the effect seems to be relatively small, suggesting that the stock market may not be as fully developed as those in the US and other industrialized countries and that the proportion of the population owning financial stocks may be relatively small. The recent increase in the federal funds rate by 25 base points suggests that the BSP may consider increasing its key policy interest rates of 6.75 percent for the overnight borrowing or reverse repurchase (RRP) rate. That being the case, consumption and investment expenditures would decline.

The findings open up areas for future research. Other interest rates such as the euro rate may be considered for the world interest rate. The model may be expanded to consider potential substitution between domestic and foreign currencies due to changes in the exchange rate. Other possible variables may be considered so long as their inclusion does not cause a high degree of multicollinearity that normally exists in macroeconomic time-series data.

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