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EXCHANGE RATE UNCERTAINTY AND MONETARY TRANSMISSION IN THE PHILIPPINES

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ABSTRACT

This is an empirical investigation of how exchange rate volatility and monetary policy have been transmitted in a developing macro economy of the Philippines. The main thesis of this paper is that the relationship between exchange rates and interest rates are unpredictable in a globalized finance. However, under some standard assumptions, interest rates can be adjusted to smooth nominal exchange rate movements at the expense of increased volatility in other variables.

An open and dynamic macroeconometric model is estimated and identified the channels of monetary policy transmission – interest rate, exchange rate and expectations – and provide three innovative points. First, the specification of the exchange rate based on uncovered interest parity condition is a first formal attempt to uncover its role, along with the uncertainties it takes, to the central bank reaction function. Second, the limited role of money assumed in this model paves the way for the importance of using 'policy rule' in interest rate setting. And third, the inclusion of the Government's medium-term inflation target is a first formal shot on how the central bank may treat expectations in monetary management.

Results show that although the lag structure is short, the policy interest rate elasticity to macroeconomic equilibrium is low. This leaves the impression that a slight deviation from the expected path requires a significant change in policy rate to bring the economy back to the central path. In contrast, the direct and indirect pass through effects from exchange rate to inflation are both relatively high, suggesting that it is an effective transmission mechanism.

However, the influence of monetary policy on the exchange rate is limited as the standard uncovered interest parity condition is satisfied inadequately. Results show that the more volatile risk premium largely determines the behavior of exchange rate, suggesting that it may not be grounded on fundamentals. These findings indicate that the link between the interest rate and the exchange rate is highly unpredictable, leading up to uncertainty in the conduct of monetary policy.

EXCHANGE RATE UNCERTAINTY AND MONETARY TRANSMISSION IN THE PHILIPPINES

1. INTRODUCTION

The main argument throughout this paper is that the relationship between exchange rates and interest rates are unpredictable. However, under some standard assumptions, interest rates can be adjusted to smooth nominal exchange rate movements at the expense of increased volatility in other variables.

This paper draws insights from results of a medium-scale macroeconomic model of the Philippine economy. With 39 behavioral equations, this model specifies the monetary policy transmission mechanism required to anchor inflation in the long run. Ordinary least squares and two-stage least squares are used to estimate the relevant parameters while an algorithm to run the model with consistent forward-looking indicators is implemented. Policy experiments are simulated to emphasize its reasonable tracking ability and robustness. Using simulations and impulse response, implied dynamics and magnitude of the impact of a policy change on output and inflation are generated.

The model identified three channels that provide important information about the stance of monetary policy – interest rate, exchange rate and expectations – and provide three innovative points. First, the specification of the exchange rate based on uncovered interest parity condition is a first formal attempt to uncover its role, along with the uncertainties it takes, to the central bank reaction function. Second, the limited role of money assumed in this model paves the way for the importance of using policy rule in interest rate setting. This indicates that interventions in the foreign exchange market are non-sterilized simply because the Bangko Sentral ng Pilipinas's (BSP) primary objective is to change its policy lever which then feeds into the market interest rates and on the exchange rate. And third, the inclusion of the Government's medium-term inflation target is a first formal shot on how the BSP may expectations in monetary management.

Results show that although the lag structure is short, the policy interest rate elasticity to macroeconomic equilibrium is low. This leaves the impression that a slight deviation from the expected path requires a significant change in policy rate to bring the economy back to the central path. In contrast, the direct and indirect pass through effects from exchange rate to inflation are both relatively high, suggesting that it is an effective transmission mechanism.

However, the influence of monetary policy on the exchange rate is limited as the standard uncovered interest parity condition is satisfied inadequately. Results show that the more volatile risk premium largely determines the behavior of exchange rate, suggesting that it may not be grounded on fundamentals. These findings indicate that the link between the interest rate and the exchange rate is highly unpredictable, leading up to uncertainty in the conduct of monetary policy.

These uncertainties pose crucial implications to the inflation targeting (IT) framework and dilemma for monetary authorities especially when the exchange

rate serves as a focal point for inflation expectations. In fact, there is a growing evidence that monetary authorities have exchange rate targets which they try to achieve through interest rate manipulation and through direct interventions on the foreign exchange markets. Hence, there is fear of floating.

This paper is structured as follows. The structure of the macro model is laid out in Section 2. The overall modeling strategy, diagnostic tests, solution and evaluation for the Philippines are discussed in Section 3, leading up to a stroke of monetary policy transmission mechanism in Section 4. The sticking points of the model are presented in Section 5. Lessons for monetary policy set the concluding remarks in Section 6.

2. THE OPEN AND DYNAMIC MACRO MODEL: THE CORE STRUCTURE

As a first step in laying out the analytical properties of the model, this section presents the assumptions in various markets and prices of each sector of the Philippine macroeconomy.

2.1 The real sector

The real sector is composed of the goods markets which are assumed to be monopolistically competitive (Blanchard and Kiyotaki, 1987). The goods markets benefit from the interaction of the demand (expenditures) side and supply (production) side to determine aggregate output and the aggregate price level. Consistent with the dynamics of Philippine data (Estrella and Fuhrer 2002), an important assumption of aggregate output is that it is demand-determined, backward-looking while aggregate prices are sticky (Ball 1999). Different expenditure components, namely consumption and investment by both the private sector and the government as well as merchandize exports and imports are specified.

The specification of the real private consumption (c) follows the permanent income and life-cycle hypothesis. In the long run, it is assumed to depend on real disposable income $q - \frac{ty}{p}$, real wealth $\frac{m}{p}$ and real interest rates $r - \pi^e$. This is based on the notion that liquidity-constrained consumers arrive at consumption choices based on disposable income and that their rate of time preference and rate of return are identical. In addition, b_t account for consumption smoothing (Pauly 2000).

$$c = c(r - \pi^e, q - \frac{ty}{p}, \frac{m}{p}, b_t) \tag{1}$$

Government consumption (G) in equation 2 depends on output q and to a large extent on government budgetary accounts such as, real taxes $\frac{ty}{p}$.

$$g = g(q, \frac{ty}{p}) \tag{2}$$

The desired investment spending by domestic firms (*I*) uses the accelerator principle linking the desired fixed capital with output q, real interest $r-\pi^e$ and exchange rates e^r (Montiel 2003). Firms are assumed to produce value added using a constant elasticity of substitution (CES) technology. Firms also hold inventories which represent insurance against demand surprises. However, in this model, this will be taken as exogenous, implying that firms make their decisions for capital, labor and prices first, then make decision about the desired level of inventories.

$$i = i(r - \pi^e, e^r, q) \tag{3}$$

The net exports *(t)* indicate net spending by foreigners on domestic goods. It is derived as the difference between exports and imports of goods and services. Net exports depend on foreign market income q^* and export price in foreign currency terms $\frac{p_t / e^n}{p^*}$.

$$t = t(q^*, \frac{p_t / e^n}{p^*}) \tag{4}$$

In empirical estimation, equations (1) to (4) are disaggregated further. Substituting these equations in the national income accounting identity, $q=c + i + g + t$, yields the *IS* equation.

The production side is divided into agriculture sector and the advanced sector (which includes industry and services sectors). Agricultural supply and prices are assumed fixed in the short run. On the other hand, the advanced sector is assumed to have excess capacity. Hence, supply responds to the level of aggregate demand. Prices, on the other hand are based on mark up over producers' cost which in this model is represented by wholesale price index. The system of equations simultaneously solves for total production (aggregate supply) and expenditures (aggregate demand), hence, the overall equilibrium.

A measure of potential output is derived by fitting a trend on gross value added of industry and services sectors using the Hodrick-filter (HP). The output gap then is computed as the difference between the log of a one quarter seasonally-adjusted moving average of supply side output (industry and services) and potential output.

Meanwhile, the fiscal sector affects the real sector through expenditures on capital and operating expenses which partly determine the level of output. The fundamental role of the fiscal sector is to determine the level of the budget deficit. This is attained through an accounting of the government's fiscal operation, namely expenditure and revenue generation.

2.2 Monetary and external sectors

The assumptions presented so far have been generally unchanged from most macro models in the Philippines and elsewhere, in particular, the goods and labor markets. The key difference lies in the implementation about what motivates the central bank, its constraints and characteristics of the open and globalized asset markets that characterize the monetary and external sectors of

the economy. This approach is broadly consistent with the New Keynesian model discussed. This approach is a first formal attempt in the Philippine setting.

The monetary and external sectors assume that the asset markets (domestic and foreign) are imperfect. The monetary sector works through an asset market that is largely dominated by the banking sector and is fragile to sharp swings in investor confidence. Meanwhile, the external sector largely replicates free flow of goods and services, capital and transfers in and out of the Philippines. There are however some regulations on capital movements. The foreign exchange market is inefficient to the extent that persistent movements in the exchange rate risk premium appear to be confirmed by empirical data (Sarno and Taylor 2003). This assumption embeds the uncovered interest parity (UIP) to exchange rate determination while fully flexible exchange rate regime is assumed.

Estimating the level of money supply rests mainly from the central bank and balance of payments accounts. The money multiplier approach is assumed in determining the relationship between money supply and base money. Following the current mainstream in monetary macroeconomics, this overview assumes that money stock only plays a minor role in describing monetary policy effects (Romer 2000).

The critical link between monetary policy, the real economy and inflation is the domestic interest rate. The domestic interest rate policy is left to the central bank (in this model the BSP) which has the task of anchoring the nominal side of the economy. The BSP is assumed to be a flexible inflation targeter, sets an annual target and has the ability to adjust the nominal interest rate. Given the lags between a change in interest rate and inflation (Svensson 1997) and nominal rigidities (such as price and wage), the use of a reaction function akin to Rudebusch and Svensson (1999) is required to anchor inflation in the long run.

Equations 5 and 6 below are the equilibrium asset price equations. The BSP's overnight reverse repurchase rate (*RRP*) is prescribed as the nominal interest rate which adjusts to the output gap, exchange rate gap (or the difference between the expected exchange rate and realized exchange rate) and inflationary pressure measured by the difference between the inflation forecast and inflation target. This is measured as,

$$r = r^d + \beta(\pi^f - \pi^*) + \rho(q_t - q^*) + \gamma(e^n_{t+1} - e^n_t), \quad (5)$$

where r is the *RRP*, r^d is the desired *RRP* that is expected to prevail when inflation and output are at their targets, π^f is the two-year ahead inflation forecast, π^* is the medium-term inflation target announced by the Government, q is output, q^* is potential output, e^n_{t+1} is the expected nominal exchange rate , e^n is the nominal exchange rate. The presence of inflation forecast to indicate future inflationary pressure connotes that the framework is an inflation forecast targeting.

The nominal exchange rate (e_t^n) in equation 6 is inherently forward-looking and expectations determined. The UIP cum persistent risk premium underlines the baseline dynamics of nominal exchange rate for two reasons. First, UIP relies on arbitrage arguments which are expected to be true although arbitrage is often subject to limits (Shleifer and Summers 1990; Shleifer and Vishny 1997; Wollmershauser 2003), it is nonetheless one of the basic building blocks of economic decision making.

$$e_t^n = r_t^f - r_t + e^n{}_{t+1} + u^e{}_t, \tag{6}$$

where the difference between the foreign interest rate r^f and domestic interest rate r^d represents the interest rate differential, $e^n{}_{t+1}$ is the expected nominal exchange rate and $u^e{}_t$ as the risk premium (Leitemo and Soderstrom 2004, West 2003 and Wollmershauser 2006). This risk premium is assumed to follow the stationary process,

$$u^e{}_{t+1} = \rho_e u_t^e + \varepsilon^e{}_{t+1}, \tag{7}$$

where $0 \leq \rho_e < 1$. In this equation, ρ_e could capture the UIP disturbances or effects of persistent movements in the risk premium.

To determine the link between the real exchange rate and the nominal exchange rate, equation 8 below explicitly takes into account that deviations from purchasing power parity occur in the short-run. This is seen in,

$$e_t^r - e_{t-1}^r = e_t^n - e_{t-1}^n + p_t^f - p_t, \tag{8}$$

where e_t^r is the real exchange rate, p_t^f is the foreign price and p is the domestic price.

The absence of microstructure data on foreign exchange rate market leads into a rational expectations assumption in estimating expected exchange rate. This assumption takes up findings from a vast literature studying exchange rate prediction which all have concluded that the best single predictor of the exchange rate next period is the exchange rate this period (West 2003):[1]

$$e^n{}_{t+1} = e^n{}_t. \tag{9}$$

This indicates that modelling expected exchange rate starts with estimating an exchange rate equation (equation 6) and then incorporating this as forward-looking exchange rate by moving variables one period ahead. This feeds into equation (5).

[1] While there are studies that reject the hypothesis that exchange rate expectations are rational, Liu and Maddala (1992) and Osterberg (2000), using co-integration technique cannot reject the hypothesis that expectations are rational. Indeed the vast literature on rational expectations model offer some standing issues out of this broad framework. Pesaran (1987) and Fair (1984) both argued that because of the imperfect information and the uncertainty in the economy the rational expectations model may not be suitable for developing countries.

2.3 Nominal wages

The labor market is fundamental to establishing the level of unemployment rate in the economy. The behavior of nominal wages, defined as the average compensation of combined industry and services sectors workers, reflects the Phillips curve through changes in the unemployment rate and prices to reflect. These wages, along with labor force participation rate, determine the supply of labor. The difference between labor supply and labor utilization generates the unemployment rate. This then influences the non-agricultural compensation index.

2.4 The headline inflation and expectations

The central price variable in the model is the wholesale price expressed in index (P^w). This feeds directly into the industry and services sectoral prices.

$$P^w = P^w(mc, w, og, m/p^c), \tag{10}$$

where wholesale price index depends on the import cost (*mc*), wages (*w*), the output gap (*og*) and wealth effects as indicated by real money supply (m/p^c).

The overall deflator (or GDP deflator) is determined by relative weights of agriculture, industry and services sector prices to total output. This then is the core basis of the consumer price index (p^c) and the rate of headline inflation (π).

Using limited information, the role of long run inflation expectations (π^e) is assumed rather than determined. A hybrid structure (that contains both forward-looking and backward-looking expectations) is assumed that includes rational component of inflation, indicated by the medium-term inflation target announced by the Government (π^*) and inertial component indicated by past inflation rate. The rational component is based on Demertzis' and Viegi's (2005) work on inflation targets as focal points for long run inflation expectations. The idea is that in the absence of a concrete information of inflation expectations, the only information that agents have is the quantitative inflation target announced by the Government. Meanwhile, the inertial component assumes that agents develop expectations based on past actual inflation rates.

$$\pi_t^e = \vartheta\pi_t^* + (1-\vartheta)\pi_{t-1} \tag{11}$$

3. MODELING STRATEGY, DIAGNOSTIC TESTS AND SOLUTION

3.1 Modelling strategy

The final specification of the equations in the model depended on the availability of reliable quarterly data over a period of 16 years (1988 to 2003) to allow the conduct of time series and regression analysis. For the model to have a unique solution there should be typically be as many equations as there are endogenous variables. In addition, each equation in the model must have a

unique endogenous variable assigned to it. In this model, there are 102 endogenous variables in 102 equations indicating that a unique solution is feasible.

Out of these 102 equations, 39 are behavioral equations and the remaining are link equations. Link equations (or simply definitional identities) provide the empirical bridge between two or more endogenous variables. The 39 behavioral equations are simultaneous structural equations. To address simultaneity (or endogeneity bias), these equations are estimated one by one by two-stage least squares. The choice of instruments is assumed to be all the lagged endogenous variables and all current and lagged exogenous variables in the whole system. These equations are largely overidentied while the rest are identified. It is argued that there is nothing wrong with overidentified equations since the statistical fit is never fit anyway. Meanwhile, the remaining equations in the model are estimated by ordinary least squares.

Nevertheless, the model is transformed with log-linear functional forms, autoregressive error serial correction, lagged dependent variable and specific lag structures. This model assumes that in general indicators are stationary, thus shunning away spurious results that can possibly be brought by their being cointegrated or by plainly having unit roots.

While recent macroeconomic models make extensive use of econometric theory-based explanations of equilibrium through cointegration techniques, this model relies largely on modern macroeconomic theory as the main guide in the estimation of the model. In particular, this model takes McCallum's (1993) argument that unit roots in macroeconomic time series are not crucial provided that serial correlation corrections are applied to the residuals of the relationships being studied. There are cases in which studies encounter the same problem but argued that unit root tests have low power anyway (Clarida, Gali and Gertler 2000).

Following Bautista et al. (2004), it could also be argued that this model's adopted line of macroeconometric model building as a response to the challenge presented in Valadkhani (2004) that called for the use of recent developments in macroeconomic theory in the modelling process. Literature points to two disadvantages in relying on cointegration analysis in specifying a structural macroeconomic model. First, it limits the ability to adopt desirable specifications. For instance, a regression of the real exchange rate level on the real interest rate differential, while having a rigorous theoretical foundation, is not permitted because the latter is known to be I (0) while the former is often found to be integrated in the order of (1). Second, the unit root test is known to have weak power over the alternative of linear mean reversion. It is therefore difficult to assert that no relationship exists simply because no evidence of cointegration was found.[2]

[2] Bautista et al. (2004) also pointed out that the unit root literature is also evolving and recently, a unit root test against the alternative nonlinear mean reversion has been developed by Kapetanios et al. (2003) which can potentially reverse results of previous papers.

3.2 Diagnostic tests

In general, all the behavioral equations pass through the diagnostic tests. The adjusted R^2 values for all equations are greater than 60 percent and values in all equations suggest there is no penalty for the number of explanatory variables that are used. All calculated *F*- values are higher than the critical values, at 5% to 10 % level of significance, thereby indicating a significant degree of reliability of coefficients of determination. Attempts to correct for varying degrees of serial correlation in the structural equations are made. The model is intended to provide forecasts of key macroeconomic variables.

Breusch-Godfrey is used to check for higher order serial correlation. With lag order of up two and at 5% to 10% level of significance, results show that all equations do not exhibit serial correlation. There are equations which initially exhibit serial correlation but additional lags are incorporated to make the residuals stationary. White's heteroskedasticity test in the residuals is also used. White's test is a test of the null hypothesis of no heteroskedasticity. Regression specification error test (RESET) up to two fitted items results reveal that there are no specification errors in equations.

3.3 Model solution

Both deterministic and static simulations are performed using Gauss-Seidel algorithm for a single period. The Gauss-Seidel algorithm, often referred to as Fair-Taylor method,[3] is an iterative algorithm, where each equation in the model is solved for the value of its associated endogenous variable, treating all other endogenous variables as fixed. Terminal conditions are assumed to hold at a specified time period. Put simply, this means that the values contained in the actual series after the end of the forecast sample are used as fixed terminal values. Forward solution is similarly used to equations that contain future (forward) values of the endogenous variables.

3.4 Testing macro model

The model's historical and forecasting performance over parts of the sample period and simulated to some exogenous changes in policy variables is assessed. The simulation period is from the first quarter 1994 to the first quarter 2003. To gauge the simulation performance of the model, the mean absolute percent error (*MAPE*) of selected endogenous variables is computed. As a general rule, the smaller the MAPE the better the fit of the model to the actual data. *MAPE* (which is unit free) is computed as follows:

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[3] Although the Fair-Taylor algorithm includes a particular handling of terminal conditions (the extended path method) that is slightly different from the options provided by EVIEWS 5. When solving the model, EVIEWS 5 allows the user to specify fixed end conditions by providing values for the endogenous variables beyond the end of the forecast sample, or to determine the terminal conditions endogenously by adding extra equations for the terminal periods which impose either a constant level, a linear trend, or a constant growth rate on the endogenous variables for values beyond the end of the forecast period.

$$MAPE = (1/n)\sum/(P-A)/A/*100\ , \qquad (12)$$

where *A* refers to the actual value, *P* predicted or simulated by the model and *n* as the number of periods covered by the simulation. In this model, the major macroeconomic variables can be predicted with reasonable error margins. Using dynamic forecasting, real and financial sectors have *MAPE* below the benchmark 10%.

Fifteen policy experiments are simulated to check the model's tracking ability.[4] The historical simulation results show adequate tracking ability. For each experiment, an exogenous/policy variable is changed to determine if it has a recessionary or expansionary effect. The results for all experiments show that their effects on the price level and output conform to predictions of economic theory. This means that the model is able to capture the expected movements in key economic variables as a result of changes in selected external or policy variables.

4. A STROKE OF MONETARY POLICY TRANSMISSION MECHANISM

The objective of this section is to trace the monetary policy transmission in the Philippines and thresh out some issues and implications.[5]

Figure 4.1 below depicts the relationship between monetary policy reaction and transmission mechanism. Policy actions, defined to include current and expected, are directly transmitted to money and asset markets. Changes in these markets in turn affect goods and labor markets and ultimately aggregate output and prices. Finally, changes in current and projected output and inflation feed back into the monetary policy reaction. This reflects central bank's aim and strategy to attain its policy objectives.

For a small open economy like the Philippines, the choice of the more effective channels in bringing about changes to economic activity is clearly a matter of judgment.

In a report that provides an in-depth examination of Philippine capital market, a major finding reveals that the bond market is shallow and lacks liquidity which means that there are few investors, very few classes and types of securities. At the same time the market is dominated by government securities and there is lack of variety in private bond issues. In a similar vein, it is argued that stock market continues to be thin. Overall, these findings suggest that the capital market as channel in bringing about changes in economic activity in the Philippines is argued to be slim.

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[4] The model is also tested for its forecasting ability. For these few experiments, an exogenous/policy variable is changed to determine if it has a recessionary or expansionary effect. Preliminary results for all experiments show that their effects on the price level and output are reasonable.

[5] The complete diagnostics, including the *t-statistics* or *probability (p)* values of the model, are available with the author.

The credit channel creates an avenue for small firms for financing as it is expensive for them to issue securities in the capital markets. With this feature of credit channel, several studies have proved that bank lending responds to stance of monetary policy. However, the importance of this channel has been ascertained to have declined during the last few years. Recent studies reveal that financial and capital account liberalization and the resulting significant surge in alternatives to bank loans have diminished the link between the real economy and bank lending channel, thereby reducing the importance of credit as channel of monetary transmission.

From the demand side, a study by the BSP (2004) revealed that in the case of the Philippines econometric results show that income variables (disposable income and agricultural income) are significant determinants of changes in consumption spending.[6] This finding is consistent with the evidence from the empirical literature on the 'excess sensitivity' of consumption to income. It also suggests that Filipino consumers typically tend to rely more on their own income rather than on borrowing for their consumption needs.

These findings leave us with the four channels of monetary policy relevant to the Philippines – the interest rate, the exchange rate, money supply and expectations.

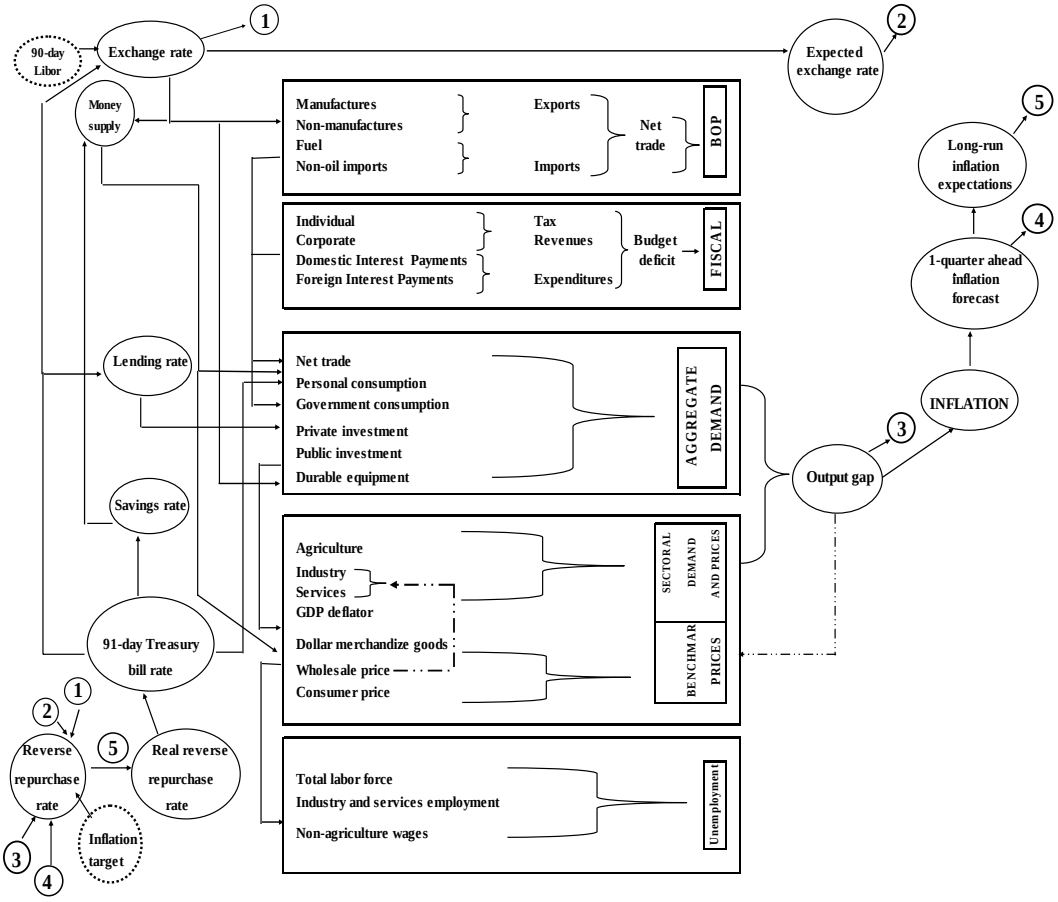
4.1 The BSP policy rate (RRP)

The key point in this section is that the BSP derives the power to determine a specific interest rate in the money markets from the fact that it controls base money. Since prices are assumed to be sticky, the BSP in this model has the ability to influence real rates. The BSP then chooses the price at which it will lend base money to banks which is the overnight RRP.

In the estimation of RRP the luxury of having long sample is limited due to the fact that official announcement of inflation targets (taken from the BSP and Medium-Term Development Plan of the National Economic and Planning Authority) started in 1994 only, while the official IT framework was only announced in January 2002. The regression starts from first quarter 1994 up until fourth quarter of 2003 or a total of 40 observations. Some macro models have the same specification and the number of observations in this equation is empirically acceptable.

[6] Using a quarterly data for 1981 to 1999, a direct test for credit constraints on consumption by explicitly incorporating data on credit constraints on consumption equation using an instrument variable estimation procedure. The consumption spending is estimated as a function of income, credit and the spread between lending rates and the benchmark Treasury bill rate, the level of overseas workers' remittances to see whether income transfers affect consumption via consumption smoothing, and the deviation of deseasonalized agricultural output from its trend as a proxy for agricultural income.

FIGURE 4.1
Philippine transmission mechanism of monetary policy



The BSP's RRP reacts to inflationary pressure seen in the difference between inflation forecast and inflation target, output gap or the difference between actual GDP and potential GDP, the exchange rate gap or the difference between expected nominal peso-dollar rate and actual nominal peso-dollar rate. In addition, the RRP permits some inertia over time for the guiding rate and a constant that reflects a neutral instance for monetary policy.

BSP's reaction since 1994 that is consistent with the IT requirements. The BSP raises RRP rate whenever the difference between inflation forecast and target is expected. The two-year ahead inflation forecast in an IT framework is the market-based expectations. However, Bernanke and Woodford (1997) indicate that there are key limitations of market-based inflation expectations. In particular, inflation expectations are backward-looking and reflect adaptive behavior by the public. In addition, where a central bank conduct inflation (forecast) targeting based on market-based inflation expectations and where there is a gradual learning about the anti-inflation process stance of the central bank, it is very difficult to determine the properties of such expectations.

Taking these difficulties and in line with BSP's operating procedure, the two-year ahead inflation forecast is used and compared with the inflation target.[7]

The BSP's policy rate responds to economic fluctuations as seen in the significant coefficient of the output gap. This implies that the BSP increases RRP when a rise in the output gap or excess in aggregate demand is anticipated.

The more appealing finding of this specification is the exchange rate gap. It is similarly significant and signifies that the BSP has restricted shocks to nominal peso-dollar rate to contain possible expansionary impact to inflation. Assuming all other things unchanged, the mechanism of the BSP to stabilize the exchange rate is to adjust RRP with interest rate hikes (cuts) when the exchange rate gap is expected to widen (narrow).

While the three gaps connote some forward-looking component of BSP's interest rate reaction, the lagged RRP rate received the biggest importance in terms of larger coefficient. This is not unusual though as most quarterly macro models exhibit this behavior. This estimation takes the more conventional wisdom that this gradual adjustment reflects a policy inertia (or an action of not adjusting once-for-all to changing conditions) or interest rate smoothing behavior by BSP.[8]

This estimation is appropriate for current nominal scheme. Although not included in the final specification, Fischer equation is assumed in the model that indicates that the real ex-ante rate is equal to the nominal rate minus expected annualized quarterly inflation rate. This also applies to all the other interest rates.

There are three issues to be specified at this point. First, following Clarida, Gali and Gertler (2000), the equation may include a desired interest rate that is expected to prevail when inflation and output are at their targets. The absence of micro-founded behavior equations does not allow this model to endogenously find steady state value for the interest rate.

Second, it should again be stressed that changes in exchange rate can also be achieved by interventions in the foreign exchange market. However, interventions are non-sterilized in this model simply because BSP's primary objective is precisely to change the interest rate, and by this, the exchange rate.

The third issue pertains to the measure of inflation. It should be noted that in both textbook and New Keynesian models, the measure of inflation that appears in the Phillips curve is domestic or core inflation, rather than the overall (or headline) inflation. The use of CPI-based expected and target inflation is consistent with the BSP's IT framework. The BSP uses the CPI-

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[7] From the technical point of view, this model could also proceed if inflation expectations only is included in the monetary policy rule as suggested by Huang et al. (2001).

[8] The literature on interest rate smoothing has generally laid out some hypotheses on this: (a) policy-makers dislike frequently reversing the direction of interest rates; (b) that the nature of the decision-making process leads to conservatism; and (c) that smooth changes in the target provide greater control over long-term interest rates and thereby control over inflation and economic activity (Lowe and Ellis 1998).

based (headline) inflation rate as its target for monetary policy, since the CPI is the commonly used measure of inflation and is, therefore, widely known and easily understood by the public. However, since some price movements are not within the control of monetary policy, the BSP would also take into account the movements in the so-called 'core inflation'[9] in setting the monetary policy stance. Thus, it would serve as an additional indicator of consumer price movements.

In the case of the Philippines, some studies have argued that the strongest influence on headline inflation are the weather and the Philippine policy on agricultural importation.[10] The implication is that if supply-side factors dominate inflationary movements in the Philippines, then a commitment to inflation targeting, by directing monetary policy to a process over which it has very weak control, would serve no purpose except to decrease its credibility. But then core inflation figures are limited, that is, official figures from the National Statistics Office (NSO) and BSP run from 1995 to present only. On a more important manner, there seems to be a rethinking among central banks regarding the use of core inflation under IT framework. IT pioneers like the Reserve Bank of New Zealand, Bank of England and Reserve Bank of Australia have moved back to headline CPI inflation as the operating target due to limitations of core inflation.

4.2 From RRP to benchmark interest rate

The RRP rate is transmitted to market interest rates through the natural arbitrage condition. The 91-day T-bill rate (*TBR91*) is considered the benchmark rate for all the market rates, particularly the lending rate.[11] There is a direct channel of movements of *RRP* to *TBR91,* albeit moderate, long run-inflation expectations (*XINFL*) and changes movements of 90-day Libor (*LIBOR90)*. The idea is that increases in *TBR91* are warranted when *RRP, XINFL* and *LIBOR90* rise. In its original specification, real money supply (as indicator of demand for private loans), fiscal deficit and peso-dollar were included but were dropped as they yielded insignificant coefficients and incorrect signs.

It should be noted that the transmission to longer term rates are seen in market expectations. This is because the Philippine financial market continues to be underdeveloped compared with other East Asian countries. This means that the market could interpret current policy decisions as a signal of future monetary policy decisions, making longer term rates react consistently. For instance, a decline in RRP can be construed as a factor that will raise future

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[9] In February 2004, the National Statistics Office (NSO) began publishing, alongside the CPI headline inflation rate, an official rate of core inflation, defined as the rate of change of headline CPI after excluding selected food and energy items. (Guinigundo 2004).

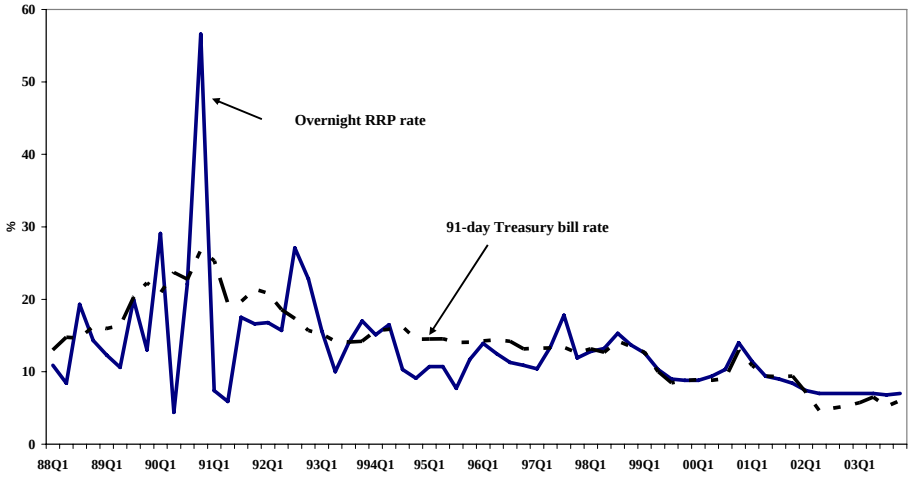
[10] See, the reaction by Dr. Felipe Medalla on the paper by Dr. Donald Brash, Fifty Years of Central Banking in the Philippines: Symposium on Inflation Targeting and the Asian Crisis (Manila: Bangko Sentral ng Pilipinas, 1999).

[11] Other market interest rates tend to cluster within 2-5 percentage points around it.

inflation. Since a contractionary monetary policy is expected to offset such an increase in inflation, longer term Treasury bill rates may end up increasing as an indication of the expected increase in the future policy rate.

Figure 4.2 below shows the rather close tracking performance of both *RRP* and *TBR91* in the model. However, the magnitude of such track is rather modest. On balance, this moderate impact could be attributed to the apparent overregulation in Philippine financial system with a variety of credit variations, mandatory allocation of funds, and distorting taxes. Although there was an agreement between the BAP and the BSP to keep the lending spread at 2.5 percentage points, this spread remains high.[12] This makes the transmission mechanism channel from the traditional interest rate to market-determined lending rates much weaker than desirable. In part, this could also explain the high volatility of interest rates observed since the peso was floated in 1997.

FIGURE 4.2
Overnight RRP and 91-day Treasury bill rate
First quarter 1988 to fourth quarter 2003



A related point is that the monetary authorities (BSP and the Government) insist that the financial system operates as a free market. In practice, however, interest rates are determined by the market only up to a certain point. The Bureau of Treasury (BTr) auctions Treasury bills (in tenors of 91, 182 and 364 days*)* twice a month, and rates are determined by the bids BTr accepts. The BTr may reduce or increase its regular offering of T-bills to influence rates, either to save the government from paying high rates on its

[12] Since May 1998 the private Bankers Association of the Philippines (BAP) has had a standing agreement to keep interest spreads over the base rate at no more than 1.5 percentage points for prime customers and at no more than five percentage points for non-prime borrowers. In practice, some banks charge non-prime lending spreads of up to eight percentage points above the 91-day T-bill rate.

debt or to control liquidity. It may also reject all tenders in order to force participating financial institutions to return the following week with lower bids.

The policy implications are quite clear. The relative moderate impact of policy rate leaves the impression that a slight deviation from the expected path requires a significant change in the RRP to bring the economy back to the central path. Put simply, this is a strong indication that the interest rate elasticity to macroeconomic equilibrium is moderate. There is then a need to correct these distortions in the financial system and improve the efficiency of transmission mechanism.

Changes in the 91-day T-bill rate have significant impact on the other market interest rates, such as savings deposit rate and the average lending rate. In these two equations, the smoothing parameter is significant. These rates are particularly significant feedback mechanism to the real sector.

4.3 From RRP to nominal peso-dollar rate[13]

An indication of the peso's competitiveness in international trade, a positive current account balance (or current account surplus) relative to GDP leads to an appreciation of FXR.

The interest rate differential (the difference between 90- day LIBOR and 91-day Treasury bill rate) and risk premium[14] drive the behavior of FXR significantly. A positive interest rate differential, that is when the 90-day Libor is higher than the 91-day T-bill rate, and an increasing risk premium signify a depreciating FXR in the future.

Risk premium is usually associated with macroeconomic fundamentals and a number of subjective factors that are not easily anticipated. An indicator of risk premium is the spread between the price and yield of the 10-year Philippine bonds. Despite the rise in the risk premium in June 2006, the overall trend since November 1996 has been on a downtrend, bringing the spread at 432 basis points by the end of June 2006. However, this spread is still far from equaling the latest levels of other emerging countries such as Brazil (301 points as of January 2006), Mexico (122 as of December 2005) and Russia (113 points as of December 2005).

The uncertainties on changes in nominal peso-dollar and the constraints to BSP's reaction clearly imply that the specification of exchange rate becomes unpredictable and limited to achieve impressive real effects.

In this model, the absence of microstructure data on foreign exchange rate market leads into a rational expectations assumption. This assumption takes up findings from a vast literature studying exchange rate prediction which all have

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[13] In its original form, inflationary pressure, specified as the difference between inflation forecast and inflation and inflation target as well as relative money stocks and GDP have been tested, but the coefficients sign were incorrect. Following Garcia et al. (2002), a measure of interest spread is included, that is *LIBOR90* and *RRP*, but was similarly insignificant.

[14] In numerous studies, this is sometimes refereed to as inertia. This is not unusual following the uncertainty and shocks affecting movement of the peso-dollar rate.

concluded that the best single predictor of the exchange rate next period is the exchange rate this period (West 2003). Assuming rational expectations, the FXR is the basis for expected peso-dollar rate. The difference between FXR and EXPFXR then feed into RRP.

In this model, real peso-dollar rate is defined as constant exchange rate and is determined by dividing nominal peso-dollar rate with the peso-dollar rate of $18.607/US$ in 1985. The choice of 1985 corresponds to the base year that the BSP is using in the computation of its real effective exchange rate. In this model, the constant exchange rate takes the indirect channel through real dollar prices manufactured and non-manufactured exports. Both are computed by dividing these prices by real exchange rate.

4.4 From market interest rate to money supply

The behavior of money supply is estimated to have a benchmark of the quantity of money that the economy will require, without the BSP setting any target for it. Two accounts from the liabilities side are estimated. The real deposit balances with output, lagged four quarters, nominal peso-dollar and real savings deposit rate. The level of real currency in circulation depends with output and real 91-day T-bill rate. There is a significant break in data prior to 1994. The break is explained by the impact of financial innovation which affected the composition of money supply. Hence, estimation of deposit liabilities start in first quarter 1994 up until fourth quarter of 2003. Given the level of real deposits and real currency in circulation, the money multiplier is computed. The components of money multiplier are the currency deposit ratio, the regular and liquidity reserve-deposit ratio. Given the money multiplier, reserve and base money are estimated. Once the level of base money is determined, domestic liquidity is determined.

4.5 From interest rates, exchange rate and money supply to aggregate spending

The effects of monetary policy are transmitted to aggregate demand through the functioning of money markets. Compared with the more recent assumption of IT models that the aggregate output is forward-looking, the dynamics of Philippine data show that it is backward-looking (Estrella and Fuhrer 2002, Ball 1999). The macro model uses a more detailed approximation of gross domestic product (GDP). This provides the impact of RRP, 91-day Treasury bill rate, lending rate, peso-dollar rate and money supply into the different components of expenditure and sectoral output separately, allowing us to identify monetary policy transmission channels more accurately. Inflation expectations provide the bridge between these short term savings and lending rates with long-term rates.

Monetary policy feeds into real private consumption through the real 91-day Treasury bill rate and real money supply. Backed by sustained inflows of remittances from Filipino workers abroad this has been the main driver of economic growth in the Philippines. It relates positively with disposable

income, its behavior one quarter ago and seasonal factors (second to fourth quarters).

The presence of disposable income implies a proportion of households are 'liquidity constrained' in the short run. The remaining household's consumption however, is determined by wealth position as indicated by real money supply. Meanwhile, the real T-bill rate captures the direct substitution effect between consumption and savings. A substantial degree of consumption smoothing also takes place as households protect themselves against fluctuations in income.[15]

Monetary policy affects the real government spending through the real lending rate. This indicates that it is financed by domestic borrowings as seen in the inclusion of lending rate. Government spending includes compensation of government employees, interest payments, allotment to local government units and maintenance and other operating expenses. Real tax revenues and level of output , also determine government spending. Tax revenues and real operating expenses of the government both indicate government's financial position and in empirical studies represent an important determinant of spending.

Two expenditure items are modeled separately, domestic and foreign interest payments. Apart from expenditure on personal services and maintenance, interest payments comprise the bulk of government expenditure at more than 20 % in 2005. In addition, interest payments are arguably more prone to exchange rate changes.

Gross domestic capital formation (total investments) are classified into private, government and durable equipment. The Philippines has one of the lowest investment ratio in the East Asian region, and the lowest capital stock per worker among emerging economies in the region (ADB 2005). In fact, over the long run, both national savings and domestic investment rates have been falling. The persistent inflows of remittances has helped boost consumption, but the relatively slow rate of new investment raises questions of its overall sustainability. Nevertheless, the estimated components show that monetary policy impact significantly on total investments through the real lending rate and nominal peso-dollar rate.

Private construction is determined significantly by real lending rate (lagged by one quarter) and output The relevance of output in behavior of private construction connotes that government must revive economic growth and later sustain this growth in order to maintain private investment. The smoothing indicator captures the adjustment costs in investment decisions of individuals, potentially due to expectations.

Another source of capital formation is the government. In most macro models, the results for government investment should not carry much weight since investment by this sector is usually taken as a policy variable and designed to maintain an environment conducive to private sector investment.

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[15] In its original specification, the unemployment rate was include to capture perception of household uncertainty and expectations. However this was dropped as it proved insignificant based on *t-statistic*.

Nevertheless, it is instructive to flesh out the determinants of government investment as this remains a crucial issue in Philippine context. Meanwhile, spending on real durable equipment is largely influenced by output requirements of the economy and movements of nominal peso-dollar rate significantly. The significant indirect effects of exchange rate reveals that depreciation of peso-dollar rate is expected to dampen demand for imported equipment.

Another component of the economy's spending pattern is net trade. Monetary policy affects net trade through the nominal and real peso-dollar rate. Manufactured and non-manufactured export groups comprise the bulk of Philippine total exports of goods. In 2005, the top five manufactured export goods include semi-conductors and electronic microcircuits, garments, finished electrical machinery, other manufactured products, ignition wiring sets. These goods occupied 33 percent of total merchandize exports as of 2005.[16] Meanwhile, the major non-manufactured exports include crude coconut oil, shrimps and prawns, bananas and plantains which occupied less than 10 percent of total merchandize exports as of 2005.

The effects of real peso-dollar rate into real demand for manufactured goods. A depreciating real peso-dollar rate (lagged one quarter) lowers demand for manufactured goods by 15.7%. It is expected that a peso depreciation leads to higher demand for manufactured goods. This reflects the phenomena where foreign exchange earnings in response to depreciation follow a J-curve, first declining and then rising afterwards or where current account worsens initially but as exports respond and import-substitutes are found, the current account will improve substantially. This brief period of adjustment eventually leads to the increase in foreign exchange earnings, improvement in net exports, hence, output.

Demand for manufactured goods also captures the dependence of Philippine export products to the US economy. There is inertia in the behavior of manufactured goods which could be explained by uncertainty in international trade market. In a similar manner, demand real export of non-manufactured goods captures the impact of real peso-dollar rate and the US economy. The impact of a depreciating real peso-dollar rate on the real non-manufactured exports follows the J-curve phenomena. Behavior of real export of non-manufactured goods also depend on a dummy variable to take account of the Asian currency crisis.

Over the long run, demand for real imports of goods is a function of output and the relative price of these goods. Import of goods are estimated separately for fuel imports (include mineral, fuel and lubricants) and non-oil imports. These two import groups comprise the bulk of total imports of goods that feed into trade balance and consequently into current account.

The nominal peso-dollar rate, output and price index of merchandize goods, lagged by two quarters, determine the behavior of real fuel import goods. Meanwhile, behavior of real non-oil imports is dependent on output, lagged one quarter, the real-peso-dollar rate and seasonal dummy variables.

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[16] Total exports of goods based on NSCB's National Income Accounts (NIA) in 2004.

Non-oil imports exhibit inertia, reflecting uncertainty and perhaps expectations on demand for non-oil imports.

All the changes in spending behavior discussed so far, when added up across the whole economy, generate changes in aggregate spending. It is very clear so far that among the monetary channels – interest rate, exchange rate and money supply, the exchange rate proved to have biggest impact. Total domestic expenditure plus the balance of trade in goods and services reflects the aggregate demand in the economy, and is equal to gross domestic product.

4.6 From aggregate spending to sectoral demand and to output gap

GDP (demand) then feed into the production side which consist of two sectors: the primary sector (agriculture) and the advanced sector (industry and services). Over the long run, demand for agriculture, industry, and services sectors are determined by their own price relative to the overall consumer price index and to total domestic demand.

An attempt was made to estimate a more detailed potential output, through a production function for industry and services, with capital stock and employment for industry and services determining output. This is essential in determining the output gap. Recall that the output gap is one of the main variables affecting medium-term inflationary pressures. However, the estimation equation was weak in terms of diagnostic tests.

This is not however unusual. There are several key issues surrounding the output gap in the context of IT. The most important issue is the use of appropriate technique to estimate the output gap. Yap (2003) expounded that several research strategies have been employed concerning the output gap estimation in the Philippines. There is a common weakness though running across these categories that the estimates of output gap are largely dependent on the sample period. Changing the sample therefore creates large deviations in the estimates.

Following studies that suggest Hodrick-filtered (HP) output gaps yield more benefits in terms of maintaining a rate of inflation nearest to its target, this model used the HP filter procedure. In particular, potential output (or trend GDP) is derived by fitting a trend on gross value added of industry and services sectors using the HP filter. Output gap in this model is estimated based on Dakila (2000) in which it is expressed as the difference between the log of a one quarter moving average of supply side (industry and services) GDP (less deseasonalization factor[17]) and potential output.[18]

Output gap then feed into the central price variable, wholesale price index. It should be recalled that prices are based on mark up over producers' cost which in this model is represented by wholesale price index. Wholesale price index is significantly affected by (1) the average dollar prices of merchandise imports, (2) the excess liquidity as indicated by the amount of seasonally-

[17] Deseasonalization factor is based on the X12 ARIMA.
[18] Also cited in Angeles and Tan (2004).

adjusted real money supply relative to gross domestic product, (3) the average compensation (or wages) for industry and services sectors and the output gap and (4) behavior of wholesale price index one quarter ago. In this specification, the main link monetary policy has on the price level and inflation is through the output gap. Hence there is a significant effect of monetary policy on expenditure. In addition, the amount of money supply relative to GDP strengthens the link to price level and consequently between monetary policy and the production sector. And by transitivity between monetary policy and GDP.

The inertial component in the behavior of wholesale prices is an indication of price rigidity. As mentioned earlier on, this implies limits in the analysis of any optimizing foundations and the related forward-looking behavior of inflation. From the point of view of BSP, this suggests some difficulty for policy action since it reduces the efficiency of domestic interest rates in controlling inflation.

The overall deflator (or GDP deflator) is determined by relative weights of agriculture, industry and services sector prices to total output which are indirectly affected by demand factors as well. This then is the basis of the consumer price index.

4.7 From sectoral output and prices to labor force and employment

The GDP deflator then feed into labor force and interacts with labor demand to determine the rate of unemployment. Labor force is estimated simply as a function of the working age population, age 15 years and above, non-agricultural compensation index and some degree of inertia.

Sectoral demand employment is estimated for the combined industry and services sector. Employment growth has been strongest in the services sector. Employment in services sector grew by almost 50% in the 1990s, well above growth in the industry sector (30 %) and agriculture (8 %). By the end of 2003 (October 2005 being the last labor force survey), employment in the services and industry sectors registered a combined share of 63 % to total employment. In this model, sectoral employment is determined strongly and positively by industry and services output. A high degree of inertia generally captures uncertainty and expectations.

Unemployment rate is then determined as the difference labor force and employment in the agriculture and sectoral demand employment. The unemployment rate influences the non-agricultural compensation index through a Phillips curve relationship. It is then affected by consumer price index due to indexation.

4.8 Consumer prices, inflation and inflation expectations

Consumer price index is normally constructed as a weighted average of consumer prices of food, clothing, energy products, etc. Each of these goods is an aggregation of imported goods and goods produced domestically using domestic and imported inputs. A detailed breakdown of consumer prices in

this manner is difficult to incorporate in a model of this size as it requires a different data set. This could be another area of improvement, including the measure of core inflation.[19]

Consumer prices (CPI) are dependent on GDP deflator. The rate of inflation is described within this index using 1994 as base year. This then feeds into RRP.

There is also a direct effect of exchange rate changes on domestic inflation. This arises because exchange rate changes affect the peso prices of imported goods, which are important determinants of many firms' costs and of retail prices of many goods and services. An appreciation of the peso lowers the peso price of imported goods and a depreciation raises the peso price of imported goods. The effects though may take many months to work their way fully through the pricing chain. Based on the latest BSP estimates, monetary policy normally requires 15 to 21 months to take full effect on inflation.

Results of the macro model and Table 4.2 below confirm a long-standing line of research that the influence of exchange rate changes on domestic prices or the so called exchange rate pass through for emerging market economies are high. There were four studies in Table 4.2 which presented exchange rate pass through effects across emerging countries who have adopted IT. It is not expected though that all the magnitudes are comparable across studies. For comprehensiveness of estimates, this analysis is compared to the study of Choudri and Hokura (2001) and argue that is rather obvious that the pass-through effects estimated in the model is higher than those of the non-G3 countries and even with those of emerging countries in Latin America (except Brazil), Europe (except Hungary), Middle East and Africa and Asia (except Indonesia). The estimated equation indicates that a one percent increase in the nominal peso-dollar rate affects wholesale prices by 9.3% in a quarter, bringing the total pass through effects of 37.2% in a year.

One point that is clear in this comparison is that the BSP is indeed relatively more concerned about the exchange rate, not least for its impact on domestic prices. Two distinct reasons are worth noting which could explain why the pass-through effects to prices of nominal peso-dollar rate is rather high. One, the historically high inflation which heightens the linkage between exchange rate and domestic prices. The Philippine inflation rate from 1981 to 2005 has been relatively high (compared with its Asian neighbors) and highly variable.

A related point is the history of crisis in the Philippines. The idea is that episodes of large devaluation or depreciation could raise the saliency of the local price of foreign exchange into domestic prices and wages, that could heightened the exchange rate sensitivity of domestic inflation. As noted in most studies, the economy suffered from the 'boom-bust cycle' especially after

[19] In its annual macroeconometric model, the BSP provides a more detail determination of prices in the economy. Headline and core CPI inflation and treated separately in the model. In the specification of core CPI inflation, food and energy prices are taken out.

the authorities embraced various measures of liberalization and globalization of financial markets.

TABLE 4.2
(Exchange rate) pass-through effects to prices

Country/Region		Choudri, Hakura	Hausmann et al.	Campa, Goldberg	Mihaljek, Klau
		1979-2000	*1990-1999*	*1980-2000*	*1980/90-2000/01*
	Duration	*One year*	*One year*	*One year*	*3 quarters*
Asia					
Indonesia		0.41	0.92	-	0.94
South Korea		0.10	0.59	-	0.13
Philippines		0.33	1.16	-	0.17
Thailand		0.12	0.19	-	0.28
Latin America					
Brazil		0.39	-	-	0.84
Chile		0.35	-	-	0.07
Mexico		0.27	0.93	-	0.94
Europe					
Czech Republic		0.16	1.17	0.61	0.06
Hungary		0.48	-	0.85	0.54
Poland		0.08	0.80	0.99	0.45
Middle East					
Israel		0.28	0.55	-	-
Africa					
South Africa		0.13	0.47	-	0.14
Memo items:					
Philippines:		0.37			0.28
Baseline model: 1988-2003		(one year)			(3 quarters)
Emerging countries: Average		0.26	0.75	0.82	0.35
Non-G3 countries */		0.12	0.19	0.67	-

*/ Includes Australia, Canada, New Zealand, Sweden, Switzerland and the United Kingdom.
Source of data: Ho and McCauley (2003), "Living with flexible exchange rates: issues and recent experience in inflation targeting emerging market economies," BIS Working Paper No. 130, February.

It is instructive at this point to highlight the indirect pass-through of peso-dollar rate to prices. It was mentioned earlier on that among the monetary policy channels , the peso-dollar rate generated the bigger impact in aggregate demand. The impact works through the durable equipment (a component of total investment), domestic and foreign interest payments and net trade. The impact of peso-dollar rate was felt significantly in imports of goods. The net impact to aggregate impact is more significant such that a one percent increase in peso-dollar rate (that is depreciation) brings about a net decline in aggregate demand of 1.4%, assuming all other things affecting aggregate demand remain unchanged.

Table 4.3 below shows that a depreciation of the peso-dollar rate raises the prices of essential imports and raises costs (direct effects). Further, it is clear that depreciation creates negative effects on the aggregate demand side.

TABLE 4.3
Philippines: Direct and indirect pass-through effects to prices

Indicators	Direct effects	Indirect effects (via aggregate demand)	
	Nominal	Nominal	Real
Durable equipment	-	-0.385	-
Interest payments			
Domestic	-	0.392	-
Foreign	-	0.052	-
Net trade			
Manufactured export goods	-	-	-0.147
Non-manufactured export goods	-	-	-0.100
Fuel imports	-	-0.460	-
Non-oil imports	-	-	-0.745
Prices of merchandize goods	0.093	-	-
Total effects	**0.093**	**-0.401**	**-0.992**

Inflation also feed into long-run inflation expectations. Different assumptions about the inflation expectation structure were tried and tested. Such estimations led to a hybrid structure that includes rational component of inflation, proxied by the medium-term inflation target announced by the Government and contemporaneous inflation.

As mentioned earlier on, the role of expectations in this model is assumed rather than determined. There are several business tendency surveys being conducted by the private sector which could indicate expectations. These include those being done by the Social Weather Station, Pulse Asia, Makati Business Club and Business World (in collaboration with New York-based Roper ASW Asia Pacific). The BSP has initiated the harmonized Business Expectations Survey (BES) in the second quarter of 2001. To complement the BES in judging the state of domestic demand in monetary policy, consumer expectations survey was initiated in 2004. Results from these surveys are designed to validate key demand indicators, including demand for money and loan growth. However, all these surveys have limited scope. The BES has six quarterly observations for analysis (Cintura and Gador 2003) while consumer expectations survey started in December 2004 only.

The estimated long-run inflation expectations is based on Demertzis' and Viegi's (2005) work on inflation targets as focal points for long run inflation expectations. The idea is that in the absence of a concrete information of inflation expectations, the only information that agents have is the quantitative inflation target announced by the Government. Under this situation, the agents assume that ultimately inflation is affected by both central bank's objectives and the policies it pursues.

The relatively larger coefficient on current inflation signifies that BSP's credibility is an important factor. Private agents observe credibility of the BSP and forms expectation based on what they have learned at the end of the current period. In turn, credibility of the BSP will determine the effectiveness of IT. Moreover, agents are similarly interested on the declining medium-term path of inflation announced by the Government.

What this structure means is that expected inflation has strong impacts on inflation and vice-versa, indicating the significant spiraling effect of inflation expectation on inflation. This also signifies that the BSP has to work more to contain inflationary pressure and unwelcome volatility from the peso-dollar rate in directing inflation expectation.

5. 'STICKING POINTS' IN THE MODEL

The modeling efforts in previous section succeeded in reaching a reasonable degree of reliability and sensible dynamics. There are 'sticking points' or areas that need improvement though in the model.

First, the general limitations stemming from model parameter uncertainty apply. Second, the statistical time series for the Philippine economy after the floating of the peso in 1997 is too short to yield sufficiently robust results. Moreover, a sequence of stabilization plans from 1986 to 1996 produced important structural breaks in many economic series, thus making it extremely difficult to treat them with the usual econometric techniques. Although this was treated with the use of dummy variables, it is important to point this out.

Third, from the specification, the more important area that needs to be improved is the estimation of the output gap. A detailed breakdown of consumer prices, including the measure of core inflation is useful as well. This model concentrates on GDP implicit price index while inflationary expectations are assumed. Further work will be done to model the CPI relationship and expectations more carefully.

And fourth, from the econometric modeling, the present expectations framework is sufficiently simple but may still be modified. A deterministic exercise on computing for model consistent expectations can easily be done as one simply writes out the expectation terms using lead operators in the program. Introducing uncertainty however makes the problem more complex. The entire distribution of stochastic simulations with future values of endogenous variables forecasted by the model could be dealt with. This requires stochastic simulations with future values of endogenous variables.

6. CONCLUDING REMARKS: LESSONS FOR MONETARY POLICY

The estimated model reflects the structure of the Philippine economy. There are 'sticking points' though, both in the specification and modeling techniques. Nevertheless, in general the individual equations have good fit and with the correct signs with respect to the explanatory variables. The elasticities obtained are within reasonable range of values.

This chapter described in greater detail the major links in Philippine monetary policy transmission mechanism from the BSP's policy rate decisions to economic activity and inflation. In particular, this chapter traced how the policy rate affected important variables such as inflation and economic growth through three different variables – (a) the traditional channel of interest rate or the 91-day Treasury bill rate, deposit and lending rates and its impact on consumption, investment demand and money supply, albeit limited; (b)

exchange rates and its impact on international trade, durable investment, price level and expected exchange rate, and (c) inflation expectations and its impact on consumption and investment.

However, there are issues as monetary policy transmits its effects to the overall economy. First, the reverse repurchase rate and the 91-day Treasury bill rate showed rather close tracking performance. However, the magnitude of such track is rather modest when compared to Brazil and Chile to which this model is patterned. The relative moderate impact of policy rate leaves the impression that a slight deviation from the expected path requires a significant change in the RRP to bring the economy back to the central path. Put simply, this is a strong indication that the interest rate elasticity to macroeconomic equilibrium is moderate. There is then a need to correct these distortions in the financial system and improve the efficiency of transmission mechanism.

Second, the peso-dollar rate contains important information about the stance of monetary policy and is therefore an effective transmission mechanism. Both direct pass-through and indirect effects to inflation are high. There are two reasons why this is relatively high. One, the historically high inflation which heightens the linkage between exchange rate and domestic prices. Philippine inflation rate from 1981 to 2005 has been relatively high (compared with its Asian neighbors) and highly variable.

A related point is the history of crisis in the Philippines. The idea is that episodes of large devaluation or depreciation could raise the saliency of the local price of foreign exchange into domestic prices and wages, that could heightened the exchange rate sensitivity of domestic inflation. The Philippine economy suffered from the 'boom-bust cycle' especially after the authorities embraced various measures of liberalization and globalization of financial markets.

The indirect pass-through of nominal peso-dollar rate to prices was even higher. The depreciation creates negative effects on the aggregate demand side. This indicates that depreciation is also an expenditure switching mechanism for the Philippines, with possible stagflationary consequences.

This justifies BSP's concern over excessive shocks to the peso-dollar rate. BSP intervenes, if only to reduce the short-run fluctuations of the peso. However, such intervention may create uncertainty in the foreign exchange market creating negative signalling effects in the exchange market which could eventually lead to exchange rate instability.

A more significant finding of this paper is the significant degree of risk premium in the nominal peso-dollar rate behavior. This indicates that instead of the UIP, another exchange rate model is a better description of peso-dollar rate at a certain moment in time. This leads to uncertainty in the conduct of monetary policy .

With all these issues in the relationship of interest rate and exchange rate, it is instructive to point out the implications of price stickiness in the transmission mechanism. When prices are sticky, a monetary policy tightening results in a substantial real appreciation of the exchange rate. And this is even more pronounced in the presence of a risk premium to the extent that the exchange rate may continue to appreciate before falling back to its long-run equilibrium. This real appreciation has two clearly distinct effects. First, its

immediate impact is to lower the prices of imported goods. This accelerates the impact of a policy tightening on consumer prices in two ways. It reduces the prices of imported consumer goods. It also reduces the price of imported intermediate goods thereby reducing the marginal cost of firms. And second, the loss of competitiveness following the real appreciation has substitution effects as both domestic and foreign demand will shift towards goods produced abroad. This leads to a fall in net exports and a fall in output putting further pressure on domestic prices.

Given these uncertainties on changes in nominal peso-dollar and the constraints to BSP's reaction function it could be tentatively concluded that the effectiveness of monetary policy in an IT framework is limited.

REFERENCES

Angeles, Rj. F., and Margot Aissa C. Tan (2004) 'The Contribution of the Output Gap in the Conduct of Inflation Targeting in the Philippines', research paper submitted in partial fulfilment of the requirements for Economics 199, University of the Philippines School of Economics.

Arestis, Philip (2003) 'Inflation Targeting: A Critical Appraisal', The Levy Economics Institute of Bard College Working Paper No. 388 (September).

Asian Development Bank (2005) 'Empirical Assessment of Sustainability and Feasibility of Government Debt: The Philippine Case', Economics and Research Department (ERD) Working Paper Series No. 64, Asian Development Bank, Manila, Philippines (February).

Ball, L. (1999) 'Policy Rules for Open Economies', in J.B. Taylor (ed.) *Monetary Policy Rules*, pp. 127-56. Chicago: The University of Chicago Press.

Bangko Sentral ng Pilipinas (2004) 'Consumer Debt and the Transmission Mechanism of Monetary Policy', 12th Annual Report, Volume 1 , Box Article 2.

Bautista, Carlos B., Roberto S. Mariano, and Bayani Victor Bawagan (2004) The NEDA quarterly macroeconomic model: theoretical structure and some empirical results", paper for presentation in the 9th National Convention in Statistics (4-5 October 2004).

Bernanke, B.S. and Michael Woodford (1997) Inflation Forecasts and Monetary Policy", *Journal of Money, Credit, and Banking* 24: 653-84.

Blanchard, Olivier J. and N. Kiyotaki (1987) 'Monopolistic competition and the effects of aggregate demand', *American Economic Review* 77: 647-66.

Calvo, Guillermo A. (1983) 'Staggered prices in a utility maximizing framework', *Journal of Monetary Economics* 12(3): 383-98.

Campa, J.M. and Goldberg (2002) 'Exchange rate pass-through into import prices: a macro or micro phenomenon?', National Bureau of Economic Research Working Paper No. W8934.

Choudri, E.U. and D.S. Hokura (2001) 'Exchange rate pass-through to domestic prices: does the inflationary environment matter', IMF Working Paper No. 01/194.

Cintura, Antonio B. and Ludy Gador (2003) 'The BSP's Business Expectations Survey', *Bangko Sentral Review*, BSP (January).

Clarida, R., J. Galí, and M. Gertler (2000) 'Monetary policy rules and macroeconomic stability: Evidence and some theory', *Quarterly Journal of Economics* 115: 147-80.

Dakila, Francisco Jr. (2000) 'Evaluation of Alternative Monetary Policy Rules: A Simulation-Based Study for the Philippines', dissertation paper, University of the Philippines School of Economics.

Demertzis, Maria and Nicola Viegi (2005) 'Inflation Targets as Focal Points', De Nederlandsche Bank (DNB) Working Paper No. 17 (version October 2005), DNB, Amsterdam.

Estrella, A. and J.C. Fuhrer (2002) 'Monetary Policy Shifts and the Stability of Monetary Policy Models', *The Review of Economics and Statistics* 85(1): 94-104 (11).

Fair, R.C. (1984), *Specification, Estimation, and Analysis of Macroeconomic Models*, Cambridge, MA: Harvard University Press.

Garcia, Carlos, P. Garcia, I. Mendoza, J. Restrepo (2002) 'A Medium-Sized Macroeconometric Model of the Monetary Transmission Mechanism in Chile', Banco Central de Chile (March).

Guinigundo, Diwa (2004) 'An Official Core Inflation Measure for the Philippines', condensed version of a paper presented at the First Quarter Meeting of the Philippine Statistical Association (PSA) in April 2004. A full-length version was published in the July 2004 issue of the *Bangko Sentral Review*.

Hausmann, R., U. Panizza and E. Stein (2000) 'Why do countries float the way they float', Inter-American Development Bank Working Paper (April).

Huang, Angela, Dimitri Margaritis and David Mayes (2001) 'Monetary policy rules in practice: evidence from New Zealand', *Multinational Finance Journal* 5: 175-200.

Kapetanios, G., Y. Shin, A. Snell (2003) 'Testing for unit root in the linear STAR framework', *Journal of Econometrics* 112: 359-79.

Leitemo, K. and U. Sodestrom (2004), "Simple Policy Rules and Exchange Rate Uncertainty,"*Journal of International Money and Finance* 24 (2005), p. 481-507.

Liu, Peter and G.S. Maddala (1992) 'Rationality of survey data and tests for market efficiency in the foreign exchange markets', *Journal of International Money and Finance* 11(4): 366-81.

Lowe, P. and L. Ellis (1998) 'The Smoothing of Official Interest Rates, in Philip Lowe '(ed.) *Monetary Policy and Inflation Targeting: Proceedings of a Conference*, pp. 286-312. Sidney: Reserve Bank of Australia.

McCallum, Bennett T. (1993) 'Unit Roots in Macroeconomic Time Series: Some Critical Issues', *Federal Reserve Bank of Richmond, Economic Quarterly* 79(2) (Spring).

Medalla, Felipe (1999) Reaction to Dr. Donald Brash lecture on 'Inflation Targeting: An Alternative Way of Achieving Price Stability', Fifty Years of Central Banking in the Philippines: Symposium on Inflation Targeting and the Asian Crisis, Bangko Sentral ng Pilipinas, Manila.

Mihaljek, D. and M. Klau (2001) 'A note on the pass-through from exchange rate and foreign price changes to inflation in selected emerging market economies', Bank for International Settlements (BIS) Papers No. 8, pp. 69-81.

Montiel, Peter J. (2003) *Macroeconomics in Emerging Markets*. Cambridge: Cambridge University Press.

Osterberg, William P. (2000) New results on the rationality of survey measures of exchange rate expectations', *Federal Reserve Bank of Cleveland Economic Review* 36(1): 14-21.

Pauly, Peter (2000) 'A framework for a macroeconometric model of an emerging small open economy', revised draft, Institute of Policy Analysis, Toronto.

Pesaran, M.H. (1987), *The Limits to Rational Expectations*, Oxford: Blackwell.

Romer, D. (2000) *Advanced Macroeconomics*. McGraw-Hill.

Rudebusch, G.D. and L.E.O. Svensson (1999) 'Policy Rules for Inflation Targeting', in J.B. Taylor (ed.) *Monetary Policy Rules*, pp. 203-246. Chicago: The University of Chicago Press.

Sarno, Lucio and Mark P. Taylor (2003) *The Economics of Exchange Rates*. Cambridge: Cambridge University Press.

Shleifer, A. and R.W. Vishny (1997) 'The Limits of Arbitrage', *The Journal of Finance* 52: 35-55.

Shleifer, A. and L.H. Summers (1990) 'The Noise Trader Approach to Finance', *Journal of Economic Perspectives* 4: 19-33.

Svensson, L.E.O. (1997) 'Inflation Forecast Targeting: Implementing and Monitoring Inflation Targets', *European Economic Review* 41: 1147-71.

Valadkhani, A. (2004) 'History of macroeconometric modelling: lessons from past experience', *Journal of Policy Modelling* 26: 265-81.

West, Kenneth D. (2003) 'Monetary policy and the volatility of real exchange rates in New Zealand', Reserve Bank of New Zealand discussion paper series, DP 2003/09.

Wollmershauser, Timo (2006) 'Should Central Banks React to Exchange Rate Movements? An Analysis of the Robustness of Simple Policy Rules under Exchange Rate Uncertainty', *Journal of Macroeconomics*, unpublished.

Wollmershauser, Timo (2003) 'A Theory of Managed Floating', inaugural dissertation, University of Wurzburg.

Yap, Josef T. (2003) 'The Output Gap and Its Role in Inflation Targeting in the Philippines', *Bangko Sentral Review* V(2) (July).