Preliminary Draft

(Not to be Quoted)

CAN THE ASSET-MARKET VIEW EXPLAIN EXCHANGE RATE MOVEMENTS: THE PHILIPPINE CASE

*Mario B. Lamberte**

December 1984

*Research Fellow, Philippine Institute for Development Studies (PIDS). The author is grateful to Prof. Paul Evans of Stanford University and Erwin W. Heri of Basel University for many helpful discussions, Vangie Yu for research assistance and Vicky Doctora for typing the draft.

CAN THE ASSET MARKET VIEW EXPLAIN EXCHANGE RATE MOVEMENTS: THE PHILIPPINE CASE

I. Introduction

Countries which have adopted the flexible exchange rate system since the early '70s have experienced disproportionately wide fluctuations in their respective exchange rates. This surprises a lot of economists who expected more modest and more orderly movements of the exchange rates. The Philippines' experience with flexible exchange rate system is not an exception. Figure 1 shows the quarterly changes in the official nominal exchange rate, i.e., peso vìs-a-vìs the US dollar, from 1970 to 1980. The marked fluctuations in the exchange rate cannot be attributed to seasonal factors since they occurred in different quarters. The black market rate even shows more pronounced fluctuations during the same period (see Table 1). Pante (1982) describes the exchange rate experience of the Philippines in the following manner: (1) March 1973/1974:3 - the official nominal exchange rates were slightly appreciating; (2) 1974:4/1975:3 - depreciation was the dominant trend; (3) 1975:4/1979:4 - rates were slightly appreciating and relatively stable; and (4) 1980:1/1981:4 - rates started to depreciate once again.

2

Figure 1

1 0 0
PLOT OF THE SERIES (1-B) (1-B) LE

MEAN = 0.85186818E-02
STANDARD ERROR = 0.19928719E-01

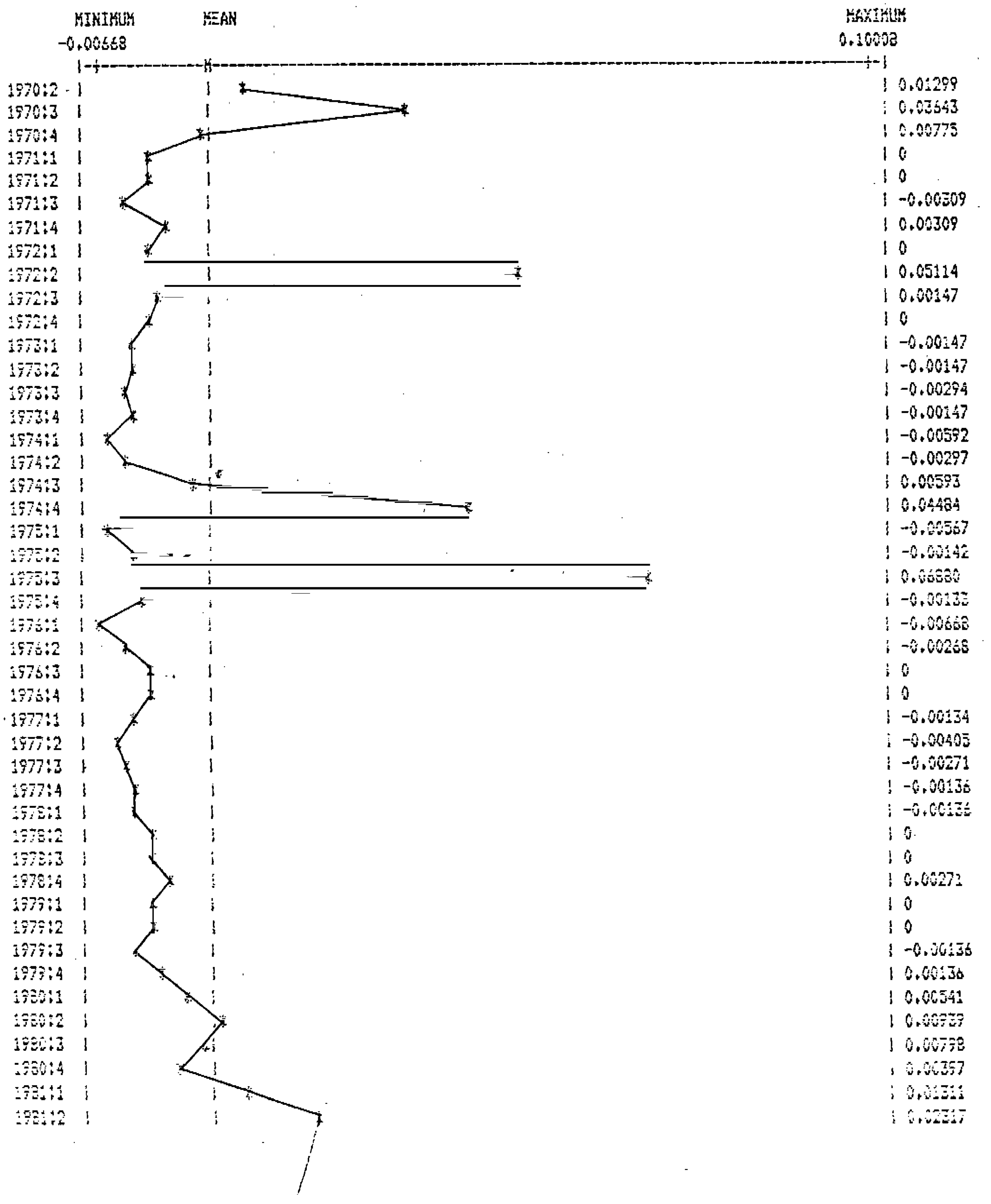

Table 1

VARIABILITY OF THE OFFICIAL AND BLACK MARKET RATES
(Monthly 1972 - 1983)

	Official	Black Market
$\bar{x}$	7.6759	8.1908
S.D.	1.2579	1.6941
C.V.	16.4%	20.7%

The recent experience with flexible exchange rates has motivated a lot of researchers to devise theoretical models to explain exchange rate movements. Among the proposed theoretical models, the asset-market view has been the dominant one.

The task of this paper is to examine whether the portfolio-balance model, which is one of the branches of the asset-market view, can explain exchange rate movements in the case of the Philippines.[1/] The model includes both monetary and real variables as possible explanatory variables of exchange rate movements. Specifically, it argues that innovations in money stock, current account balance and relative price contain some information about future movements in nominal exchange rate. The specification of the role of the current account balance is a special feature of this model.

Section II briefly reviews the portfolio-balance model. In Section III, the empirical model and data requirements are discussed. Empirical results are discussed in Section IV. Section V concludes the study.

1/ See Frankel (1983) which presents a taxonomy of asset-market models of floating exchange rates.

II. A Review of the Portfolio-Balance Model

Although a lot of studies have discussed the portfolio-balance models, our review will mainly be drawn on Branson (1983).[2/] Since our main interest is to find out the applicability of the portfolio-balance model to the Philippine case, we merely discuss the main ideas that guide our empirical analysis instead of going into the details.

The basic assumptions of the model are:[3/] a small open economy is being analyzed. Domestic residents are the only ones who wish to hold domestically denominated assets. The domestic country is assumed to be too small for its assets to be of interest to foreign residents. Foreign and domestic assets are imperfect substitutes. Liquidity, tax treatment, default risk, political risk, and exchange risk may be the reasons why two assets can be imperfect substitutes.

The asset-market equilibrium conditions are:

$$M = m(r, \bar{r} + \hat{e}) \cdot W \qquad (1)$$

$$B = b(r, \bar{r} + \hat{e}) \cdot W \qquad (2)$$

$$eF = f(r, \bar{r} + \hat{e}) \cdot W \qquad (3)$$

$$W = M + B + eF \qquad (4)$$

[2/] Among others, see Frankel (1983), Dornbusch (1980, 1983, 1984), Kouri (1984), Dornbush and Fischer (1980) and Bigman (1984).

[3/] Frankel (1983) outlines the basic assumptions of various asset models.

where: M = domestic money stock held by the private sector;

B = domestic assets (i.e., bonds) held by private sector;

F = foreign assets held by domestic private sector;

W = total domestic wealth;

e = exchange rate which is assumed to be flexible;

r = interest rate on B;

$\bar{r}$ = rate of return on F which is assumed to be fixed; and

$\hat{e}$ = expected rate of change in the exchange rate.

The right-hand side of (1), (2) and (3) are the demand for money, bonds and foreign assets, respectively. The demand for each asset depends positively on W. While the demand for money depends negatively on both r and $r + \hat{e}$, the demands for bonds and foreign assets depend positively on their own rates of return and negatively on those of other assets.

For the moment, we assume static expectations, i.e., $\hat{e} = 0$. Note that (4) is a balance sheet constraint. Therefore, given the balance sheet constraint, any pair of (1) - (3) can determine the short-run equilibrium values of e and r. Figure 2 shows the pairs of e and r that satisfy equations (1) - (3). We can analyze the effects of accumulation in any one of the asset stocks, holding the others constant, on short-run equilibrium e and r. M can be increased through a money-financed budget deficit; likewise, B can be increased through a bond-financed

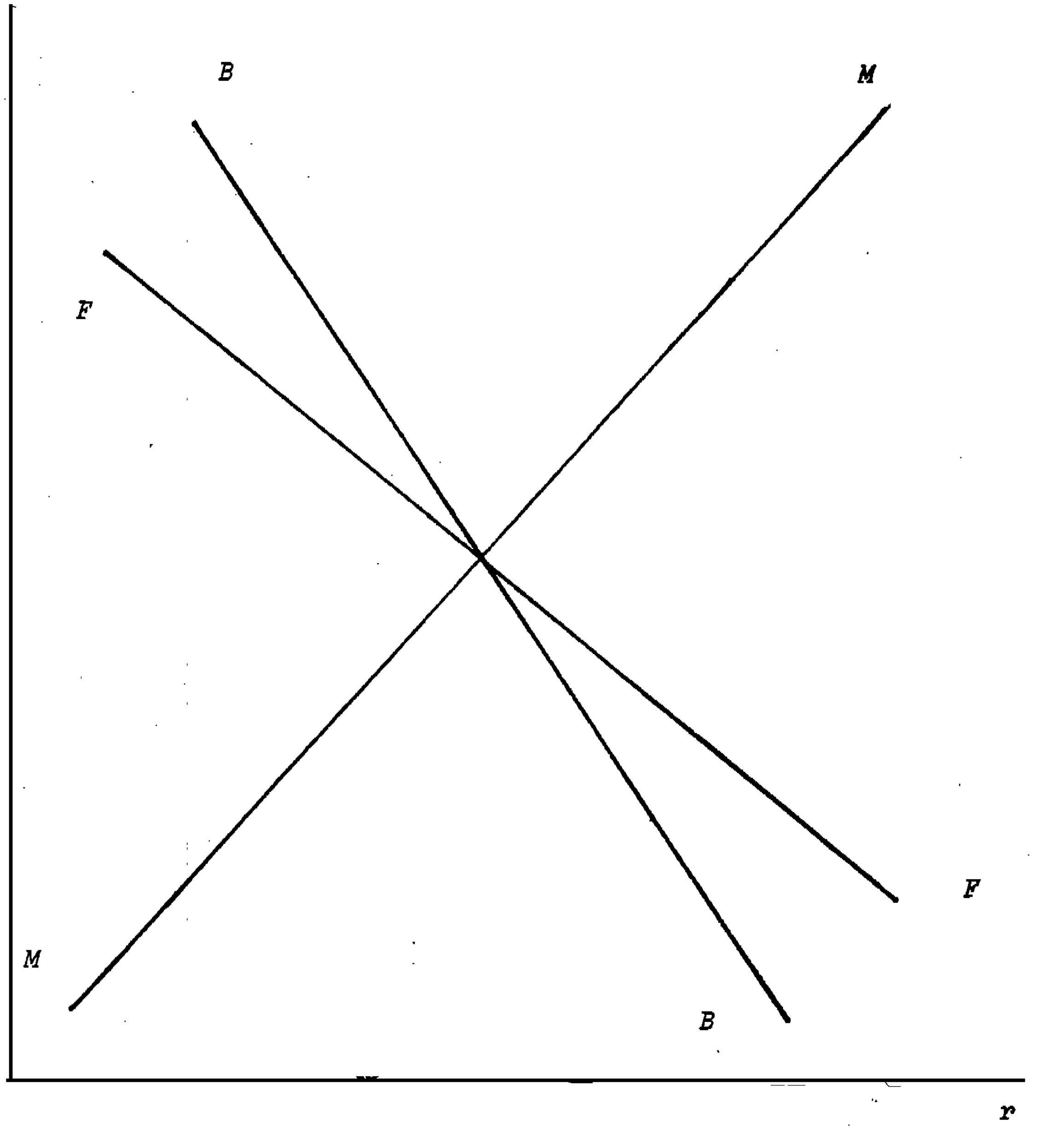

Figure 2

government deficit. F can be increased only if the country is running a current account surplus. The effects of open market operations on the short-run equilibrium e and r can also be examined. The Central Bank can do open market operations in domestic assets by swapping money for domestic assets or in foreign assets by buying foreign-denominated assets from domestic asset holders. Table 2 summarizes the effects of asset accumulations and open market operations on equilibrium e and r.

The results described in Table 2 imply the following reduced form equation for the exchange rate.

$$e = \tilde{e}(F, M; B) \quad ; \quad e_F < 0 \; ; \; e_M > 0 \tag{5}$$

where e_F and e_M are partial derivatives. That B is placed after a semi-colon indicates that the B - equation can be omitted in the analysis without loss of information since the balance sheet constraint is assumed to hold. Equation (5) states that the instantaneous value for e is a function of the relevant asset supplies.

The analysis above pertains to short-run determination of exchange rate. Next, we describe the adjustment mechanism and long-run equilibrium of the system. We consider first the price dynamic equation:

$$\frac{dP}{dt} = \dot{P} = \lambda (m - m^*) \tag{6}$$

Table 2

EFFECTS OF INCREASES IN ASSET STOCKS ON SHORT-RUN EQUILIBRIUM INTEREST RATE (r) AND EXCHANGE RATE (e)

Effects on	Effects of Accumulation of Stocks			Effects of Open Market Operation	
	ΔM	ΔB	ΔF	$\Delta B = -\Delta M$	$e\Delta F = -\Delta M$
r	−	+	Ø	−	−
e	+	±, Ø	−	+	+

where: M = domestic money stock,

P = price level,

m = M/P, and

m^* = the equilibrium value of real balances corresponding to long-run equilibrium output.

Although it is recognized here that the price level responds to changes in domestic money stock with a lag, nevertheless, in the long-run, the price level changes proportionately to the money stock. So, the long-run equilibrium condition is $dP/P = dM/M$.

The dynamic equation for the balance-of-payments identity is:

$$0 = X + \bar{r}F - \dot{F}$$

where: X = net exports of goods,

$\bar{r}F$ = net income of foreign assets, and

$\dot{F}$ = dF/dt = rate of accumulation of net foreign assets.

It may be rewritten as:

$$\dot{F} = X + \bar{r}F \qquad (7)$$

We assume that X reacts positively to changes in the real exchange rate, e/P, as well as to exogenous real variable, z, i.e.,

$$X = X(e/P, z) \qquad X_e > 0 \text{ and } X_z > 0 \qquad (8)$$

Using equations (5) and (8), the dynamic equation for $\dot{F}$ may now be written as:

$$\dot{F} = X\left[e(F, M; B)/P, z\right] + \bar{r}F \qquad (9)$$

The long-run equilibrium conditions are outlined in equations (6) and (9). In particular, $\dot{P} = \dot{F} = 0$.

Now, consider a permanent increase in the supply of money. According to our model, the price level rises gradually up to a new equilibrium where $dP/P = dM/M$. The price adjustment path is depicted in Figure 3. Here, $P^*(0)$ is the initial equilibrium price level, P^{**} is the new equilibrium price level and $t(0)$ is the time when a permanent increase in money supply occurs.

The response of the nominal exchange rate is quite elaborate. The exchange rate adjustment path is also drawn in Figure 3. In response to an increase in M at $t(0)$, the nominal exchange rate jumps instantaneously from e^* to e_1, realizing a real depreciation as well. Assuming that the Marshall-Lerner condition holds, net current account balance becomes positive at $t(0)$. As F accumulates, e gradually falls thereby reducing X and $\dot{F}$. Note that the real exchange rate at $t(i)$ where the P and e paths intersect is just equal to the initial real exchange rate. At this point, X shrinks back to its initial value. But since F has increased yielding an income of $\bar{r}F$, $\dot{F}$ is still positive at this point.

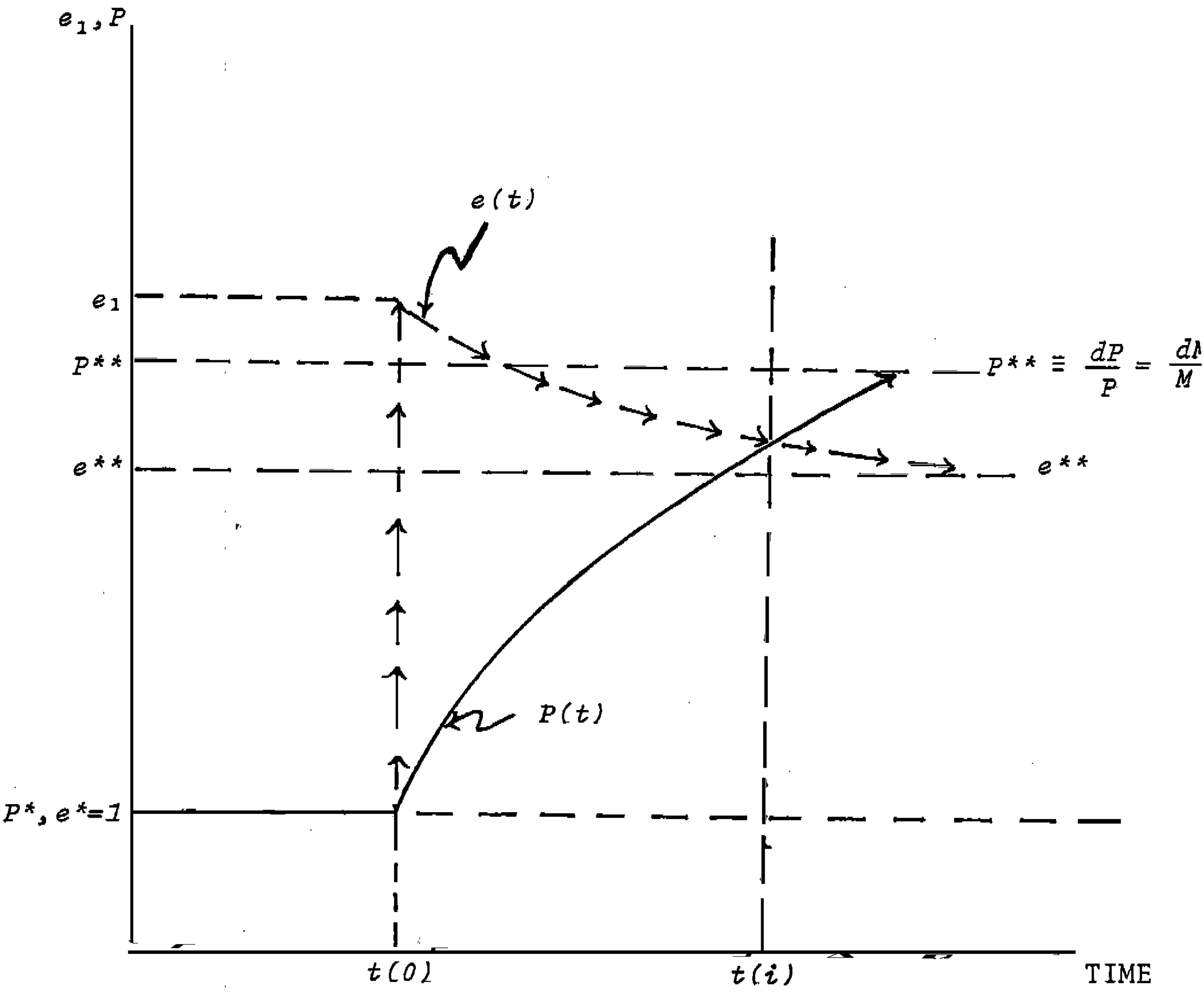

Figure 3. Adjustment of price level and exchange rate to an increase in M.

Therefore, e must still fall further up to the point where the decrease in X just outweighs the increase in $\bar{r}F$. This is indicated in Figure 3 where the e path approaches e^{**}. At this new long-run equilibrium level, $e^{**}/P^{**} < e^{*}/P^{*}$, i.e., a real exchange rate appreciation is realized.

The effect of a real disturbance, z, on e under static expectations is straightforward. An increase in z at $t(0)$ leads to a current account surplus, thus $\dot{F}$ becomes positive. An incipient decline in e occurs until the equilibrium condition is satisfied. The gradual decline in e is shown in Figure 4. Here, we have an appreciation in both the nominal and real exchange rate.

The analysis above has considered the effect of current account disturbance on exchange rate under static expectations. The result of the model under rational expectations is quite interesting, and it may be worthwhile to discuss it here. Again, we use equations (1) - (4) and (9), but we change our assumption regarding $\hat{e}$. Perfect foresight is assumed here, i.e., $\hat{e}$ is the rate of change of e. Since the balance sheet constraint holds, one of the asset equations may be omitted. Here, we choose to omit the B equation again.

Dividing equations (1) and (3) by W, and differentiating totally, the following equations are obtained:

$$\begin{aligned} d(M/W) &= m_r\,dr + m_{\hat{e}}\,d\hat{e} \\ d(eF/W) &= f_r\,dr + f_{\hat{e}}\,d\hat{e} \end{aligned} \qquad (10)$$

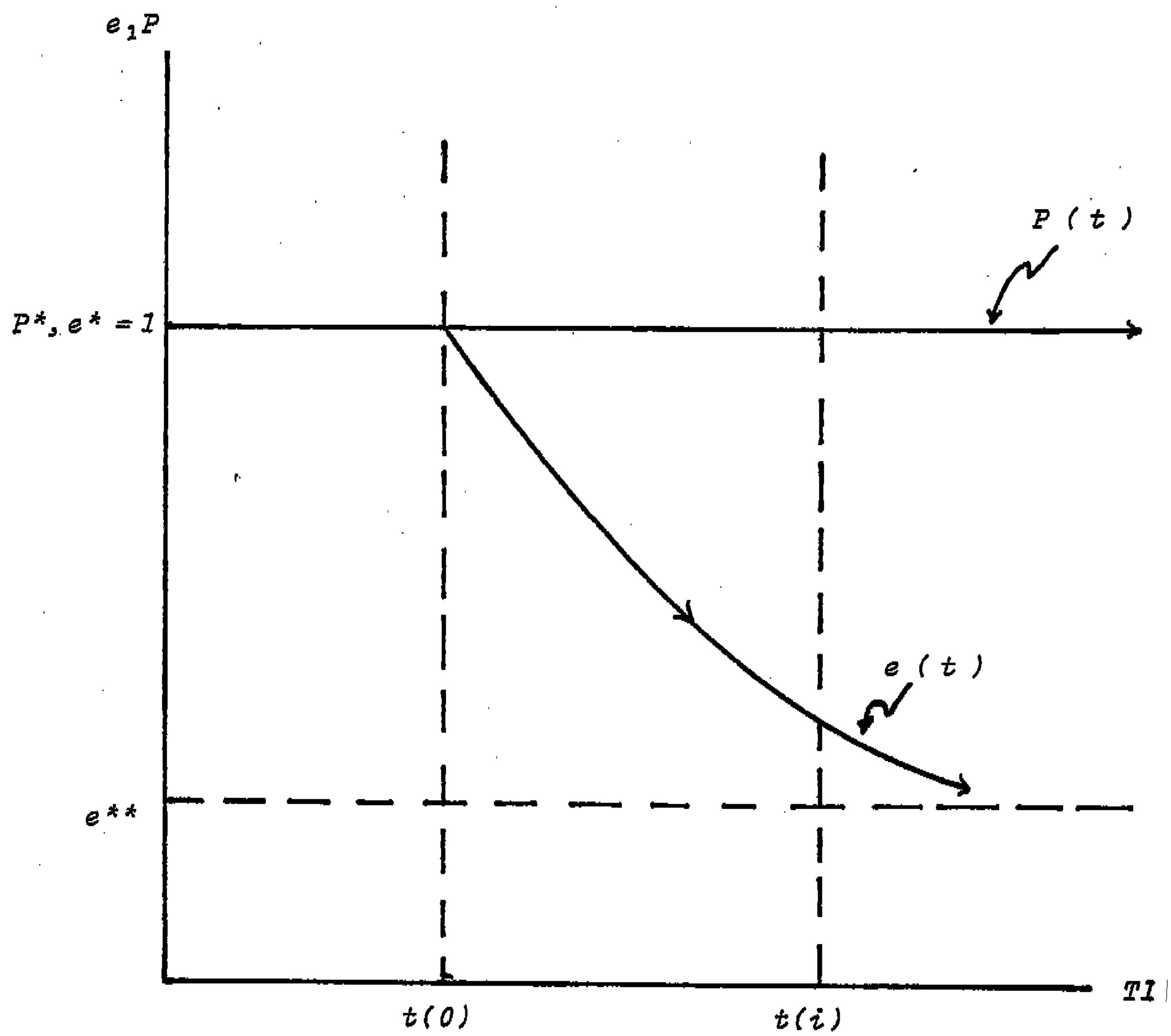

Figure 4. Adjustment of exchange rate to an increase in z .

From equation (10), the reduced form equation for e can be derived. This is expressed as:

$$\hat{e} = \phi(eF/W, M/W) \tag{11}$$

The $\hat{e} = 0$ locus is drawn in Figure 5 as a rectangular hyperbola in the $e - F$ space since eF enters multiplicatively in (11).

Taking the total derivative of equation (9), equating it to zero and solving for de/dF, we have

$$\frac{de}{dF}\bigg|_{\dot{F} = 0} = -\frac{\bar{r}}{X_e} \tag{12}$$

Since $\bar{r}$ and X_e are positive, equation (12) must be negative. The $\dot{F} = 0$ locus is also drawn in Figure 5. The broken line in Figure 5 indicates the saddle point path, a typical characteristic of a rational expectations model.

Now, consider a permanent increase in z, making the current account balance positive. The $\dot{F} = 0$ locus shifts down as shown in Figure 6. Note that the exchange rate jumps instantaneously from E_0 to E_1 at F_0. Then, the $e - F$ dynamics move the system along the saddle point path to the new equilibrium point E_2 at F_1. Note that under static expectations, e moves gradually to the new equilibrium point with a disturbance in the current account balance, whereas under the rational expectations assumption, e makes an instantaneous jump

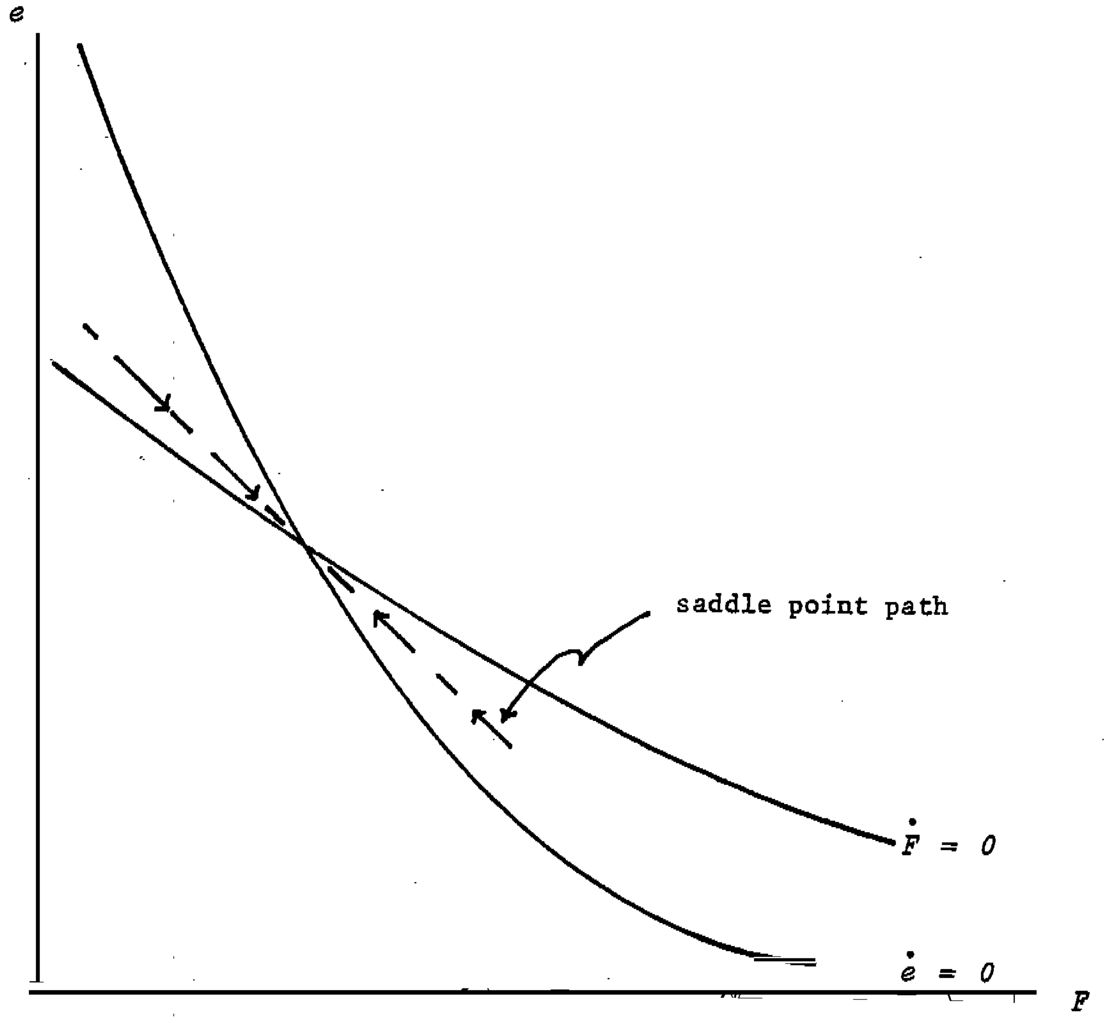

Figure 5. Equilibrium path for e and F.

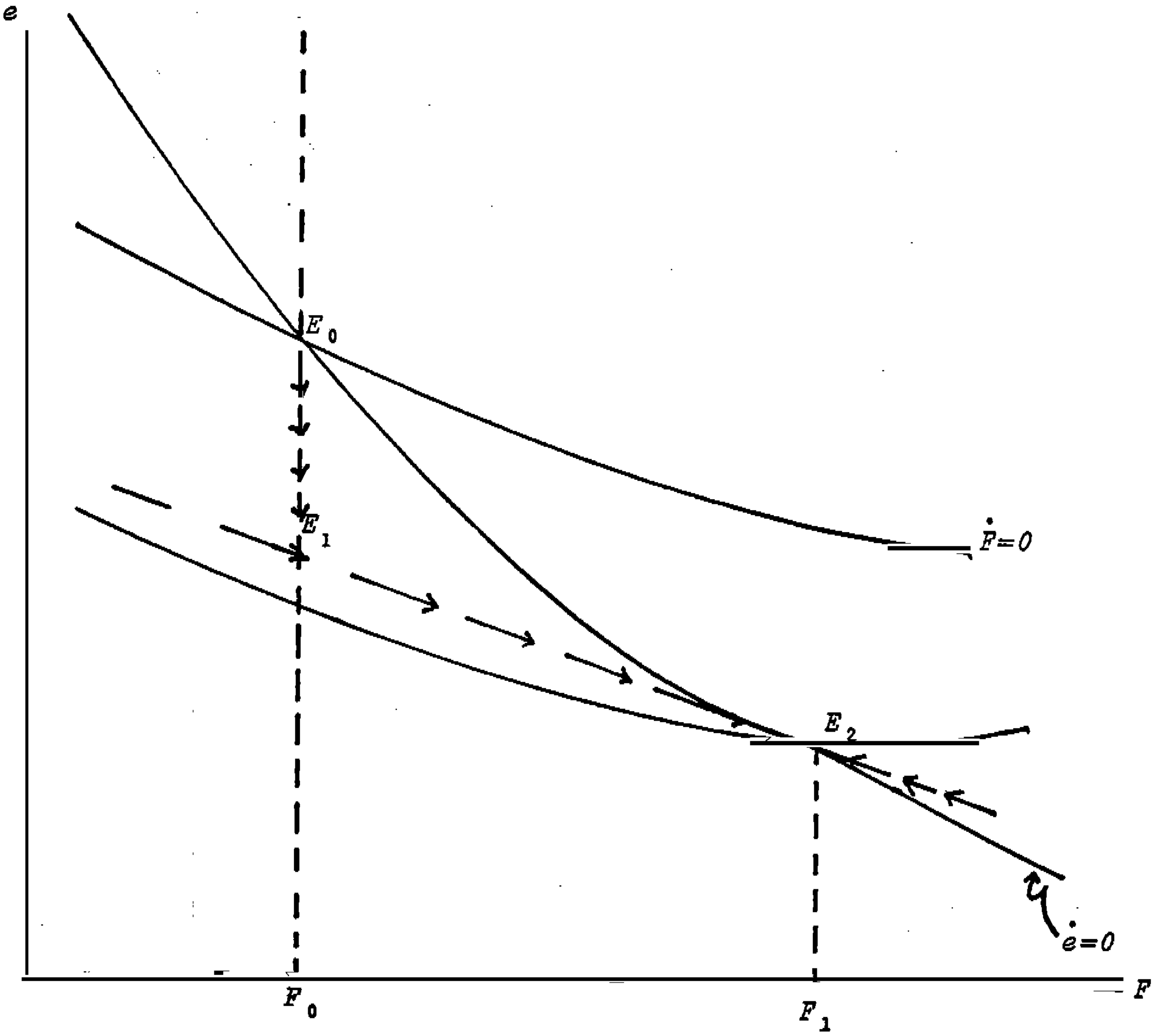

Figure 6. Effect of current account disturbance.

with a current account balance disturbance, and afterwards makes a gradual movement to the new long-run equilibrium.

The analysis presented above suggests that innovations in money stock, current account balance and relative price contain some information about future movements in nominal exchange rate. Specifically, money stock and relative price innovations are positively correlated with nominal exchange rate innovation, while current account balance innovation is negatively correlated with nominal exchange rate innovation.

III. Empirical Model and Data Requirements

(a) Empirical Model

As discussed in Section II, the variables required in testing the hypothesis of the model are: nominal exchange rate, current account balance, money stock, and relative prices, i.e., the ratio of domestic to foreign price level. The empirical model used in this study is vector auto-regression *(VAR)* which consists of a system of regressions with one equation for each variable in the system. In each equation, the current value of each variable is regressed on lagged values of all the variables in the system. Since the explanatory variables in a vector autoregression include observations only prior to the current period, the disturbance is the only contributing factor to a given dependent variable's value that is "new" to the current period. Accordingly, the current disturbance in the equation for a given variable is known as the innovation for that variable in the current period. To test our hypothesis, the innovation of each equation will be correlated with the innovations of other equations in the system.

One problem that we face in using *VAR* is determining the appropriate lag length for each variable in the system. We want to have a manageable number of parameters to be estimated without sacrificing reliability of the model results. Some choose the lag length of the variable arbitrarily. Others resort to the use of some statistical criteria suggested by Akaike (1970) and elaborated by Hsiao (1981) in determining the optimal lag length. Still others use prior information about the time series properties of the relevant variables in order to put a constraint on the lag length of the said variables. For example, if the exchange rate follows a random walk process, then only one lag will be imposed on the exchange rate. This study follows the last approach. We first examine the time series properties of each variable. The autoregression process that the variables would follow would give us indication regarding the number of lags to be included for each variable in a regression equation.

The autoregression structure of the time series data is

$$Y_t = \alpha_0 + \sum_{i=1}^{n} b_i Y_{t-i} + dt + U_t \qquad (13)$$

where: Y_t = current value of a variable included in the model,

Y_{t-i} = value of the corresponding variable lagged i quarter,

t = time variable,

α_0 = constant term,

U_t = error term, and

b_i, d = parameters to be estimated.

Note that the constant term and a time trend are included to induce stationarity in the error terms. The number of lags for each variable is determined by the following procedure. We begin by estimating equation (13) using four lags for each variable. Whenever we find the coefficient of the fourth lag not significant, we estimate again equation (13) using three lags. This process is continued until we find a significant coefficient of the lagged variable at the far end of the lag.

(b) Data Requirements

The four variables in our *VAR* model are: current account balance, money stock, exchange rate and relative prices. Two monetary aggregates, namely *M1* and *M3* are used in this study. For the exchange rate, we use the official exchange rate (i.e., pesos vis-a-vis the U.S. dollar) and the official effective exchange rate. The latter is derived using the bilateral tade weights proposed in Pante (1982). Since the Philippines followed a dirty float, a parallel market for foreign exchange has emerged in the system. The presence of the parallel foreign exchange market also requires the inclusion of the nominal and effective black market rates.

Relative prices pertain to the ratio of Philippine price level to the U.S. price level. Two measures of relative prices are utilized: one is *CPI*- based and the other, *WPI*-based. Whenever official and black market effective exchange rates are considered in the analysis, the denominator of the relative prices refers to the weighted foreign price level. The weights are the same as those used to calculate the effective exchange rate. The definition of the variables and data sources are presented in Table 3. Quarterly data for the period 1970:I to 1980:IV are utilized. All variables, except *CAB* , are expressed in logarithm.

Table 3

DEFINITION OF VARIABLES AND DATA SOURCES

Variables	Definition	Sources
1. *NER*	Official nominal exchange rate	IFS (IMF)
2. *NEER*	Official effective exchange rate	Raw data from IFS, Trade weights from Pante (1982)
3. *BNER*	Black market nominal exchange rate	Pick's Currency Yearbook
4. *BNEER*	Black market effective exchange rate	IFS, Pick's Currency Yearbook, Trade weights from Pante (1982)
5. *CAB*	Current account balance	Philippine Financial Statistics
6. *M1*	Narrow Money	CB Statistical Bulletin
7. *M3*	Total Liquidity	CB Statistical Bulletin
8. *CPI*	CPI Philippines ÷ CPI U.S. (relative price)	IFS
9. *WPI*	WPI Philippines ÷ WPI U.S. (relative price)	IFS
10. *CPIEF*	CPI Philippines ÷ Trade Weighted foreign CPI (relative price)	IFS, Trade weights from Pante (1982)
11. *WPIEF*	WPI Philippines ÷ Trade Weighted foreign WPI	IFS, Trade weights from Pante (1982)

IV. Empirical Results

(a) Results of Univariate Autoregressions

Table 4 presents results of univariate autoregression by ordinary least squares for all the variables included in the model. Two results are shown for each variable: column (1) for univariate autoregression with four lags, and column (2) for univariate autoregression with shorter lags which we think best describes the time series structure of the variable. In variables where no figures appear under column (2), *AR4* process is thought as the best autoregressive process that describes the time series structure of the said variables.

CAB tends to follow an *AR4* process, suggesting a longer adjustment period for this variable. Past values of *CAB* and the time trend explain only 69 percent of the total variation of the current value. Thus, *CAB* could have also been influenced by other factors. *NER* tends to follow a stable *AR1* process. This result contradicts the commonly-held view that the exchange rate follows a random walk process. The immediate past value of *NER* and the time trend account well movements of the current value of *NER* . *NEER* shows a completely different time series structure. It tends to follow an *AR4* process, suggesting an adjustment to disturbances slower than *NER*. *BNER* tends to follow an *AR3* process. This result is altogether

Table 4

RESULTS OF UNIVARIATE AUTOREGRESSION

	C A B		N E R		N E E R		B N E R		B N E E R	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
t-1	-0.3480 (-2.12)		0.8672 (5.21)	0.7817 (8.70)	0.7398 (4.57)		0.7634 (4.47)	0.7485 (4.68)	0.7896 (4.69)	0.7 (4.5
t-2	0.1535 (0.94)		-0.1592 (-0.74)		-0.1396 (-0.75)		-0.4926 (-2.33)	-0.4808 (-2.60)	-0.5249 (-2.59)	-0.4 (-2.3
t-3	0.3888 (2.41)		0.2893 (1.39)		0.4724 (2.49)		0.3155 (1.52)	0.2785 (1.74)	0.4625 (2.31)	0.2 (1.9
t-4	0.2945 (1.77)		-0.2225 (-1.40)		-0.3302 (-2.05)		-0.0604 (-0.35)		-0.2103 (-1.30)	
$\bar{R}^2$	0.69		0.92	0.94	0.92		0.75	0.72	0.81	0.8
D.W.	1.93		2.00	1.92	2.03		1.99	1.96	1.96	1.8
S.E.	131.26		0.0150	0.0148	0.0149		0.0336	0.0328	0.0235	0.0

NOTE: The autoregression equations include a constant and a time trend.

Table 4. (Continued)

	M 1		M 3		C P I		C P I E F	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
t-1	0.5993 (3.60)	0.6716 (4.20)	1.4365 (8.60)		1.0914 (6.44)	1.1134 (7.24)	1.0399 (6.08)	1.0718 (6.83)
t-2	-0.3781 (-1.94)	-0.4876 (-2.66)	-0.7767 (-2.70)		0.0242 (0.10)	-0.2537 (-1.67)	-0.0834 (-0.34)	-0.2346 (-1.54)
t-3	0.1140 (0.56)	0.3069 (1.91)	0.5331 (1.82)		-0.3706 (-1.51)		-0.1608 (-0.65)	
t-4	0.2003 (1.19)		-0.3244 (-1.87)		0.1096 (0.66)		-0.0076 (0.05)	
$\bar{R}^2$	0.99	0.99	0.99		0.97	0.97	0.94	0.95
D.W.	1.74	2.09	2.21		1.99	2.12	2.00	2.05
S.E.	0.0438	0.0440	0.0339		0.0239	0.0237	0.0272	0.0261

Table 4. (Continued)

	W P I		W P I E F	
	(1)	(2)	(1)	(2)
t-1	1.3325 (7.94)	1.1305 (8.79)	1.0094 (6.04)	0.8680 (13.40)
t-2	-0.3298 (-1.21)	-0.3988 (-2.74)	-0.2079 (-0.89)	
t-3	-0.3022 (1.13)		0.2270 (0.96)	
t-4	0.2063 (1.28)		-0.1960 (-1.22)	
$\overline{R}^2$	0.97	0.98	0.98	0.98
D.W.	1.97	1.96	1.78	1.73
S.E.	0.0298	0.0298	0.0297	0.0288

unexpected since it shows a much slower adjustment for *BNER* than for *NER* to shocks. Asset prices in a free market are generally thought to respond more quickly to shocks than those in a controlled one. Yet, results for the official and black market nominal exchange rates show otherwise. *BNEER* also tends to follow an *AR3* process. Although, result indicates a quicker adjustment for *BNEER* than for *NEER*, it is still deemed slower considering the fact that the black market for foreign exchange is a free market. There seems to be some rigidities in the Philippine black-market that impinge on the adjustment process of asset prices. Moreover, the relatively low value for $\bar{R}^2$ indicates that other factors other than past values of *BNER*, and *BNEER* account a significant proportion of the total variations of the current values of those variables.

The two money stocks are found to be slow in adjusting to shocks. *M1* tends to follow an *AR3* process, while *M3*, an *AR4* process. Past values almost completely explain current values of these variables. Both *CPI* and *CPIEF* tend to follow an *AR2* process. However, they exhibit unstable cyclical responses to shocks, although past values explain well current values of these variables. *WPI* tends to follow an *AR2* process with stable cyclical responses to shocks. Past values of *WPI* almost completely account for the variation of the current values of the said variable. Finally, *WPIEF* tends to follow a stable *AR1* process.

Its immediate past value explains well the variation of its current value.

The results of the univariate autoregressions are mixed. On one hand, if we consider only *NER* , *CPI* and *WPI* , results tend to support the hypothesis implied by the asset-market view that asset price adjusts more rapidly to disturbances than commodity price. On the other hand, if *NEER* , *BNER* and *BNEER* are considered along with *CPI* , *CPIEF* , *WPI* and *WPIEF* , results tend to contradict the asset-market hypothesis. There is, therefore, a strong indication that if people really behave according to the asset-market view, they must be using the variables *NER* , *CPI* and *WPI* in their decisions, rather than *NEER* , *BNER*, *BNEER*, *CPIEF* and *WPIEF* .

(b) <u>Results of Vector Autoregressions</u>

The next stage in our analysis is estimating the *VAR*s. Due to the different definitions of money stocks, exchange rates and relative prices, 16 *VAR* systems, each having four equations are estimated. For easy reference, the *VAR* systems are numbered from 1 to 16. The results of the univariate autoregressions provided us a way of restricting the number of lags for each variable to be included in the *VAR* systems.

Results of fitting vector autoregressions to sample data are reported in Annex A. The $\bar{R}^2$s for the money stocks and relative prices equations are extremely high. In constrast, the $\bar{R}^2$s for the current account balance and the exchange rate equations are relatively low, suggesting that other factors that also influence the current values of those variables are excluded from the model.

The *F*-statistics for excluding all lagged values of each variable from each equation are shown in Annex B. Past values of each variable are important in determining current values of each variable. A look at the results for individual equations are quite instructive. We will consider first the regression results for *CAB*. The immediate past value of official nominal exchange rate is an important explanatory variable for the current account balance. In contrast, past values of official effective exchange rate do not have explanatory power for current account balance. Both the past values of black market nominal and effective exchange rates significantly influence movements of current account balance. The coefficient of the past value of official nominal exchange rate and the sum of the coefficients of the past values of black market nominal and effective exchange rates are positive, indicating that exchange rate depreciation improves future current account balance. This finding supports the policy of using exchange rate policy to improve current account balance.

The sum of the coefficients of past values of the money stocks is negative for all regression results. This is to be expected since an increase in money supply leads to an increase in total demand including demand for imports, thereby adversely affecting the current account balance. However, only *M3* in *VAR* system No. 10 yields a statistically significant F-statistic.

The sum of the coefficients of past values of relative prices is negative for all regression results. This supports the view that a higher domestic inflation rate relative to foreign inflation rate without corresponding adjustment in the nominal exchange rate would adversely affect the current account balance. Again, we have to point out that only *CPIEF* in *VAR* systems Nos. 5 and 13 has a statistically significant effect on *CAB*.

Next, we will consider the regression results for the exchange rate. Although the sum of the coefficients of past values of *CAB* has the expected negative sign for all regression results, however, none of the computed *F*-statistics for excluding *CAB* from the exchange rate regression equations is statistically significant. Considering the earlier result, there seems to be a one way causality running from exchange rate to current account balance.[4/]

4/ This is not really a rigorous test for causality.

None of the computed *F*-statistics for excluding the money stocks from the exchange rate regressions is statistically significant. With respect to relative prices, past values of *CPI* have a significant effect on nominal exchange rate both in *VAR* systems Nos. 1 and 2, while past values of *WPI* have a significant effect on nominal exchange rate but only in *VAR* system No. 3. The positive sign of the sum of the coefficients of past values of relative prices for all the exchange rate regression equations means that upward movements of relative prices would lead to exchange rate depreciation in the future.

Results for the money stocks regressions are quite interesting. While past values of current account balance and relative prices do not have a significant effect on current values of money stocks for all regression equations, the immediate past values of official nominal exchange rate (*NER*) significantly influence current values of *M1* and *M3* (*VAR* systems Nos. 1, 2 and 4). The coefficient of the past value of *NER* is positive for the three regression results in *VAR* systems Nos. 1, 2 and 4, indicating that an exchange rate depreciation would lead to an increase in the money stock in the future. Considering the earlier result, there appears to be a one-way causality running from official nominal exchange rate to money stocks. In other words, money stocks are endogenous with respect to official nominal exchange rate.

Finally, regression results for relative prices will be considered. The variables, namely exchange rate and money stocks, which are expected to influence future movements of relative prices do not perform well. Only past values of *CAB* in *VAR* system Nos. 1, 3, 11, and 16, exhibit statistically significant effect on relative prices. Note that the absence of a significant effect of past values of exchange rate on relative prices suggests a causality running from relative prices to exchange rate. This supports the PPP view.

To test the hypothesis of the asset-market view, residuals of each regression were correlated with residuals of other regressions within the *VAR* system. The results are reported in Table 5. Note that in the asset-market view, the current account balance innovation is expected to be negatively correlated with the exchange rate innovation, while the money stock and relative prices innovation is expected to be positively correlated with the exchange rate innovation.

Using the official nominal exchange rate, the black market nominal exchange rate and the black market effective exchange rate, the *CAB* correlation coefficients yield the expected signs. However, the correlation coefficients are disappointingly low and are not statistically significant. When the official effective exchange rate is used, the *CAB*

Table 5.1

CORRELATION OF EXCHANGE RATE RESIDUALS
AND OTHER RESIDUALS FOR VAR SYSTEMS
(Official Nominal Exchange Rate)

	M1	M3		M1	M3
CAB	-0.093	-0.016	CAB	-0.117	-0.070
M	-0.164	0.013	M	-0.238	-0.029
CPI	-0.254	-0.274*	WPI	-0.008	0.052

*Significant at 10% level.

Table 5.2

CORRELATION OF EXCHANGE RATE RESIDUALS
AND OTHER RESIDUALS FOR VAR SYSTEMS
(Official Effective Exchange Rate)

	M1	M3		M1	M3
CAB	Ø.3Ø2*	Ø.3Ø8*	CAB	Ø.143	Ø.164
M	-Ø.Ø72	Ø.Ø41	M	-Ø.Ø92	Ø.Ø56
CPIEF	-Ø.Ø55	-Ø.Ø66	WPIEF	-Ø.Ø7Ø	Ø.Ø19

Table 5.3

CORRELATION OF EXCHANGE RATE RESIDUALS
AND OTHER RESIDUALS FOR VAR SYSTEMS
(Black Market Nominal Exchange Rate)

	M1	M3		M1	M3
CAB	-0.081	-0.086	CAB	-0.120	-0.149
M	0.074	-0.034	M	0.035	-0.502*
CPI	-0.302*	-0.264	WPI	-0.224	-0.166

Table 5.4

CORRELATION OF EXCHANGE RATE RESIDUALS
AND OTHER RESIDUALS FOR VAR SYSTEMS
(Black Market Effective Exchange Rate)

	M1	M3		M1	M3
CAB	-0.021	-0.045	CAB	-0.095	-0.126
M	-0.030	-0.112	M	-0.044	-0.105
CPIEF	-0.207	-0.210	WPIEF	-0.250	-0.005

correlations become positive, statistically significant for *CPI*-based *VAR* systems and not statistically significant for *WPI*-based *VAR* systems. It seems that exchange rates innovation contain some information about future movements of current account balance. This contradicts the expected result of the asset-market view.

The money stocks correlations seem to have mixed results. Using the official nominal exchange rate, the money stocks correlations show negative signs for both the *WPI*-based *VAR* systems. *M1* correlation has a negative sign, while *M2* correlation has the expected sign. When the official effective exchange rate is used, *M1* correlations yield negative signs for both the *CPI*-based and *WPI*-based *VAR* systems while *M3* correlations give positive signs for both the *CPI*-based and *WPI*-based *VAR* systems.

Using the black market effective exchange rate, the *M1* and *M3* correlations have negative signs for both the *CPI*-based and *WPI*-based *VAR* systems. When the black market nominal exchange rate is used, *M3* correlations exhibit negative signs, while *M1* correlations show positive signs in both the *CPI*-based and *WPI*-based *VAR* systems. Note that among the money stocks correlations, only *M3* in the *WPI*-based *VAR* system that uses the black market nominal exchange rate has a statistically negative correlation coefficient. The statistically insignificant correlations and statistically significant negative correlation are indications that the Central Bank is following a "leaning-against-the-wind" policy behavior in which money growth slows when the currency depreciates, and vice-versa. Specifically, the conduct of monetary policy in the Philippines is such that money supply changes in reaction to movements in the exchange rate. This result is consistent with the earlier results of univariate autoregressions showing that money stocks are endogenous with respect to the exchange rate.

The results for the relative prices are indeed hard to interpret. All correlation coefficients have negative signs, contradicting the expectations of the asset-market view.

Since information about exchange rate is readily available on a daily basis while information about money stocks, current account balance and relative prices are obtained with some lag, we performed a correlation analysis using the current values of exchange rate residuals and one period lagged values of current account balance, money stocks and relative prices residuals. The results were basically the same as those discussed above.

V. Concluding Remarks

This study has attempted to analyze exchange rate movements using the asset-market view. The main hypothesis is that innovations in current account balance, money stocks and relative prices contain some information about future movements of the exchange rate. Generally, the results do not support the asset-market view. Instead, what has been found is that exchange rate innovations contain information about future movements of money stocks. This suggests that monetary policy in the Philippines is oriented towards external targets, thereby making money stocks endogenous with respect to the exchange rate. Moreover, *CAB* is found to be endogenous with respect to exchange rate. This implies that upward adjustment of the exchange rate (i.e., de facto devaluation) is an appropriate policy response to a current account imbalance.

The results presented here should be taken as tentative. As pointed out in Section III, the number of lags for the univariate autoregressions were arbitrarily set to four. Perhaps, longer lags can be tried in the future to allow us to study thoroughly the underlying time series structure of the relevant variables.

Annex B

VAR System No. 1

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION
(Official Nominal Exchange Rate)

	CAB	NER	M1	CPI
CAB	3.56**	0.94	0.43	3.05**
NER	6.57**	41.82*	4.72*	2.49
M1	0.66	0.59	5.67*	1.26
CPI	1.93	5.72*	1.79	50.93*

VAR System No. 2

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION (Official Nominal Exchange Rate)

	CAB	NER	M3	CPI
CAB	4.16*	Ø.47	1.65	Ø.27
NER	6.73**	42.Ø5*	6.Ø3*	Ø.77
M3	1.49	Ø.72	37.85*	1.58
CPI	Ø.29	4.24*	Ø.ØØ	41.Ø2*

VAR System No. 3

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION (Official Nominal Exchange Rate)

	CAB	NER	M1	WPI
CAB	3.02**	0.89	0.22	5.26*
NER	7.52**	56.78*	0.75	0.52
M1	0.62	0.33	3.91*	1.46
WPI	0.96	4.44*	0.00	43.25*

VAR System No. 4

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION
(Official Nominal Exchange Rate)

	CAB	NER	M3	WPI
CAB	4.23*	Ø.59	2.52	1.81
NER	7.21**	48.95*	6.74*	Ø.64
M3	1.52	Ø.45	34.94*	1.39
WPI	Ø.Ø9	2.86	Ø.ØØ	34.57*

VAR System No. 5

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION
(Official Effective Exchange Rate)

	CAB	NEEF	M1	CPIEF
CAB	3.32**	0.17	0.52	0.70
NEEF	0.88	4.05**	0.33	0.07
M1	1.18	0.49	4.43*	0.23
CPIEF	3.91**	2.17	0.28	27.85*

VAR System No. 6

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION (Official Effective Exchange Rate)

	CAB	NEER	M3	CPIEF
CAB	3.3Ø**	Ø.Ø7	1.38	Ø.46
NEER	1.75	3.85**	Ø.81	Ø.28
M3	Ø.99	Ø.57	35.Ø1*	2.59
CPIEF	1.4Ø	1.67	Ø.ØØ	23.64*

VAR System No. 7

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION
(Official Effective Exchange Rate)

	CAB	NEER	M1	WPIEF
CAB	2.71*	Ø.27	Ø.48	2.2Ø
NEER	2.Ø9	7.94*	Ø.25	1.Ø4
M1	Ø.45	Ø.47	4.96**	Ø.37
WPIEF	3.67	1.27	1.79	22.38*

VAR System No. 8

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION
(Official Effective Exchange Rate)

	CAB	NEER	M3	WPIEF
CAB	2.86**	0.11	2.17	0.53
NEER	1.48	6.30*	1.90	0.64
M3	0.74	0.66	5.31*	0.72
WPIEF	1.61	2.35	2.71	19.75*

VAR System No. 9

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION
(Black Market Nominal Exchange Rate)

	CAB	BNER	M1	CPI
CAB	3.05**	0.90	0.56	2.36
BNER	4.27*	3.13**	0.74	0.36
M1	0.80	0.18	5.02*	1.09
CPI	1.29	2.02	0.43	38.63*

VAR System No.1Ø

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION (Black Market Nominal Exchange Rate)

	CAB	BNER	M3	CPI
CAB	4.Ø3**	Ø.37	1.63	Ø.24
BNER	19.39*	7.74*	2.79	Ø.31
M3	2.9Ø**	Ø.4Ø	29.Ø6*	1.63
CPI	Ø.64	1.6Ø	Ø.46	35.34*

VAR System No. 11

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION
(Black Market Nominal Exchange Rate)

	CAB	BNER	M1	WPI
CAB	2.77**	1.24	0.69	4.85*
BNER	4.95*	4.25*	0.56	0.95
M1	0.71	0.42	4.73*	1.46
WPI	1.34	0.95	0.12	40.36*

VAR System No. 12

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION
(Black Market Nominal Exchange Rate)

	CAB	BNER	M3	CPI
CAB	3.93**	Ø.45	2.29	1.91
BNER	6.44*	3.55**	1.69	1.34
M3	2.52	Ø.55	28.99*	2.42
CPI	Ø.25	Ø.54	1.78	37.65*

VAR System No. 13

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION
(Black Market Effective Exchange Rate)

	CAB	BNEER	M1	CPIEF
CAB	3.39**	0.04	0.80	0.91
BNEER	4.91*	4.62*	0.18	0.22
M1	0.94	0.17	4.03*	0.46
CPIEF	3.53**	0.71	0.00	28.41*

VAR System No. 14

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION
(Black Market Effective Exchange Rate)

	CAB	BNEER	M3	CPI
CAB	4.83*	0.90	1.98	0.47
BNEER	6.05*	4.36*	0.77	0.09
M3	2.36	0.25	40.80*	2.51
CPI	3.10	1.06	0.23	37.61*

VAR System No. 15

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION
(Black Market Effective Exchange Rate)

	CAB	BNEER	M1	WPIEF
CAB	2.67**	1.40	0.60	2.84**
BNEER	3.95*	6.32*	0.27	0.38
M1	0.30	0.55	4.68*	0.00
WPIEF	2.62	0.25	0.00	26.65*

VAR System No. 16

F-STATISTICS FOR EXCLUDING EACH VARIABLE FROM EACH REGRESSION
(Black Market Effective Exchange Rate)

	CAB	BNEER	M3	WPIEF
CAB	3.71**	1.09	2.25	0.91
BNEER	4.75*	5.66*	0.79	0.57
M3	1.71	0.50	43.38*	0.98
WPIEF	1.54	0.85	0.00	26.98*