

**FINANCIAL LIBERALIZATION AND
INTEREST RATE DETERMINATION:
THE CASE OF THE PHILIPPINES, 1981-1985**

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I INTRODUCTION

Much has been written about the need to liberalize financial markets in developing countries. There are empirical studies which indicate a direct relationship between economic performance and the degree to which the financial sector is developed, including the degree to which interest rates are market-determined. McKinnon's study (1986, pp 320-321) posits that a high M2/GNP ratio and its rapid growth induces a large real flow of loanable funds through the organized financial sector which is

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The views expressed in this study are those of the author and do not necessarily reflect those of the Institute

positively correlated with real GDP growth. He cites as examples the cases of West Germany, Japan, Taiwan, and Singapore. There is, however, a dearth of literature on the subject of how interest rates are determined once the financial sector has been liberalized. Experiences of countries which have liberalized their financial sector - such as the southern cone countries of Latin America, namely, Argentina, Chile, and Uruguay - show that domestic interest rates increased to very high levels following the commencement of financial liberalization programs. Empirical evidence also suggests that external factors, including high and volatile world interest rates, have been transmitted to developing countries. It is clear that there is a need to examine how both domestic and external factors affect interest rates in developing countries which have liberalized their financial sectors.

The degree of openness of the capital account plays an important role in the process of determining interest rates. If capital flows were totally unrestricted, world interest rates, the expected rate of change of the exchange rate, and risk factors would determine domestic interest rate via the interest parity relationship.

If the capital account were completely closed, domestic interest rates would be determined by the domestic real interest rate, monetary conditions and the expected rate of inflation via the Fisher effect. Having a fully-open or fully-closed capital account is an extreme assumption to make. It is assumed that developing countries fall somewhere in between these two.

In this study, an attempt is made to explain how interest rates are determined by both domestic monetary conditions and external factors once the financial sector is liberalized. The empirical model utilized incorporates these domestic and external factors. Monthly, end-of-period data from January 1981 to December 1985 are used. A generalized least squares procedure is used to estimate the model.

The study is divided into the following sections. Section II contains a summary of the literature on the role of interest rate in economic development, the effects of financial repression, and the rationale behind financial liberalization programs. Section III briefly narrates the interest rate regimes in the Philippines. Section IV discusses the empirical model, explaining the behavior of monetary policy and exchange rate movements. Section V presents the empirical results. Finally, Section VI contains the summary and conclusions of the study.

II. BACKGROUND

The importance of interest rates in developing countries varies depending on factors such as the degree of monetization of the economy, the degree of separation of the savings and investment decisions, the degree of market-orientedness of the economy, etc.

In developing countries which have not undertaken financial liberalization, interest rates are administratively-determined, usually through limits on lending rates and deposit rates set

below market equilibrium levels. Various alleged rationalizations are given for the need to impose these limits including, the prevention of an oligopolistic banking system and the need to offset distortions in certain sectors of the economy.

If borrowers have unsatisfied credit demands due to the below equilibrium ceilings on interest rates, they may be induced to borrow from the curb market at significantly higher interest rates. Institutionally, this practice is not conducive to the development of a formal, organized financial sector. It also undermines the effectiveness of the interest rate controls.

Non-price rationing, via selective credit controls and the like, may also induce borrowers with unsatisfied credit needs to borrow abroad. Savers, on the other hand, are induced to lend abroad. It then becomes trivial to see why capital controls also necessarily accompany repressed interest rates. At the same time, however, the evasion of these capital controls tends to be inversely related to the degree to which domestic interest rates deviate from foreign interest rates.

Another result of holding nominal interest rates below market equilibrium is that if the inflation rate is high and variable, real rates of interest become negative. Negative real interest rates have been allowed to prevail for such reasons as to reduce the cost of servicing the public sector's debt and to encourage investment and subsidize disadvantaged sectors.

In developing countries with underdeveloped capital markets, although the savings ratio may be high, most saving is in the

form of physical or real assets rather than financial saving. McKinnon (1986, pp. 323-325) points out that if the rate of inflation is high, the private sector is forced to postpone current consumption. Instead, the private sector attempts to build-up its holdings of nominal money balances to compensate for the loss of purchasing power due to the inflation. This inflation tax accrues to the government as the sole issuer of money and is classified in the GNP accounts as if it were saving. However, real personal financial assets are not accumulating and the flow of loanable funds to the private sector is small. Negative real deposit rates mean that real assets earn a higher return than savings accounts and hence, people purchase inflation hedges such as real estate, real goods, etc. This reduces the amount of financial savings and could raise the rate of inflation if people hedge by buying domestic goods. If people hedge by purchasing foreign assets and foreign goods, foreign exchange reserves are depleted and the domestic exchange rate will tend to depreciate. Similarly, if real loan rates are negative, it is profitable to borrow even when the borrowed funds are channelled to endeavors with very low rates of return.

It is not clear, however, how an increase in nominal interest rates, via financial liberalization, to positive levels in real terms to negate the effects of financial repression, affects the economy. People may be encouraged to save more. This is basically the thesis of McKinnon (1973, p. 15, 67) and Shaw (1973, p. 73, 237). In the short-run, people may be encouraged to purchase domestic interest-bearing financial assets,

increasing the supply of bank credit available for investment. Kapur (1976) takes the argument one step further and posits that the increased amount of funds available for investment will raise output and hence reduce inflation. An opposing view regarding the effect of the real interest rate on savings is given by Giovannini (1983). This study of several countries including the Philippines indicates that the elasticity of savings with respect to the real rate of interest is insignificant or significantly negative.

The arguments of McKinnon et al. have recently been challenged in the literature. The Sacay, Agabin, and Tanchoco (1985, p. 102, 124) study shows that income is the major determinant of saving. The interest rate may have a greater effect on the form of savings, either financial or real, than on its level. An Asian Development Bank (ADB) study (1985, p. 48) also shows that the interest rate effect on financial saving is considerably greater than the national saving interest rate effect.

Even if higher interest rates were to lead to a higher savings rate à la McKinnon, the growth rate may decline. Buffie (1982) and Van Wijnbergen (1983) have shown that the conclusions of McKinnon et al. depend on the assumption that when financial liberalization takes place, people shift into domestic financial assets whose interest rates have risen by shifting out of 'unproductive assets,' such as currency and foreign bonds which do increase the supply of loanable funds. At the same time, there is also a link between the supply side of the economy and the credit

via the financing of working capital. If people shift out of curbmarket loans instead of these 'unproductive' assets, the aggregate loan supply contracts and the rates on curbmarket loans will rise. If there is a significant curb market and curb loans are good substitutes with domestic financial assets, there will be a contractionary effect on the aggregate supply of credit and, hence, the supply of output. This will tend to accelerate inflation. A recent study by Lim (1985) shows this to be the case for the Philippines. Van Wijnbergen's thesis is that asset market structures are important in the transmission of monetary policy, a thesis first put forth by Tobin in 1975. In order to determine the effect of rising interest rates on savings, it is important to determine the degree of substitutability between the domestic financial assets versus 'unproductive' assets or curbmarket loans.

To summarize, few would probably argue that interest rates are unimportant in a developing economy, especially in an economy in which working capital costs are financed with credit. The policy to liberalize the financial sector and free interest rates from administrative controls is presumably intended to remove the inefficiencies arising from non-price rationing such as selective credit controls, negative real interest rates, and intermediation through informal markets, by allowing the pricing process to give the correct market signals. There is less agreement, however, on the effects of the freeing of interest rates on the rate of savings as well as on output growth and inflation. The success of financial liberalization programs depends on a number of

important parameters, on fiscal control, such as the absence of budget deficits which are financed by money creation, and a non-inflationary environment.

III. A BRIEF HISTORY

The period from 1956-1973 is recognized as the period of low and rigid interest rates^{1/}. Ceilings on loan rates were prescribed by the Usury Act of 1916. In 1956, ceilings were imposed on deposits. This was probably a deliberate policy move to protect thrift and rural banks from competition from commercial banks, the former viewed as institutions which provide medium and long-term loans. However, the interest differentials on deposits offered by commercial banks versus those offered by thrift and rural banks was so small. Moreover, the interest rate differential between savings and time deposits was also small. Hence, funds were neither attracted to institutions which provide medium and long-term loans nor to long-term financial assets. Specialized banks to meet the mostly medium and long-term needs of certain sectors were created by the Central Bank. Due to Central Bank regulations outlining the special banks, the financial system became fragmented.

Evidence on the flow of loanable funds shows that M2/GNP declined continuously in the early '70s. This indicates that as

^{1/} For a more detailed discussion, see Lamberte, Mario B. "Financial Liberalization and the Internal Structure of Capital Markets: The Philippine Case," PIDS Staff Paper Series No. 85-07 (April 1985).

inflation increased, real rates declined and people hedged by switching their portfolios in favor of real assets. In addition, after 1965, the pace of economic activity increased, as did the demand for credit. With loan rates still prescribed by the Usury Act and ceilings on deposit rate below market equilibrium, the gap between the supply and demand for loanable funds widened. Selective credit controls to allocate the available credit and meet the needs of certain sectors were imposed. Simultaneously, however, these controls lost their selectivity as the Central Bank liberalized its rediscounting policy. The wide spread between rediscounting rates and prescribed loan rates encouraged banks to borrow from the Central Bank to meet the excess demand for loanable funds and undermine the selective credit controls. Also, since only short-term papers were eligible for rediscounting, there was seemingly a bias against long-term lending. In any case, banks tended to act as allocators of Central Bank funds rather than as mobilizers of savings.

The equity market remained underdeveloped also because it was cheaper for firms to borrow from banks than to raise equity by selling stocks.

The development of new financial "non-bank" institutions, whose financial investments were unregulated and aimed at circumventing the ceilings on interest rates served as an impetus for the development of the money market. Reforms were introduced in 1972 to cope with the increasing sophistication of the financial system. These reforms, however, seem to have exacerbated the specialization among financial institutions. Starting in

1973, the Monetary Board was given the authority to set maximum lending rates, rendering obsolete the Usury Act of 1916.

The period from 1974-1980 is the transition period marking the commencement of financial liberalization. Interest rates were still fixed but were adjusted constantly by the Monetary Board to reflect market conditions. The policies were aimed at reducing and stabilizing 'money market rates and providing a base for the development of a long-term market' (IMF/WB Report 1979). In general, the results indicate that the flow of loanable funds increased as seen in the rising M3/GNP ratio over the period. These policy changes are discussed below.

In 1974, ceilings on short-term deposits were raised while the rate on the long-term time deposits was deregulated in order to attract long-term funds.

To be able to compete with the growing share of deposit substitutes, interest ceilings on savings and time deposits were increased in 1976. Simultaneously, for deposit substitutes, an interest ceiling was imposed, minimum placement requirements were raised and a reserve requirement ratio of 20 percent was imposed. This was aimed at encouraging the flow of funds towards long-term assets.

In 1977, the interest rate ceilings on loans were made synonymous with effective interest rate ceilings in order to reduce the effective cost of funds to borrowers.

In 1979, the interest rate ceiling on various financial instruments increased by two percentage points to compensate lenders and savers from the inflation attributed to the second oil crisis and to prevent outflows as interest rates abroad increased.

In 1980, rates on loans of four years or more were deregulated.

Institutionally, the minimum paid-in capital requirements of banks were increased, encouraging the merger and consolidation of banks. Equity participation of foreign entities in domestic banks likewise increased. The expansion of Foreign Currency Deposit Units (FCDUs) and Offshore Banking Units (OBUs) allowed greater access to the foreign currency market. It did, however, also encourage firms to depend on debt financing rather than equity financing as rates abroad were lower at least prior to 1979, and also because the Central Bank provided forward cover to minimize exchange rate risk and/or default risk.

1981 marks the beginning of the floating interest period. Interest rate ceilings on all types of deposits and loans except short-term were lifted. Ceilings on short-term loans, however, were only lifted in 1983.

The financial system was restructured to increase the competitive conditions in the financial system. There was a reduction in the differentiation among categories of banks and non-banks authorized to perform quasi-banking (NBQBs). Universal banks offering a wide range of financial services were promoted. Bank minimum capital requirements were increased. There is some evi-

dence presented in Lamberte and Remolona's (1986) study that the financial reforms put a squeeze on bank profits.

In 1981, the Central Bank started phasing out its CBCIs in order to make way for treasury bills.

The M3/GNP ratio rose consistently when interest rates on time and savings deposits were substantially positive. However, the fully flexible interest rate regime failed to increase the flow of loanable funds because of the haphazard rediscounting policy of the Central Bank and the Central Bank's use of money creation to finance budget deficits.

The medium and long-term rediscounting facility allowed banks to rediscount papers for the acquisition of assets, working capital, and investment in affiliates and high grade securities. To encourage the transformation of short-term loans to medium and long-term loans, the Central Bank allowed any paper, regardless of maturity, to be accepted as security. Instead of attempting to increase the supply of loanable funds by mobilizing savings, banks seem to have simply borrowed from the Central Bank. Hence, while the term structure of bank portfolios was lengthened, the volume of financing provided was insufficient for the country's needs. Liberal rediscounting also discouraged the development of the equity market by encouraging debt borrowing.

A liquidity and BOP crisis in 1984 accelerated new financial liberalization efforts in the form of floating interest rates. Rates on time deposits increased from 14 percent per annum in

1980 to 15.6 percent per annum in 1981. In 1984, it rose to 32.5 percent due to a 50 percent rate of inflation, yet the M3/GNP ratio declined. This is evidence that a highly inflationary environment is detrimental to the mobilization of financial savings as people switch from nominal assets to real assets and/or from domestic currency to foreign currency.

IV. THE EMPIRICAL MODEL

Edwards and Khan (1985) is the only paper that the author is aware of which has a model of interest rate determination for an economy which has just undergone financial liberalization.

In the case of a fully-closed economy, i.e., one in which no capital flows are permitted, the interest rate is determined via the Fisher relationship:

$$i_t = rr_t + \Pi_t^e \quad (1)$$

where i_t = nominal rate of interest at time t
 rr_t = real rate of interest at time t
 Π_t^e = expected rate of inflation at time t

Furthermore, the real rate of interest is composed of a natural rate or that which is unaffected by nominal variables, and a cyclical component. The cyclical component may be viewed as the deviations from the natural rate induced by an excess supply of money. Attempts by portfolio holders to get rid of this excess supply of money gives rise to the so-called liquidity effect.

The liquidity effect pertains to the decline in interest rates as portfolio holders get rid of the excess money supply by purchasing financial assets and goods. The prices of financial assets rise and nominal interest rates decline. This initial decline in interest rates is subsequently reversed by income and price expectations effects. The Fisher Effect states that nominal interest rates will adjust upwards as expected inflation rises, in order to keep the real rate of interest constant. We ignore the so-called Darby-Feldstein effect of taxes on the nominal interest rate which could raise nominal interest rates beyond that implied by the Fisher effect.

The implicit assumptions that expected inflation does not affect the real rate of interest via the so-called Mundell-Tobin effect and that the excess supply of money does not affect the expected rate of inflation are made.

In their model, the excess supply of money is measured as the difference between actual and desired money balances. Edwards and Khan allow for the partial adjustment of desired to actual money balances. Desired money balances depends on income, the nominal interest rate, and expected inflation. Given a measure of expected inflation, equation (1) can be estimated for a closed economy.

A fully-open economy is one which there are no barriers to capital controls such as administrative controls, large transactions costs or imperfect asset substitutability due to differing risk characteristics between foreign and domestic financial

assets In this case, the domestic interest rate is determined via the uncovered interest parity relationship

$$i_t = i_t^* + e_t \quad (2)$$

where

i_t = domestic nominal rate of interest
 i_t^* = foreign nominal rate of interest
 e_t = expected rate of depreciation of the domestic currency

In other words, the expected rate of depreciation of the domestic currency depends on the interest rate differential between domestic and foreign assets. As long as there is a measure of the expected rate of depreciation of the domestic currency, equation (2) can be estimated for an open economy. Edwards and Khan also assume a sluggish adjustment of domestic to foreign interest rates.

In general, the capital account is never fully-closed or fully-open, so it is improper to simply estimate either equation (1) or (2). Even in the case of a country with legal barriers to capital flows, it is not obvious that capital is perfectly immobile.

For these reasons, Edwards and Khan estimate a linear combination of equations (1) and (2) in which the weight used is the degree of financial openness of the capital account.

$$i_t = \psi (i_t^* + e_t) + (1 - \psi) (r_t + \pi_t^e) \quad (3)$$

where ψ measures the degree of financial openness of the capital account. If $\psi = 1$, the capital account is fully-open, and (3) reduces to (2). Conversely, if $\psi = 0$, the capital account is fully closed, and (3) reduces to (1). In general, we would expect ψ to lie between zero and one.

This study takes this general approach used by Edwards and Khan. It varies from their approach in two ways:

(a) It is assumed that it is unanticipated monetary growth that leads to the so-called liquidity effect rather than the excess supply of money. Unanticipated monetary growth is defined as the difference between actual and expected monetary growth as in Barro (1977). In other words, when actual monetary growth exceeds that which had been expected, portfolios are disturbed. People rid their portfolios of this by purchasing financial assets and goods. Again, prices of financial assets rise and interest rates decline temporarily. Similarly, expected inflation is measured as the difference between anticipated monetary growth and the growth of output. Note that in our model, it is assumed that the liquidity effect and the Fisher effect occur concurrently whereas in past studies, the liquidity effect occurs first and is only reversed by income and price expectation effects subsequently. Here, we allow the liquidity effect and the Fisher effect to occur concurrently as it is assumed that they are due to different components of monetary growth.

(b) A generalized least-squares estimation procedure is used. The equations for expected monetary growth, expected exchange

rate depreciation, and the interest rate are estimated jointly with constraints imposed across equations.

$$MG_t = Z_{t-1} \gamma + e_t \quad (4)$$

where MG_t is monetary growth at time t .
 Z_{t-1} is a vector of variables available at time $t - 1$ when the forecast is made
 γ is a vector of coefficients
 e_t is an error term which is assumed to be serially uncorrelated.

The optimal linear forecast of MG_t namely $E(MG_t / I_{t-1})$ or AMG_t where I_{t-1} is the information set available on which the forecasts is conditioned from (4)

$$AMG_t = Z_{t-1} \gamma \quad (5)$$

where AMG_t = anticipated monetary growth

By definition, therefore, unanticipated monetary growth, UMG_t , is simply the difference between (4) and (5), i.e.,

$$UMG_t = MG_t - AMG_t \quad (6)$$

Suppose that the real rate consists of a natural rate and a cyclical component affected by unanticipated monetary growth.

$$rr_t = R - L_o UMG_t + w_t \quad (7)$$

where rr_t = real rate of interest at time t
 R = natural rate

L_o = coefficient which measures the 'pure' liquidity effect

w_t = error term

Assume that

$$\Pi_t^e = \text{UMG}_t - Y_t \quad (8)$$

where Π_t^e = expected rate of inflation at time t
 Y_t = growth of real output at time t

Following the Fisher relation, $i_t = rr_t + \Pi_t^e$

In this case, therefore,

$$i_t = R - L_o \text{UMG}_t + E_o (\text{UMG}_t - Y_t) + \epsilon_t \quad (9)$$

where E_o = the coefficient which measure the 'pure' effect of expected inflation on the interest rate, and

ϵ_t = an error term.

If the capital account were fully-closed, (9) would describe the manner in which the interest rate is determined.

In the case of an open economy, following the uncovered interest parity relationship, it is necessary to specify an equation which describes how expectations of exchange rate changes are formulated.

$$\dot{e}_t = X_{t-1} \delta + \eta_t \quad (10)$$

where X_{t-1} = a vector of variables used to explain exchange rate changes at time t available at time $t-1$ when the forecast is made.

δ = a vector of coefficients

η_t = an error term which is assumed to be serially uncorrelated.

If we assume, as Edwards and Khan do, that domestic interest rates adjust to foreign interest rates with a lag, then

$$i_t = \theta (i_t^* + \dot{e}_t) + (1 - \theta) i_{t-1} \quad (11)$$

Substituting for \dot{e}_t in (11),

$$i_t = \theta (i_t^* + X_{t-1} \delta) + (1 - \theta) i_{t-1} + V_t \quad (12)$$

where V_t is an error term.

If the capital account were fully-open, (12) would describe the manner in which the interest rate is determined.

If the economy is neither fully-closed nor fully-open, interest rates will be determined by both domestic monetary conditions and open economy factors. The degree to which either or both of these factors matter depends on the degree of financial openness. Combining equations (9) and (12), assuming slow adjustment of domestic interest rates to foreign interest rates, following (3) we obtain:

$$i_t = \psi \theta (i_t^* + X_{t-1} \delta) + \psi (1 - \theta) i_{t-1} \quad (13)$$

$$+ (1 - \psi) [R - L (MG - Z \gamma)]$$

$$+ (1 - \psi) E_o (Z_{t-1} \gamma - Y_t) + \epsilon_t$$

In (13), the assumption is made that there is a constant risk premium. If, however, the risk premium varies with time, or if the controls on capital are liberalized smoothly over time, ψ should be modelled as a function of a time trend.

$$\psi = K_0 + K_1 * \text{TREND}$$

Alternatively, if capital controls are loosened and tightened sporadically over time, a dummy variable could be constructed such that the dummy variable is equal to 1 when controls are loosened or equal to 0 when controls are tightened. ψ would then be modelled in the following way:

$$\psi = K_0 + K_1 * \text{DUMMY}$$

In the estimation procedure used, (5), (10), and (13) are estimated jointly, where the δ in (10) and (13) and the γ in (5) and (13) are constrained to be equal across equations.^{2/} This

^{2/} Tests of the validity of these constraints could be conducted by estimating (2), (7), and (10) without the said constraints. The test statistic is constructed in the following manner:

$$- 2n \log [SSR^t - SSR^u]$$

where n is the number of observations
 SSR^t is the sum of squared residuals of the constrained system
 SSR^u is the sum of squared residuals of the unconstrained system

The test statistic is distributed as a $X^2(q)$ where q is the number of constraints.

The validity of the constraints not only indicates whether market participants form their expectations consistently with the known economic structure but also indicates the appropriateness of the model specified. A rejection of the constraints, therefore, could be due to the failure of one or both of these.

assumes that people form their expectations consistently with the known economic structure.

Equations (5), (10), and (13) are estimated jointly using a generalized least squares procedure. The computer package is SAS and the seemingly unrelated regression procedure in the ETS library is used. The error term in (13) is modelled using a first order autoregressive process to correct for serial correlation, i.e., $e_t = \rho e_{t-1} + \eta_t$.

1. Monetary Policy in the Philippines

In Porzecanski's (1979) study of monetary policy in Latin America two (2) different patterns of money supply growth are postulated. The Central Bank may have as its chief goal the maintenance of currency and price stability. Given such a monetary policy, the Central Bank will vary money creation directly with the lagged growth of foreign exchange reserves. The Central Bank's reaction to the lagged rate of growth of output is not clear, a priori. The monetary authorities may restrict the rate of growth of domestic credit to dampen import demand if they interpret the increase in real GNP growth as temporary. On the other hand, if the increase in GNP growth is viewed as permanent, the monetary authorities could expand credit in order to meet the increased demand for money.

Alternatively, the Central Bank may have goals other than the maintenance of currency and price stability. The pursuit of these other goals could lead to inflationary effects and exchange

rate depreciations. For example, the Central Bank could be used to finance chronic budget deficits, keep the rate of unemployment from declining, or maintain a certain level of real liquidity. Hence, under this pattern of monetary policy, lagged changes in the price level and the rate of growth of real GNP will be positively related while the rate of unemployment will be negatively related to the rate of growth of domestic credit.

In Appendix A, the results of the regressions of the rate of growth of base money on uniform lags of different explanatory variables are presented. While most of the lagged values of the explanatory variables are not jointly statistically significant at the 5 percent level using an F-test, their signs, nevertheless, give some idea about the behavior of the monetary authorities. In all cases, base money creation is negatively related to the lagged rate of international reserves. Base money creation is positively related to real output growth and to lagged rates of inflation perhaps because deficits are financed via money creation. The signs on logs of the employment rate are mixed. The positive relationship of base money creation to lagged rates of growth of output is also compatible with accommodation of the increased demand for credit from an increase in real output viewed as permanent by the monetary authorities. These findings indicate that the authorities have goals other than the maintenance of currency and price stability. On the other hand, it is not clear how the negative signs on lagged $\log(CPI/WPI)$ should be interpreted. If CPI is assumed to be the price of non-traded goods and WPI the price of traded good, the negative signs on

the lags of log (CPI/WPI) mean that the authorities are also concerned about price stability

The results of the F-test at the 5 percent level for joint significance of the lags of the explanatory variables indicate that the appropriate forecasting equation has four lags each of the growth of international reserves, and the rate of inflation (using the CPI index). However, the Durbin-Watson statistic was quite low and hence, aside from the growth rate of international reserves and rate of inflation, four lags of base money growth are included in the money forecasting equation. This is successful in ensuring that the error term is serially uncorrelated.

2 Modelling Exchange Rate Movements

The Philippine peso was allowed to float in the Foreign Exchange market on February 21, 1970. Pante's (1983) study tested alternative hypotheses regarding the behavior of the Central Bank (CB) with exchange rate

- 1) The CB acts to stabilize the effective exchange rate
- 2) A Purchasing Power Parity rule in which inflation differentials between the domestic economy and its major trading partners are compensated by exchange rate adjustments
- 3) Targetting the stock changes in the level of international reserves
- 4) Linking exchange rate changes to changes in the current account

Using the change in either the nominal or effective exchange rate as the dependent variable, and explanatory variables ascribed to hypotheses 1 through 4, Pante's results for the period 1973-1981 support the hypothesis that the CB, on average, adjusts the nominal exchange rate in response to changes in the current account balance. The relationship is significant up to a lag of two quarters.

Lamberte (1984) uses a vector autoregressive system of the nominal exchange rate, current account balance, money stock, and the ratio of the domestic to foreign price level. One of his findings is that the current account balance is endogenous with respect to the exchange rate.

This study uses the log of the black market premium, calculated as the ratio of the Hongkong bank note rate divided by the official exchange rate times 100, as the dependent variable. Uniform lags of four, six, or eight of the explanatory variables were used. The explanatory variables include lags of the black market premium, the current account balance, the growth rate of international reserves, the log of the CPI/WPI index which is similar to Lamberte's relative price index if it is assumed that the CPI index measures the price of non-traded goods and the WPI index measures the price of traded goods, the differential between the domestic 91-day interest rate and the 3-month U.S. Treasury Bill rate which could proxy for inflation differentials as in Pante's study, assuming that financial markets are efficient.

Using monthly data, the results shown in Appendix B indicate that in all except one case, only lags of the log of the black market premium are jointly significant at the 5 percent level using an F-test. In only one regression were lags of the log of international reserves jointly significant. According to these results, therefore, the black market premium is highly autoregressive. The current rate depends on the previous rate.

V. EMPIRICAL RESULTS

Using the estimation procedure outlined in section IV, the empirical results can be classified into three groups.

1. A partial adjustment model of actual to desired money balances where desired money balances depend on income, the interest rate and expected inflation, is used in an attempt to simply replicate the model used in Edwards and Khan (1985). The reduced form for the interest rate equation is:

$$TB91_t = C_0 + C_1 \left(i_t + \dot{e}_t \right) + C_2 Y_t + C_3 M_{t-1} + C_4 \Pi_t^e + C_5 TB91_{t-1}$$

where i_t^* = 90-day U.S. Treasury Bill rate
 \dot{e}_t = expected rate of change of the exchange rate
 Y_t = rate of growth of output
 M_{t-1} = lagged rate of growth of base money

Π_t^e = expected rate of inflation. It is measured as the difference between anticipated monetary growth and output growth, $AMG_t - Y_t$. Note that AMG_t is based on information available at $t-1$.

TB91 = the 91-day Treasury Bill rate

C_s = coefficients

Table I shows the results of two regressions using a partial adjustment model of actual to desired money balances.

Equation I.1 uses a forecasting equation for monetary growth with four lags of itself, the growth of international reserves, and the rate of inflation using the CPI index. The coefficients of output growth, expected inflation and the lagged interest rate are positive and statistically significant based on their t -values. The R^2 's, except for the money forecasting equation, indicate good fits. The calculated PHI coefficient is 0.85.

In order to see whether the results are sensitive to the forecasting equation used, an alternative forecasting equation for expected inflation is used. The same forecasting equation for the exchange rate is used. In equation I.2, the forecasting equation for the inflation rate using the CPI index consists of six lags of itself.

When this alternative forecasting equation is used, only expected inflation and the lagged interest rate are

significant. The R^2 's indicate good fits, including that for the expected inflation equation. The calculated PHI coefficient is above unity which is not expected, a priori.

The results are sensitive to the specification of the forecasting equation. Only expected inflation and the lagged interest rate are significant in both equations.

2. The distinction between anticipated and unanticipated monetary growth is used. It is assumed that unanticipated monetary growth gives rise to the liquidity effect. Anticipated monetary growth less the rate of growth of output captures the effect of expected inflation on the nominal interest rate and gives rise to the Fisher effect. No partial adjustment model of actual to desired or expected money holdings is assumed. The reduced form for the interest rate equation is

$$TB91_t = C_0 + C_1 * (1 + e_t) + C_2 * TB91_{t-1} + C_3 * (M_t - AMG_t) + C_4 * (AMG_t - Y_t)$$

where

$M_t - AMG_t$ = unanticipated monetary growth at time t

C_0 = $(1 - PHI) * R$

C_1 = $PHI * THETA$

C_2 = $PHI * (1 - THETA)$

C_3 = $(1 - PHI) * LO$

C_4 = $(1 - PHI) * EO$

PHI	measures the degree of financial openness. The closer PHI is to unity, the greater the degree of financial openness.
THETA	measures the speed of adjustment of domestic to foreign interest rates.
LO	measures the size of the "pure" liquidity effect.
EO	measures the size of the "pure" Fisher effect.
R	the natural component of the real rate which is unaffected by nominal variables such as inflation.

Table II presents the results of several regressions using different forecasting equations for monetary growth or inflation in which the distinction between anticipated and unanticipated monetary growth is made. Among these are an autoregressive specification with six lags of the rate of inflation using the CPI index, and a variation of the inflation forecasting equation in Mariano (1984).

In the six regressions, the lagged interest rate is significantly positive as in the previous case. However, the coefficient on anticipated monetary growth less the growth of output is not significant in any case. In four out of six cases, it has the correct positive sign. The coefficient on unanticipated monetary growth is only significantly negative in one case [Equation II.4]. Again, in four out of six cases, it has the correct negative sign.

There is not much variation in the magnitudes of the coefficients on the interest parity relationship and the lagged interest rate. There is, however, large variations in the magnitudes of the coefficients on anticipated monetary growth less output growth and unanticipated monetary growth.

The R^2 s are comparable and indicate good fits except that for the monetary growth or inflation forecasting equation whose values range from 9 percent to 68 percent.

It is possible to calculate PHI and THETA from the estimated Cs. In all cases, PHI is significant but above unity, contrary to what is theoretically expected. The values for PHI range from 1.09 to 1.22. THETA, the speed of adjustment of domestic to foreign interest rates, is never statistically significant and its magnitudes are quite small. They range in value from 0.15 to 0.23. The estimated natural component of the real rate, R, ranges in value from 7.65 to 12.16.

This is a modification of the results in group II. The degree of financial openness parameter, PHI, is modelled as depending on a time trend if it is assumed that there is a time varying risk premium or if capital controls were loosened gradually over time. An alternative formulation is to assume that capital controls were tightened or loosened sporadically over time. In this case, a dummy variable is used in place of a time trend variable in

modelling PHI. The interest rate equation is the following:

$$\begin{aligned}
 TB91 = & (1 - K1 - K2 * X) * R \\
 & + (K1 + K2 * X) * THETA * (i_t + \dot{e}_t) \\
 & + (1 - K1 - K2 * X) * EO * (AMG_t - Y_t) \\
 & + (1 - K1 - K2 * X) * LO * (M_t - AMG_t)
 \end{aligned}$$

where X = TREND or DUMMY

K1, K2 = coefficients

The dummy variable is equal to unity when capital controls are relatively loose and equal to zero during periods of relatively tight capital controls. In our case, the dummy variable is equal to one from January 1981 to October 1983 and from November 1984 to May 1986. It is equal to zero from November 1983 to October 1984 [See Lamberte *et al.* (1985)].

Again, in order to test the robustness of the results with respect to the forecasting equations used, other forecasting equations for monetary growth or inflation are used.

Table III shows the results when PHI is modelled as a function of a time trend or of a dummy variable.

When a dummy variable is used (Equations III.1 and III.2), THETA has plausible values ranging from 0.35 to 0.38 which are significant. The calculated average PHI values range from 0.85 to 0.91. The natural component of

the real rate, R , ranges from 22.30 to 22.58. The significance of K_2 , the coefficient of the dummy variable, depends on the forecasting equation used. It is significantly negative in equation III.1 where the forecasting equation for monetary growth consists of four lags itself, the inflation rate, and the growth of international reserves. A priori, we would expect the coefficient on the dummy variable to be significantly positive. In other words, if capital controls are relatively loose, PHI is closer to unity and vice-versa. One way of interpreting the finding of a significantly negative coefficient on the dummy is the following: As legal capital controls become relatively loose, this is viewed as a signal that there is less incentive to evade the controls and so capital is less likely to flee the country. The converse also holds. The calculated coefficients on anticipated and unanticipated monetary growth varies greatly, again depending on the forecasting equation specified.

When a time trend variable is used instead of a dummy variable (Equations III.3 and III.4), the results are poor. THETA is close to zero or worse, negative. This indicates that using a time trend variable is not the proper way to model PHI .

In equations III.5 and III.6, a term allowing for a lagged liquidity effect is included. It is not significant in either equation. The calculated average PHI values range from 0.87 to 0.92. THETA ranges in value from 0.36

to 0.45. R ranges in value from 22.06 to 23.35. Again, the coefficient on the dummy variable is negative but significant only in equation III.5. In equation III.5, the calculated coefficient on anticipated and unanticipated monetary growth yield more plausible values when the forecasting equation for monetary growth has four lags of itself, the inflation rate, and the growth rate of international reserves.

VI. SUMMARY AND CONCLUSIONS

A model which explains the determination of nominal interest rates in an economy which has just undergone financial liberalization has been developed.

The measure of the degree of financial openness, PHI, depends on the forecasting equation for monetary growth or expected inflation used, and whether or not an allowance is made for sporadic changes in the level and intensity of capital controls. The values of PHI range from 0.85 to above unity, the latter being inconsistent with the theoretical specification. Hence, if we look only at the results with theoretically-plausible values for PHI, those in Table III, this means that an increase in the foreign interest rate of 10 percent translates into an increase in domestic interest rate of 8.5 percentage

points on an annualized basis.^{3/} The speed of adjustment of domestic to foreign interest rates, as measured by THETA, ranges in value from 0.36 to 0.45. This means that the average or mean-time lag in the adjustment of the nominal interest rate to a change in either the foreign interest rate or the exchange rate would be between one and two quarters.

While the model yields theoretically-plausible values of PHI and THETA, the question is whether these values are realistic. If there are legal capital controls in effect, a value of 0.85 for PHI seems to indicate that these capital controls are ineffective. Is this result realistic? If it is, why is it so, given that there are legal barriers to capital. How can the legal controls be effectively enforced? It might be pointed out that in Edwards and Khan's study of Colombia, supposedly a closed economy as there are legal restrictions and capital mobility, the PHI value obtained was 0.84 while the THETA value obtained was 0.42, both of which are similar to those obtained in this study. This means that countries such as the Philippines and Colombia are more integrated with the rest of the world than expected, despite the existence of legal barriers to capital mobility. It means that domestic monetary policy has little direct effect on the interest rate although it may have an indirect influence via the forward premium.

^{3/} Note, however, that for different interest rates, one could have different values of PHI. Also, even if the capital account were completely closed, open economy factors could still affect the domestic interest rate indirectly. For example, a shock in the terms of trade could reduce real income and the demand for credit, and hence, the domestic interest rate.

If domestic and international markets are linked via capital flows, the efforts of trade liberalization reforms directed at a more realistic (higher) real exchange rate could be frustrated by capital inflows. The real exchange rate will appreciate and this will hamper export expansion. The point is that the success of financial liberalization programs impinge on and are impinged on by reforms in other areas.

One possible modification of the model is the recognition that exchange rate expectations probably depend on the domestic interest rate and domestic monetary policy. Also, a better way to quantify the effects of legal capital controls could be developed. Another possible extension of the study is to analyze the behavior of real rates of interest. Among the questions that might be addressed are the following:

- 1) What is the effect of financial liberalization on real interest rates and how is aggregate demand affected?
- 2) Have real interest rates tended to equalize across countries?

As Edwards (1985) points out, even if the capital account is fully-open and total credit is increased, real interest rates could still be high because of:

- a) an increase in the demand for credit
- b) a continuous increase in expectations of devaluation
- c) the existence of transactions costs that pose obstacles to arbitrage

d) an increase in the country-risk premium due to such factors as the rapid growth of foreign debt.

Some research could also be devoted to determining interest rates given varying degrees of financial openness.

Table 1

NON-LINEAR ESTIMATES OF THE INTEREST RATE EQUATION

$$\text{MODEL: } TB91_t = C0 + C1 * (i_t + \dot{e}_t) + C2 * Y_t + C3 * M_{t-1} \\ + C4 * \pi_t^e + C5 * TB91_{t-1} + \rho e_{t-1} + \eta_t$$

Equation 1.1

Forecasting Equations

Log of the Blackmarket Premium = f(4 lags of itself)

Growth Rate of Base Money = (4 lags of itself, 4 lags of the growth rate of international reserves, 4 lags of the inflation rate using the CPI index)

C0 = -1.05	(-0.44)
C1 = -0.074	(0.63)
C2 = 86.612**	(2.07)
C3 = 6.533	(0.44)
C4 = 79.935*	(1.92)
C5 = 0.9259**	(24.49)
ρ = -0.09	(-0.54)

Calculated Coefficients

PHI = 0.8519

	SSE	DFE	MSE	² R
Log of the Blackmarket Premium	0.1903	52	0.003	0.72
Growth Rate of Base Money	0.2368	48	0.004	0.11
91-day Treasury Bill Rate	160.091	39	4.104	0.96

Note: In this and in succeeding tables, SSE is the sum of squared errors, DFE is the number of degrees of freedom, and MSE is the mean squared error. The t-statistics are in parentheses.

NON-LINEAR ESTIMATES OF THE INTEREST RATE EQUATION

$$\text{MODEL: } TB91_t = C_0 + C_1 \left(i_t + \dot{e}_t \right) + C_2 Y_t + C_3 M_{t-1} \\ + C_4 \Pi_t^e + C_5 TB91_{t-1} + \rho e_{t-1} + \eta_t$$

Equation 1.2

Log of the Blackmarket Premium = f(4 lags of itself)
 Inflation Rate = f(6 lags of itself)

C0 =	-2.888	(-0.66)
C1 =	0.273	(0.264)
C2 =	1.019	(0.23)
C3 =	-5.191	(-1.12)
C4 =	55.636*	(1.63)
C5 =	0.9156**	(12.13)
ρ =	0.419**	(2.45)

Calculated Coefficients

PHI = 1.18

	SSE	DFE	MSE	² R
Log of the Blackmarket Premium	0.190	30	0.003	0.72
Inflation Rate	0.0097	49	0.001	0.51
91-day Treasury Bill Rate	237.955	40	5.94	0.94

Table 2

NON-LINEAR ESTIMATES OF THE INTEREST RATE EQUATION

$$\text{MODEL: } TB91_t = C0 + C1 * (I_t + \dot{e}_t) + C2 * TB91_{t-1} + C3 * (M_t - AMG_t) + C4 * (AMG_t - Y_t) + \rho e_{t-1} + \eta_t$$

Equation 2.1

Log of the Blackmarket Premium = f(4 lags of itself)

Growth Rate of Base Money = f(4 lags of itself, 4 lags of the inflation rate, 4 lags of the growth rate of international reserves).

C0 = -1.38	(-0.27)
C1 = -0.214	(0.75)
C2 = 0.9199	(9.26)**
C3 = -1.238	(-0.23)
C4 = 1.317	(0.30)
ρ = 0.50	(2.67)**

Calculated Coefficients

PHI = 1.13**
 THETA = 0.15
 R = 9.86

	SSE	DFE	MSE	$\frac{2}{R}$
Log of the Blackmarket Premium	0.190	52	0.003	0.72
Growth Rate of Base Money	0.177	48	0.003	0.33
91-day Treasury Bill Rate	259.6	40	6.49	0.94

NON-LINEAR ESTIMATES OF THE INTEREST RATE EQUATION

$$\text{MODEL: } TB91_t = C_0 + C_1(i_t^* + \dot{e}_t) + C_2 TB91_{t-1} + C_3(M_t - AMG_t) + C_4(AMG_t - Y_t) + \rho e_{t-1} + \eta_t$$

Equation 2.2

Log of the Blackmarket Premium = f(4 lags of itself)

Growth Rate of Base Money = f(4 lags of itself, 4 lags of output growth, 4 lags of international reserves, 4 lags of CPI/WPI index).

C0 = -1.46	(-0.28)
C1 = 0.221	(0.75)
C2 = 0.919	(8.88)**
C3 = -2.69	(-0.51)
C4 = 1.633	(0.38)
ρ = 0.50	(2.59)**

Calculated Coefficients

PHI = 1.14**
 THETA = 0.19
 R = 10.42

	SSE	DFE	MSE	² R
Log of the Blackmarket Premium	0.190	52	0.003	0.72
Growth Rate of Base Money	0.196	46	0.004	0.26
91-day Treasury Bill Rate	257.75	38	6.78	0.94

NON-LINEAR ESTIMATES OF THE INTEREST RATE EQUATION

$$\text{MODEL: } TB91_t = C_0 + C_1 \cdot (i_t + \dot{e}_t) + C_2 \cdot TB91_{t-1} + C_3 \cdot (M_t - AMG_t) + C_4 \cdot (AMG_t - Y_t) + \rho e_{t-1} + \eta_t$$

Equation 2.3

Log of the Blackmarket Premium = f(4 lags of itself, 4 lags of current account)

Growth Rate of Base Money = f(4 lags of the growth rate of international reserves, 4 lags of the inflation rate).

C0 = -0.75	(-0.14)
C1 = 0.195	(0.63)
C2 = 0.903	(8.16)**
C3 = -1.02	(-0.19)
C4 = 0.730	(0.16)
ρ = 0.50	(2.44)**

Calculated Coefficients

PHI = 1.09**
 THETA = 0.17
 R = 7.65

	SSE	DFE	MSE	² R
Log of the Blackmarket Premium	0.122	47	0.002	0.821
Growth Rate of Base Money	0.183	49	0.003	0.31
91-day Treasury Bill Rate	261.14	37	7.057	0.94

NON-LINEAR ESTIMATES OF THE INTEREST RATE EQUATION

$$\text{MODEL: } TB91_t = C_0 + C_1(i_t + \dot{e}_t) + C_2(TB91_{t-1}) + C_3(M_t - AMG_t) + C_4(AMG_t - Y_t) + \rho e_{t-1} + \eta_t$$

Equation 2.4

Log of the Nominal Exchange Rate = f(6 lags of itself, 6 lags of the log of international reserves)

Growth Rate of Base Money = f(4 lags of the growth rate of international reserves, 4 lags of the inflation rate).

C0 = -1.489	(-0.54)
C1 = -0.182	(0.94)
C2 = 0.975	(21.36)**
C3 = -7.55	(-3.56)**
C4 = 5.08	(1.46)
ρ = 0.115	(0.64)

Calculated Coefficients

PHI = 1.157**
THETA = 0.15
R = 9.48

	SSE	DFE	MSE	² R
Log of the Blackmarket Premium	0.083	46	0.001	0.98
Growth Rate of Base Money	1.44	48	0.030	0.09
91-day Treasury Bill Rate	191.03	36	5.30	0.95

Note: Only OLS estimates

NON-LINEAR ESTIMATES OF THE INTEREST RATE EQUATION

$$\text{MODEL: } TB91_t = C_0 + C_1(i_t + \dot{e}_t) + C_2 TB91_{t-1} + C_3(M_t - AMG_t) + C_4(AMG_t - Y_t) + \rho e_{t-1} + \eta_t$$

Equation 2.5

Log of the Blackmarket Premium = f(4 lags of itself)

Inflation Rate = f(6 lags of itself)

C0 =	-2.677	(-0.53)
C1 =	+0.286	(0.97)
C2 =	0.936	(10.11)**
C3 =	2.165	(0.48)
C4 =	-2.00	(-0.45)
ρ =	0.48	(2.67)**

Calculated Coefficients

PHI = 1.22**
 THETA = 0.23
 R = 12.16**

	SSE	DFE	MSE	² R
Log of the Blackmarket Premium	0.190	50	0.003	0.72
Growth Rate of Base Money	0.009	49	0.0001	0.52
91-day Treasury Bill Rate	257.58	41	6.28	0.94

NON-LINEAR ESTIMATES OF THE INTEREST RATE EQUATION

$$\text{MODEL: } TB91_t = C_0 + C_1 \left(i_t + \hat{\epsilon}_t \right) + C_2 TB91_{t-1} + C_3 (M_t - AMG_t) + C_4 (AMG_t - Y_t) + \rho e_{t-1} + \eta_t$$

Equation 2.6

Log of the Blackmarket Premium = f(4 lags of itself)

Inflation Rate = f(2 lags of itself, log of the blackmarket premium lagged once, lagged rate of growth of WPI, lagged growth rate of base money/growth rate of output, lag of the log of employment, lagged interest rate)

C0 = -1.16	(-0.25)
C1 = +0.192	(0.75)
C2 = 0.922	(9.35)**
C3 = 2.27	(0.51)
C4 = -1.05	(-0.26)
ρ = 0.51	(2.84)

Calculated Coefficients

PHI = 1.114**
 THETA = 0.17
 R = 10.17

	SSE	DFE	MSE	² R
Inflation Rate	0.006	52	0.001	0.688
Log of the Blackmarket Premium	0.191	53	0.030	0.723
91-day Treasury Bill Rate	260.37	43	6.055	0.944

Table 3

NON-LINEAR ESTIMATES OF THE INTEREST RATE EQUATION

$$\text{MODEL: } TB91_t = (1 - \text{PHI}) * R + \text{PHI} * \text{THETA} * (i_t * + e_t) \\ + (1 - \text{PHI}) * \text{EO} * (\text{AMG}_t - Y_t) + (1 - \text{PHI}) \\ * L0 * \text{UMG}_t + \rho e_{t-1} + \eta_t$$

Equation 3.1 where $\text{PHI} = K1 + K2 * \text{DUMMY}$

Log of the Blackmarket Premium = f(4 lags of itself)

Growth Rate of Base Money = f(4 lags of itself, 4 lags of inflation rate, 4 lags of the growth rate of international reserves).

R	= 22.58**	(4.12)
THETA	= 0.38**	(2.59)
ρ	= 0.92**	(12.09)
K1	= 1.22**	(7.67)
K2	= -0.37*	(-1.74)

Calculated Coefficients

Average PHI = 0.91

Coefficient on anticipated monetary growth less the growth rate of output = 3.25

Coefficient on anticipated monetary growth = 3.86

	SSE	DFE	MSE	R
Log of the Blackmarket Premium	0.19	52	0.003	0.72
Growth Rate of Base Money	0.18	48	0.003	0.30
91-day Treasury Bill Rate	227.18	39	5.84	0.95

NON-LINEAR ESTIMATES OF THE INTEREST RATE EQUATION

$$\text{MODEL: } TB91_t = (1 - \text{PHI}) * R_t + \text{PHI} * \text{THETA} * (i_t + \hat{e}_t) \\ + (1 - \text{PHI}) * E0_t * (\text{AMG}_t - Y_t) + (1 - \text{PHI}) \\ * L0_t * \text{UMG}_t + \rho_{t-1} + \eta_t$$

Equation 3.2 where $\text{PHI} = K1 + K2 * \text{DUMMY}$

Log of the Blackmarket Premium = f(4 lags of itself)

Growth Rate of Base Money = f(2 lags of the inflation rate, log of the blackmarket premium lagged once, lagged rate of growth of WPI, lagged growth rate of base money/growth rate of output, lag of the log of employment, lagged interest rate).

R	= 22.30**	(2.64)
THETA	= 0.35**	(2.20)
ρ	= 0.91**	(10.66)
K1	= 1.02**	(11.67)
K2	= -0.20*	(-1.16)

Calculated Coefficients

Average PHI = 0.85

Coefficient on anticipated monetary growth less the growth rate of output = 1.65

Coefficient on unanticipated monetary growth = 48.77

	SSE	DFE	MSE	R ²
Log of the Blackmarket Premium	0.19	53	0.003	0.72
Inflation Rate	0.006	52	0.001	0.68
91-day Treasury Bill Rate	242.9	42	5.78	0.94

NON-LINEAR ESTIMATES OF THE INTEREST RATE EQUATION

$$\text{MODEL: } TB91_t = (1 - \text{PHI}) * R + \text{PHI} * \text{THETA} * (i_t * + \dot{e}_t) \\ + (1 - \text{PHI}) * \text{EO} * (\text{AMG}_t - Y_t) + (1 - \text{PHI}) \\ * \text{LO} * \text{UMG}_t + \rho e_{t-1} + \eta_t$$

Equation 3.3 where $\text{PHI} = K1 + K2 * \text{TREND}$

Log of the Blackmarket Premium = f(4 lags of itself)

Growth Rate of Base Money = f(4 lags of itself, 4 lags of the inflation rate, 4 lags of the growth of international reserves).

R = 22.77** (1.71)
 THETA = 0.02 (0.10)
 ρ = 0.46** (1.97)
 K1 = 1.11** (9.14)
 K2 = -0.005 (-0.93)

Calculated Coefficients

Average PHI = 0.91

Coefficient on anticipated monetary growth less the growth rate of output = 4.52

Coefficient on unanticipated monetary growth = 10.53

	SSE	DFE	MSE	R ²
Log of the Blackmarket Premium	0.19	52	0.003	0.72
Growth Rate of Base Money	0.19	48	0.004	0.26
91-day Treasury Bill Rate	196.0	39	5.04	0.95

NON-LINEAR ESTIMATES OF THE INTEREST RATE EQUATION

$$\text{MODEL: } TB91_t = (1 - \text{PHI}) * R + \text{PHI} * \text{THETA} * (i_t + \hat{e}_t) \\ + (1 - \text{PHI}) * E_o * (\text{AMG}_t - Y_t) + (1 - \text{PHI}) \\ + LO * \text{UMG}_t + \rho e_{t-1} + \eta_t$$

Equation 3.4 where $\text{PHI} = K1 + K2 * \text{TREND}$

Log of the Blackmarket Premium = f(4 lags of itself)

Inflation Rate = f(2 lags of itself, log of the blackmarket premium lagged once, lagged rate of growth of WPI, lagged growth rate of base money/growth rate of output, lag of the log of employment, lagged interest rate).

R	= 19.90**	(3.55)
THETA	= -0.07	(-0.38)
ρ	= 0.89**	(10.06)
K1	= 1.99**	(2.72)
K2	= -0.03*	(-1.86)

Calculated Coefficients

Average PHI = 0.96

Coefficient on anticipated monetary growth less the growth rate of output = 0.10

Coefficient on unanticipated monetary growth = 3.67

	SSE	DFE	MSE	R^2
Log of the Blackmarket Premium	0.19	53	0.003	0.72
Inflation Rate	0.006	52	0.0001	0.68
91-day Treasury Bill Rate	231.29	42	5.50	0.95

NON-LINEAR ESTIMATES OF THE INTEREST RATE EQUATION

$$\text{MODEL: } TB91_t = (1 - \text{PHI}) * R + \text{PHI} * \text{THETA} * (i_t * + \dot{e}_t) \\ + (1 - \text{PHI}) * \text{EO} * (\text{AMG}_t - Y_t) + (1 - \text{PHI}) \\ * L1 * \text{UMG}_{t-1} + \rho e_{t-1} + \eta_t$$

Equation 3.5 where $\text{PHI} = K1 + K2 * \text{DUMMY}$

Log of the Blackmarket Premium = f(4 lags of itself)

Growth Rate of Base Money = f(4 lags of itself, 4 lags of the inflation rate, 4 lags of the growth rate of international reserves).

R	= 23.35**	(5.16)
THETA	= 0.45**	(3.00)
ρ	= 0.95**	(15.14)
K1	= 1.41**	(4.65)
K2	= -0.60*	(-1.69)

Calculated Coefficients

Average PHI = 0.92

Coefficient on anticipated monetary growth less the growth rate of output = 1.66

Coefficient on unanticipated monetary growth = 3.8

Coefficient on lagged Unanticipated Monetary Growth = 2.54

	SSE	DFE	MSE	R^2
Log of the Blackmarket Premium	0.19	51	0.003	0.72
Inflation Rate	0.18	47	0.003	0.30
91-day Treasury Bill Rate	224.20	37	6.06	0.95

NON-LINEAR ESTIMATES OF THE INTEREST RATE EQUATION

$$\begin{aligned} \text{MODEL: } TB91_t &= (1 - \text{PHI}) * R + \text{PHI} * \text{THETA} * (i_t * + \dot{e}_t) \\ &+ (1 - \text{PHI}) * \text{EO} * (\text{AMG}_t - Y_t) + (1 - \text{PHI}) \\ &* \text{LO} * \text{UMG}_t + (1 - \text{PHI}) * \text{L1} * \text{UMG}_{t-1} + \\ &\rho e_{t-1} + \eta_t \end{aligned}$$

Equation 3.6 where $\text{PHI} = K1 + K2 * \text{DUMMY}$

Log of the Blackmarket Premium = f(4 lags of itself)

Inflation Rate = f(2 lags of itself, log of the blackmarket premium lagged once, lagged rate of growth of WPI, lagged growth rate of base money/growth rate of output, lag of the log of employment, lagged interest rate).

R = 22.06** (2.47)
 THETA = 0.36** (2.28)
 ρ = 0.91** (10.64)
 K1 = 1.03** (10.88)
 K2 = -0.19 (-1.05)

Calculated Coefficients

Average PHI = 0.87

Coefficient on anticipated monetary growth less the growth rate of output = 1.59

Coefficient on unanticipated monetary growth = 44.0

Coefficient on lagged Unanticipated Monetary Growth = 1.72

	SSE	DFE	MSE	² R
Log of the Blackmarket Premium	0.19	53	0.003	0.72
Inflation Rate	0.006	52	0.0001	0.68
91-day Treasury Bill Rate	240.51	41	5.86	0.94

ESTIMATES OF THE EX-POST REAL INTEREST RATES

Calculated as $\text{TB91}_{it} - (\ln \text{CPI}_{it} - \ln \text{CPI}_{it-1})$

where $t = \text{year}$ and $i = \text{month}$

	1981	1982	1983	1984	1985	1986
JANUARY	-1.80749	2.52582	7.43529	-12.52300	-7.33556	10.86339
FEBRUARY	-1.33352	2.88759	7.66829	-14.79016	-4.02676	23.29789
MARCH	0.46537	2.73065	7.91210	-16.61138	0.50298	17.04036
APRIL	0.45232	2.97377	8.02892	-16.28155	0.37140	14.92965
MAY	0.65473	3.72405	7.52183	-11.54764	1.86695	13.22043
JUNE	0.73917	4.13265	6.36810	-11.53794	1.94501	
JULY	0.65111	4.48962	5.77821	-13.24115	3.40306	
AUGUST	0.93994	3.81182	5.40971	-11.21899	1.41998	
SEPTEMBER	1.97325	4.58362	5.70679	-8.21353	3.42007	
OCTOBER	2.18885	5.37892	5.01872	-6.35983	4.39938	
NOVEMBER	2.46779	6.39186	-0.39335	-4.35536	7.84679	
DECEMBER	2.63320	7.31163	-7.77404	0.81881	8.87560	

Average = 1.474249

REFERENCES

- Asian Development Bank. "Improving Domestic Resource Mobilization Through Financial Development." Manila, September 1985.
- Agabin, Meliza H., Orlando T. Sacay, Chit Irene E. Tantoco. Small Farmer Credit Dilemma, Manila: Technical Board for Agricultural Credit, 1985.
- Barro, Robert J. "Unanticipated Money Growth and Unemployment in the United States." American Economic Review 67 (1977): 101-115.
- _____. "Unanticipated Money, Output, and the Price Level in the United States." Journal of Political Economy 86 (1978): 549-580.
- _____. "Unanticipated Money Growth and Unemployment in the United States: Reply." American Economic Review 69 (1979): 1004-1009.
- Buffie, Edward F. "Financial Repression, the New Structuralists, and Stabilization Policy in Semi-Industrialized Economies." Unpublished paper, Yale University, April 1982.
- Coats, Warren L. Jr. "Interest Rate Consequences of Targeting Money." International Monetary Fund Staff Papers 29:1 (March 1982), 31-47.
- Darby, Michael R. "The Financial and Tax Effects of Monetary Policy on Interest Rates." Economic Inquiry (Long Beach, California) 13 (June 1975): 266-276.
- Diaz-Alejandro, Carlos F. "Southern-Cone Stabilization Plans." In Economic Stabilization in Developing Countries, edited by William R. Cline and Sidney Weintraub, pp. 119-141. Washington: Brookings Institution, 1981.
- Edwards, Sebastian and Moshin S. Khan. "Interest Rate Determination in Developing Countries: A Conceptual Framework." International Monetary Fund Staff Papers 32:3 (1985).
- Giovannini, Alberto. "The Interest Rate Elasticity of Savings in Developing Countries: The Existing Evidence." World Development Vol. II, No. 7 (1983).
- International Monetary Fund/World Bank Joint Mission Report. "Aspects of the Financial Sector: The Philippines." 1979.
- Kapur, B. "Alternative Stabilization Policies for Less Developed Economies." Journal of Political Economy (1976).

- Lamberte, Mario B. "Can the Asset-Market View Explain Exchange Rate Movements: The Philippine Case." PIDS Staff Paper (Preliminary Draft), December 1984.
- _____. "Financial Liberalization and the Internal Structure of Capital Markets: The Philippine Case." PIDS Staff Paper Series No. 85-07 (April 1985).
- _____, Eli M. Remolona. "Financial Reforms and the Balance-of-Payments Crisis: The Case of the Philippines: 1980-1983." PIDS Staff Paper Series No. 86-02.
- _____, Rosario G. Manasan, Roberto S. Mariano, Erlinda M. Medalla, Manuel F. Montes, and Celia B. Reyes. "A Review and Appraisal of the Government Response to the 1983-84 Balance-of-Payments Crisis." PIDS Monograph Series No. 8 (October 1985).
- Lanyi, Anthony and Rusdu Saracoglu. "The Importance of Interest Rates in Developing Economies." Finance and Development. (June 1983).
- Lim, Joseph. "The New Structuralist Critique of the Monetarist Theory of Inflation: The Case of the Philippines." Unpublished Ph. D. dissertation, University of Pennsylvania, 1985.
- Makin, John H. "Effects of Inflation Control Programs on Expected Real Interest Rates." International Monetary Fund Staff Papers 29 (June 1982): 204-232.
- Mathieson, Donald J. "Estimating Models of Financial Market Behavior During Periods of Extensive Structural Reform: The Experience of Chile." International Monetary Fund Staff Papers. Vol. 30, No. 2 (1983).
- Mariano, Roberto S. "Forecasting Monthly Inflation in the Philippines." PIDS Monograph Series No. 10 (December 1985).
- McKinnon, Ronald I. "Issues and Perspectives: An Overview of Banking Regulation and Monetary Control." In Pacific Growth and Financial Interdependence, edited by A.H. Tan and B. Kapur, pp. 319-338. London: Allen and Unwin, 1986.
- _____. Money and Capital in Economic Development. Washington, D.C.: Brookings Institution, 1973.
- Mishkin, Frederic S. A Rational Expectations Approach to Macroeconometrics. Chicago: The University of Chicago Press for the National Bureau of Economic Research, 1983.

- Pagan, Adrian. "Econometric Issues in the Analysis of Regressions with Generated Regressions." International Economic Review 25 (1984): 221-227.
- Pante, Filologo Jr. "Exchange Rate Flexibility and Intervention Policy in the Philippines, 1973-1981," PIDS Staff Paper Series No. 83-01 (February 1983).
- Porzecanski, A. C. "Patterns of Monetary Policy in Latin America." Journal of Money, Credit, and Banking 11 (1979).
- Shaw, E. Financial Deepening in Economic Development. Oxford University Press, 1973.
- Sheehey, E. J. "Money and Output in Latin America." Journal of Development Economics 14 (1984).
- Tobin, J. "A General Equilibrium Approach to Monetary Theory." Journal of Monetary Economics (1975).
- Van Wijnbergen, S. "Interest Rate Management in LDCs," Journal of Monetary Economics Vol. 12 (1983).

APPENDIX A

REGRESSIONS EXPLAINING THE GROWTH RATE OF RESERVE MONEY

Equation No	Explanatory Variables	No of Lags	Sign
1	(1) growth rate of international reserves	4	-
	(2) growth rate of reserve money	4	-
	(3) inflation rate using CPI	4	+
	Note Only (3) was significant		
2	(1) growth rate of reserve money	4	-
	(2) inflation rate using CPI	4	+
	(3) log of the nominal exchange rate	4	-
	Note Only (2) was significant		
3	(1) growth rate of reserve money	4	-
	(2) growth rate of international reserves	4	-
	(3) log of the nominal exchange rate	4	mixed
	(4) log of CPI/WPI index	4	-
	(5) inflation rate using CPI	4	+
4	(1) growth rate of reserve money	4	-
	(2) growth rate of international reserves	4	-
	(3) log of the exchange rate	4	mixed
	(4) inflation rate using CPI	4	+
	Note (4) was significant (2) and (4) were jointly significant		
5	(1) growth rate of reserve money	4	-
	(2) growth rate of index of production	4	+
	(3) growth rate of international reserves	4	-
	(4) 91-day Treasury Bill rate	4	mixed
	(5) rate of growth of WPI index	2	mixed

6	(1) growth rate of reserve money	6	mixed
	(2) growth rate of international reserves	6	-
	(3) log of the nominal exchange rate	6	+
	(4) log of CPI/WPI index	6	-
	(5) inflation rate using CPI	6	-
	(6) growth rate of employment	6	mixed
7	(1) growth rate of reserve money	6	-
	(2) growth rate of international reserves	6	mixed
	(3) inflation rate using CPI	6	mixed
Note: Only (3) was significant			

APPENDIX B

FORECASTING EQUATIONS

DEPENDENT VARIABLE: LOG OF THE BLACKMARKET PREMIUM

Equation No.	Explanatory Variables	No. of Lags	Sign
1	(1) log of the blackmarket premium	4	mixed
	(2) current account balance	4	mixed
	(3) growth rate of international reserves	4	mixed
	(4) log of the CPI/WPI index	4	-
	(5) (TB91 - USTB90) differential	4	-
	Note: Only (1) was significant		
2	(1) log of the blackmarket premium	6	mixed
	(2) current account balance	6	mixed
	(3) growth rate of international reserves	6	-
	(4) log of the CPI/WPI	6	mixed
	(5) (TB91 - USTB90) differential	6	-
	Note: Only (1) and (2) were significant		
3	(1) log of the blackmarket premium	4	+
	(2) current account balance	4	-
	(3) growth rate of international reserves	4	mixed
	(4) log of the CPI/WPI index	4	mixed
4	(1) log of the blackmarket premium	8	mixed
	(2) current account balance	8	-
	(3) growth rate of international reserves	8	-
	(4) log of the CPI/WPI index	8	mixed

DEPENDENT VARIABLE: LOG OF THE OFFICIAL EXCHANGE RATE

Equation No.	Explanatory Variables	No. of Lags	Sign
1	(1) log of the nominal exchange rate	6	+
	(2) current account balance	6	mixed
	(3) log of the CPI/WPI index	6	+
	(4) log of international reserves	6	+
	Note: (1) and (4) were significant.		
2	(1) log of the nominal exchange rate	8	-
	(2) current account balance	8	mixed
	Note: Only (1) was significant.		
3	(1) log of the nominal exchange rate	8	+
	(2) current account balance	8	+
	(3) log of the CPI/WPI index	8	+
	(4) log of international reserves	8	mixed
	Note: Only (1) was significant		

LIST OF VARIABLES

Note: All data are for the end of the month.

Variable Name	Description	Units	Source
TB91	91-day Treasury Bill Rate	percent/ annum	Central Bank
TBUS90	90-day US Treasury Bill Rate	percent/ annum	Main Economic Indicators: OECD/OCDE
INTLR	International Reserves of the Central Bank	million U.S. dollars	Central Bank Statistical Bulletin
M1	-	million pesos	Central Bank
M3	Total Domestic Liquidity	million pesos	Central Bank
CACCT	Current Account Balance	million U.S. dollars	Central Bank
RMON	Reserve Money	million pesos	Central Bank
ER	Peso Per U.S. Dollar Rate	₱/\$	Central Bank
BMKT	Blackmarket Premium on the U.S. Dollar 100*Hongkong Banknote Rate/ER	-	Hongkong Bank-note Rate - Far Eastern Economic Review
PRODN	Value of Production Index	1985=100	Industry Trends: NEDA, Statistical Coordination Office
CPI	Consumer Price Index for the Philippines	1972=100	National Census and Statistics Office

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EMP	Employment Index	1985=100	Industry Trends: NEDA, Statis- tical Coordi- nation Office
WPI	Wholesale Price Index for Imports		National Income Accounts

[monthly values obtained by interpolation of quarterly data]

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