FINANCING THE BUDGET DEFICIT IN A SMALL OPEN ECONOMY THE CASE OF THE PHILIPPINES 1981 1986

by

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FINANCING THE BUDGET DEFICIT IN A SMALL OPEN ECONOMY: THE CASE OF THE PHILIPPINES, 1981-1986

by

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The large current and expected deficits (relative to GNP) in western countries have given rise to a renewed interest in macro-economic public finance. Topics such as the effects of large deficits and their means of finance pervade the journals. Open economy issues, such as export "crowding out" have become equally important in as much as budget deficits such as those in the United States have, until recently, been accompanied by massive capital inflows and real exchange rate appreciation.

For developing countries, the manageability of budget deficits is stressed in the literature as a prerequisite for the success of liberalization programs. The experiences of the southern cone countries of Latin America are often cited. McKinnon and Mathieson state,

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> "Thus the swing from deficit to surplus in the true government accounts, where the monetary system is appropriately consolidated with the treasury accounts, is all the more remarkable and was a necessary condition for fully liberalizing the Chilean economy."[1]

Conversely,

> "The lack of fiscal control should have discouraged the Argentinian authorities from proceeding with a full-scale financial liberalization similar to the one undertaken in Chile."[2]

As developing countries proceed with liberalization schemes in their financial and trade affairs, it is important to bear in mind that the outcome of such schemes will be impinged by the size and persistence of budget deficits and the manner in which they are financed.

There has also been a revival of the invariance proposition with respect to the manner of financing government expenditure in the macro rational expectations literature [*e.g.* Barro (1974)]. Specifically, this neutrality proposition holds that the presence of inter-generational transfers allows the public to equate the current value of the bonds with the present value of future tax liabilities generated by the bonds. The implication of this is that the distinction between tax and bond financing is irrelevant.

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[1] McKinnon and Mathieson, 1981, p.2.

[2] Ibid.

In contrast, traditional theory holds that the issue of bonds raises net wealth which in turn raises consumption and interest rates, "crowding out" private investment. Indeed, numerous empirical studies have examined the degree of "crowding out". In addition, monetization of government debt is looked upon as mitigating the effects on real interest rates and hence, the "crowding out" effect. Friedman, for example, posits that the expansionary effects of government spending arise from the expansion in the money supply used to finance such expenditures.[3]

In general, therefore, the government can finance its deficit by issuing bonds (which implies future taxes) or levying taxes. Both methods of finance are within the realm of fiscal policy. Equally important, however, is the proposition of bonds that end up in the hands of the public. This lies within the realm of monetary policy. Kochin (1974, p.388), however, views money financing of the deficit as a form of excise tax on existing money balances if printing money leads to an increase in the price level. Money financing of the deficit can also be looked upon as increasing the demand debt of the government to be financed by a rise in the future rate of excise taxation on bank balances.

[3] It has been recognized in the literature that even a bond-financed increase in government spending will have to be monetized at some point. This is because the interest payments on the bonds increase the size of the deficit over time. Pure bond financing of the deficit is infeasible because of its inherent instability.

If money is neutral, as in the rational expectations paradigm, then there is no long-run relationship between money growth and real variables. Money is not only irrelevant from the point of view of financing deficits, but monetary policy is ineffective.

The validity of the different perspectives on the financing of budget deficits and, specifically on whether "crowding out" exists, can be tested empirically. Note however, that in the case of developing countries, the measure of "crowding out" will depend on whether financial markets have been liberalized or not. Under a regime with ceilings on interest rates, the degree of "crowding out" is partly captured by the degree to which private sector demand for credit is unsatisfied as a result of government borrowing although excess demand for credit may, of course, exist even without government debt financing. Under a regime of liberalized financial markets, the degree of "crowding out" may be measured by the degree to which interest rates rise in response to the financing of the deficit rather than by other market factors which raise interest rates. While numerous empirical studies of the "crowding out" effect exist for developed countries, there is a dearth of literature for developing countries.

This study is divided into two sections. The first attempts to determine whether there is a rule for financing public debt that the public can discern. If there is, then

presumably, bonds are not part of net wealth since the public can see the future taxes implicit in them. The public saves an amount equal to the present value of future taxes and an *ex-ante* "crowding out" effect occurs. If there is no discernible rule for financing public debt, then such bond issues can be perceived as adding to the public's net wealth, raising consumption and interest rates via the traditional "crowding out" effect.

The second section is a natural consequence of the first in that having determined the nature of the "crowding out" effect, if any, that exists, an attempt will be made to empirically determine its impact on nominal and real interest rates.

Review of Related Literature

Early Keynesian analysis posits that the non-distortionary changes in fiscal policy have direct demand effects on consumption via the changes in current disposable income induced by them. This effect is modified somewhat by the subsequent monetary effects arising from higher incomes which raise interest rates. An important caveat is that the manner in which the public reacts to the changes in policy has implications on the potency of policy.

It is the latter caveat which has given rise to the revival of the Ricardian equivalence proposition [See

Kochin (1974), and Tanner (1979)]. The Ricardian equivalence proposition asserts that the public responds in the same manner to a change in taxes and a change in the government deficit. A tax cut would increase the government deficit and households perceive the future tax liabilities implicit in the deficit. Thus, they would save an amount equal to the present value of interest payments needed to service the debt. Contrary to Keynesian predictions, therefore, there would be no effect on aggregate demand. Barro (1974) posits that the utility of today's generation depends indirectly on the utility of future generations as these generations overlap. Today's taxpayers will, therefore, not consume at the expense of their heirs. Instead, today's taxpayers will increase their savings so that their bequests to future generations, including government debt, would be the same as if the government deficit had not occurred.

Many of the early empirical studies use a life-cycle model to test whether government debt is perceived to add to net wealth or not. Feldstein (1982) finds support for the proposition that government debt constitutes part of net wealth as there is no evidence that consumers discount future taxes at all. Tanner (1979), Kormendi (1983), Aschauer (1985), and Seater and Mariano (1985) find evidence to the contrary.

Feldstein (1982) is skeptical about the Ricardian equivalence proposition and what he calls the *ex-ante* "crowding out" effect. He argues that changes in government expenditure would have no effect on aggregate demand only if an equal *concurrent* change in private saving were induced. Even if a change in private saving were to occur, there is no reason to believe that it would necessarily occur concurrently. It is also possible that an increase in government spending in one year may signal *higher* spending in future years and hence, higher taxes to finance such spending. A rise in current taxes may also signal a rise in future taxes. In either case, the effect on consumption depends not so much on the present fiscal policy but on the signals regarding future policy which current policy conveys. In Feldstein's view, the Ricardian equivalence proposition focuses entirely on future tax liabilities needed to service debt. He points out that current fiscal policy has implications for the future course of fiscal policy independent of debt service obligations. The potency of fiscal policy need not be negated as it would be in the case of the Ricardian equivalence proposition. Like Feldstein, Remolona (1985) is also skeptical about the significance of the Ricardian equivalence proposition, especially in LDCs. LDCs generally have fragmented or non-existent capital markets. The government can also offer debt more efficiently and hence, create net wealth. Also, the neutrality result would not hold since taxes tend to

be distortionary and there would be substitution effects from taxes needed to service the debt.

Feldstein (1982) uses a single equation model of U.S. real per capita consumer expenditure from 1930-1977, excluding 1941-1946, as a function of permanent income, the value of private wealth, the value of future social security benefits, government spending, tax revenues, government transfers, and net debt of the government. Despite some endogeneity problems arising from the effect of taxes on consumption and vice-versa, as well as potential collinearity among the regressors, Feldstein concludes that changes in government spending or taxes can have substantial effects on aggregate demand.

Yawitz and Meyer (1976) use a single equation model of real consumer expenditures as a function of real disposable income, the real net worth of households excluding holdings of government debt by the private sector, and the real market value of private sector holdings of government debt. The equation is estimated using U.S. data for the period 1953-69. They posit that if the coefficient on the real market value of private sector holdings of government debt is zero, then future taxes are being discounted completely. They find instead that the coefficient on this variable is positive, statistically significant, and larger than that on net private wealth. They conclude that there is no evidence that consumers

discount future taxes even partially. Government debt constitutes part of net wealth.

In his comment on their paper, Tanner (1979) criticizes the specification of their equation for omitting numerous sources of life-cycle income. Including variables such as accrued income, disposable income adjusted by the current unemployment rate to account for cyclical variations in disposable income, is more in keeping with the spirit of the Ando-Modigliani life-cycle approach. Using U.S. data for 1947-74, he finds that the coefficient on government debt is not statistically different from zero. He concludes that government debt is not net wealth. Kormendi (1983), Aschauer (1985), and Seater and Mariano (1985) also find no evidence that consumption is related to the budget deficit.

Other types of tests have been devised to test whether the public perceives the future tax implications of alternative methods of financing the deficit. Tanner (1970) investigates the existence of a real balance effect in Canada and finds that consumers discount 98 percent of future tax liabilities. Kochin (1974) uses Friedman's specification of the permanent income hypothesis and finds a significant amount of discounting using US data over the 1952-71 period. Feldstein (1974) and Munnell (1974) find that social security payments reduce savings in the U.S.

Barro's (1978) study shows, however, that social security payments do not affect aggregate consumption behavior.

Recent studies on the public's perception of whether financing government expenditures leads to changes in the public's net wealth have been applied to financial markets assumed to be characterized by market efficiency. These include studies by Plosser (1982), Huang (1986), and Evans (1987).

Plossser (1982) finds that innovations in government purchases are negatively related to excess nominal returns on U.S. treasury bills, implying that these innovations are associated with higher nominal interest rates. However, he cannot determine whether this is due to an increase in expected inflation or an increase in the real rate of interest. While this is the case, he also finds that using debt for taxes or base money for taxes has no bearing on interest rate movements. What this means is that the public perceives that the government merely trades current taxes for future taxes when there is a shift from tax finance to deficit finance. Furthermore, the monetization of government debt does not mitigate the "crowding out" effect.

Huang (1986) modifies Plosser's study of using real returns instead of excess nominal returns in order to test the neutrality proposition, since the latter does not rule

out an effect on nominal returns but does rule out an impact on real returns. He also uses data on corporate equities and debts in addition to those on the government bond and bill markets. He finds that contemporaneous innovations in monetized debt or privately-held debt do not affect real returns. In multi-market tests, he arrives at the same conclusion except in the case of common stocks. His results are consistent with the Ricardian equivalence proposition that the public correctly perceives that the increase in the budget deficit entails future tax liabilities and they respond by saving more. Evans (1987) also finds no evidence to support the thesis that past, present, or future budget deficits lead to higher *ex-post* real rates.

I

Financing of the Deficit[4]

The proportion of the deficit financed by money creation, domestic borrowing, and foreign borrowing using monthly data are shown in Table I-A. These ratios are calculated in the following way:

$$\text{Proportion of the Budget Deficit Financed by Money Creation} = \frac{\Delta \text{ holdings of government debt by the Central Bank} - \Delta \text{holdings of required reserves}}{\text{Budget Deficit}}$$

This measure takes into account the reserve requirement ratio prescribed by the Central Bank and recognizes that required reserves are a leakage from the money creation process.

$$\text{Proportion of the Budget Deficit financed by domestic market borrowing} = \frac{\Delta \text{ holdings of government debt by the private sector, trust funds, and semi-gov't entities} - \Delta \text{holdings of reserve-eligible securities}}{\text{Budget Deficit}}$$

The entities included in the private sector are commercial banks, thrift banks, investment houses, insurance companies, private corporations, and other private indirect bearers. Those included under trust funds are the Bond Sinking Fund, Economic Support Fund, and Industrial Guarantee Loan Fund. Finally, semi-government entities include the Social

[4] The measurement of the budget deficit is shown in Exhibit I.

Security System, the Development Bank of the Philippines, and the Government Service Insurance System. Banks in the Philippines are allowed to hold reserve-eligible securities in order to meet reserve requirements. The change in holdings of reserve eligible securities is subtracted because this is effectively part of the money supply.

$$\text{Proportion of the Budget Deficit financed by foreign borrowing} = \frac{\Delta \text{holdings of government debt by the foreign sector}}{\text{Budget Deficit}}$$

It is apparent from Table I-A that most of the money creation ratios are negative. This means that monetary policy has been quite contractionary since required reserves are larger than monetized debt, as a proportion of the deficit. The yearly averages also show how contractionary policy has been since 1983, probably in response to the IMF stabilization strategy.

The yearly average for the 11 months of 1986 is unusual because the figures for June 1986 seem to be outliers. Domestic borrowing tends to move inversely with foreign borrowing. Domestic borrowing exhibited dramatic reversals in short periods of time such as those for April 1985 (123.13) and July 1985 (-220.514).

Empirical Methodology and Results

Table I-B shows that the par value of privately-held government debt (debt held by commercial banks, thrift banks, and other private holders) over the last six years has continuously increased. The semestral average of this variable has continuously increased, with the exception of the period 1983.07 to 1983.12 in which it did not decline very much. It can therefore be surmised that the principal is essentially rolled over. We can then consider the rule for financing interest payments.

Following Cox (1984), several non-parametric procedures are utilized to obtain characteristics of the distribution of δ, the ratio of the deficit to interest outlays. Cox assumes that there is only one type of Treasury bond and it promises to pay the holder \$1 per period forever. The Treasury finances each \$1 of interest by τ ¢ via taxes and the remainder, ¢ = (\$1-τ¢), via bonds. Tests are performed to determine if δ is a normally and independently distributed random variable. If δ is not independently distributed, then there is a potentially discernible financing rule which could negate the proposition that bonds are part of net wealth.

As shown in Appendix A.I, using quarterly data for 1979-1986, the stem and leaf plot of δ exhibits tails approximating those of a normal distribution.

The average value of δ is 1.74 and the standard deviation is 2.16. Since the average value of δ is greater than unity, the implication is that there was, on the average, no tax liability over the 1979-1986 period. From the historical distribution of δ, the first and third quartile boundaries are calculated as $Q_1 = 0.1235$ and $Q_3 = 3.38051$, respectively. The difference between Q_3 and Q_1, the inter-quartile range, is 3.6816. In a normal distribution, the inter-quartile range is 1.35 times the standard deviation. It is possible, therefore, to calculate a pseudo-standard deviation by dividing the inter-quartile range by 1.35. The pseudo-standard deviation is 2.727. This pseudo-standard deviation closely approximates the historical standard deviation as the difference between them is 0.56.

Another non-parametric procedure involves calculating the upper and lower bounds for values of δ and seeing whether there are any outliers, assuming a normal distribution. The upper and lower bounds are calculated by multiplying the inter-quartile range by 1.5 and adding it to Q_3 to obtain the upper bound, and subtracting it from Q_1 to obtain the lower bound. The upper and lower bounds obtained are 8.83 and -4.75, respectively. Examination of the values of quarterly δ indicates that there are no outliers.

Appendix A.II shows the results using monthly data from 1981.01 to 1986.12. A stem and leaf plot of δ exhibits tails approximating those of a normal distribution.

The average value of δ is 2.33 and the standard deviation is 3.19. Again, since the average value of δ is greater than unity, the implication is that there was, on average, no tax liability. The first and third quartile boundaries are calculated as 0.23 and 4.28, respectively. The inter-quartile range is 4.05. The pseudo-standard deviation of 3.00 is very close to the historical standard deviation of 3.19. The difference between them is 0.19.

The upper and lower bounds of δ are 10.56 and -5.84, respectively. There are only three out of seventy-two values of δ which are outliers and these are the values for 1981.02, 1981.05, and 1982.05.

To test whether δ is non-stationary or time dependent, δ is regressed against time. Using quarterly data, the coefficient on the time variable is not statistically significant, suggesting that δ is stationary. However, when monthly data are used, the coefficient on the time variable is significantly negative. This suggests that δ may not be a stationary random variable.

Quarterly Data:1979.1-1986.4	Monthly Data:1981.01-1986.12
δ = 1.8843 - 0.0039 TIME (2.4458) (-0.0966)	δ = 4.6485 - 0.0634 TIME (6.5980) (-3.7812)
R^2 = 0.00311 DW = 0.7265 F = 0.009	R^2 = 0.1696 DW = 2.1385 F = 14.30
(Standard Errors in Parentheses)	

Figures II.A and II.B show graphs of the ratio of the budget deficit to interest payments, δ , using quarterly and monthly data. Since there is a slight downward trend in δ, the first difference of the δ series, DRAT, was obtained. Figures III.A and III.B shows graphs of the first difference of δ using quarterly and monthly data. The trend is not evident anymore.

It must be determined independently distributed over time. If δ is not independently distributed over time, then past observations may be used in forecasting expected tax liabilities of government debt. If the public can perceive the future tax liabilities implicit in the deficit then an *ex-ante* "crowding out" effect *a la* Ricardian Equivalence may occur as the public saves an amount equal to the present value of the interest payments needed to service the debt.

The partial autocorrelations for DRAT using quarterly data are shown in Appendix A.III. Based on this, an AR(2) model is estimated. Both coefficients on the AR(1) and AR(2) variables are significant. The partial auto-

correlations for DRAT using monthly data are shown in Appendix A.IV. Again, an AR(2) model is estimated. Both coefficients on AR(1) and AR(2) are significant. Using quarterly data, the Q-statistics, [Q(k)], for δ at lags of 6, 12, 18, and 24 are 29.18, 50.43, 53.61, and 55.25, respectively, indicating significant accumulated auto-correlations at short, medium, or long lags. Based on the chi-square statistics, (χ^2), with k degrees of freedom (where k is the number of lags used), we find χ^2 statistic values of 18.54, 28.38, 37.15, and 45.55 with 6, 12, 18, and 24 degrees of freedom, respectively, given a significance level of 0.005. Therefore, there is less than half a percent probability that quarterly δ is randomly distributed. However, the Q-statistics for quarterly DRAT at lags of 6, 12, 18, and 24 are 7.11, 9.53, 14.62, and 16.08, respectively, indicating that quarterly DRAT is randomly distributed. Using monthly data, the Q-statistics for δ obtained at lags of 6, 12, 18, and 24 are 33.64, 55.13, 51.17 and 66.47, respectively. This indicates that monthly δ exhibits a pattern. The same result is obtained for monthly DRAT where the Q-statistics are 32.65, 52.76, 64.28, and 77.59 for the same lags.

In general, the δ series is not independently distributed over time and exhibits a pattern. DRAT, with the exception of quarterly data, also exhibits a pattern over time.

To test whether a shift occurred in the distribution of δ, the data are divided into two groups and each group is regressed against a time variable. Using quarterly data, from 1979.1 to 1983.2, one obtains a significant coefficient on time while that using data from 1983.3 to 1986.4 is not significant. This suggests that a shift occurred in the distribution of δ. To test whether the shift is significant, the Chow test is performed. The calculated F-statistic is 5.863, and it exceeds the critical F value which is 3.34 at 0.05 level of significance with 2 and 28 degrees of freedom.

1979.1 to 1983.2	1983.3 to 1986.4
δ = -0.07 + 0.25 TIME (-0.06) (2.45)	δ = 0.4 + 0.03 TIME (0.21) (0.42)
R^2 = 0.27 DW = 0.9 F = 5.998	R^2 = 0.01 DW = 1.7 F = 0.177

Using monthly data from 1981.01 to 1983.12 and 1984.01 to 1986.12, the coefficient on the time variable is negatively significant in the former case and barely significant in the latter case. Again, there is evidence indicating that a shift occurred in the distribution of δ. The calculated F value of 4.234 exceeds the critical F value of 3.07 at 0.05 level of significance with 2 and 68 degrees of freedom.

1981.01 to 1983.12	1984.01 to 1986.12
δ = 5.98 - 0.127 TIME (4.98) (-2.25)	δ = -1.69 - 0.050 TIME (-1.00) (1.649)
R^2 = 0.13 DW = 2.4 F = 5.105	R^2 = 0.07 DW = 1.67 F= 2.72

In general, there does seem to be some evidence to indicate that the behavior of δ shifted over time.

Summary and Conclusions

This section attempts to determine if there is a discernible rule for financing public debt. Several non-parametric tests are utilized to determine whether δ, the ratio of the deficit to interest outlays, is a normal, independently-distributed random variable. δ is assumed to be the proportion of interest payments by bond issue. The focus is on the rule for financing interest payments since the evidence indicates that the principal is simply rolled over.

The evidence indicates that δ is a randomly-distributed random variable. However, its time series properties indicate that it is not independently distributed over time. This means that a discernible rule exists whereby the public is able to determine their expected tax liabilities. If this is so, then according to Ricardian Equivalence Theory, the public will save an amount equal to the present value of their expected tax liabilities and

debt issuance will not be viewed as adding to net wealth. Debt issuance will not have any effect on real consumption and therefore any discussion of a "crowding out" effect is irrelevant.

There is evidence, however, to suggest that in the case of the Philippines, the story advanced by Ricardian Equivalence Theory may not be valid despite the presence of a discernible financing rule. First, the average value of δ is above unity, suggesting that both the government and the public behave as though there are no future tax liabilities associated with financing interest payments. Since the public can discern this via the pattern exhibited by δ over time, there is no reason for them to discount future tax liabilities. The only randomness is the degree of "subsidy" via bond issuance since Chow tests reveal that δ exhibited a shift over time.

The implication is that financing rules, though discernible, do matter in the case of the Philippines. If bond issuance adds to net wealth because the government acts as though there are no future tax liabilities implicit in such issuance, then discussions of the degree of "crowding out" are not irrelevant. This means that in the case of some developing countries, such as the Philippines, the pursuit of various liberalization schemes may be hampered not only by the size of the deficit, but also by the adverse effects of financing of these deficits via bond

issuance. It also means that these adverse effects will persist until the authorities are able to make credible changes in the manner they operate. Determining the degree of the traditional "crowding out" is the subject of the next section.

II

The assumption of rational expectations or market efficiency is used to investigate the impact of financing decisions on interest rates. The interest rates used in the study are various T-bill rates. There is a well-organized secondary market for Treasury bills which justifies using tests of market efficiency in this particular market. The specification and methodology closely follow those in related studies by Plosser (1982), Mishkin (1983), Huang (1986), and Evans (1987).

Traditional theory suggests that *ceteris paribus*,
(1) balanced budget increases in government spending raise nominal interest rates;
(2) increases in debt issued by the Treasury held by private sector raise nominal interest rate via a "crowding out" effect; and
(3) increases in monetized debt lower nominal interest rates initially via a liquidity effect, or until expectations of inflation reverse this downward movement in interest rates via the Fisher effect.

A simple equation characteristic of tests of traditional theory is the following:

$$i_t = a_1 G_t + a_2 PD_t + a_3 M_t + a_4 Z_t \qquad (1)$$

where i_t is the nominal interest rate at the end of one period on one-period bonds; G, PD, and M are measures

of government spending, privately-held debt, and monetized debt, respectively; Z is a vector of other variables including lags of G, PD, and M; the a_s are coefficients to be estimated.

Applying the expectations operator $E(\cdot / I_{t-1})$ to both sides of (1), where I_{t-1} is the information available at t-1, given the assumption of market efficiency, and subtracting the resulting equation from (1) yields

$$UI_t = b_1 UG_t + b_2 UPD_t + b_3 UM_t + V_t \qquad (2)$$

where

$$UI_t \equiv i_t - E(i_t / I_{t-1})$$

$$UG_t \equiv G_t - E(G_t / I_{t-1})$$

$$UPD_t \equiv PD_t - E(PD_t / I_{t-1})$$

$$V_t \equiv a4Z_t - E(a4Z_t / I_{t-1})$$

V_t is assumed to be uncorrelated with the regressors and with G_t, PD_t, and M_t contemporaneously. If V_t is not uncorrelated with past or future values of G_t, PD_t, and M_t, then (2) will not be a true reduced form and the b_s will not be consistent.

In order to estimate (2), it is necessary to obtain measures of the unanticipated components of nominal interest rates, government spending, privately held debt, and monetized debt. Because the forward market in the Philippines does not exist except for forward cover, first differences of the nominal interest rate are used to proxy for the unanticipated component of nominal interest rate movements. In other words, $E(i_t / I_{t-1}) = i_{t-1}$, meaning

that the interest rate series follows a random walk. This assumption is not rejected empirically.[5]

For the financing variables, linear forecasting equations including lags of the particular variables in question, the other financing variables, and other relevant variables are used. The F-test is utilized to determine which variables and their lags are jointly significant at the 5% level and hence, are to be retained.

$$X_t = Z_{t-1}\,\alpha + U_t \qquad (3)$$

where X_t is the particular financing variable in question

Z_{t-1} is a vector of variables used to forecast X_t available at time t-1

α is a vector of coefficients

U_t is a serially-uncorrelated error term

Since there are three financing variables, there will be three forecasting equations following the specification in (3).

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[5] When i is regressed on 1 lag of itself, the coefficient on the lag is not significantly different from 1.

TB91 = 0.982 + 0.944 TB91(-1)
(1.181) (22.901)

See also graphs.

$$GE_t = Z_{t-1}\ \alpha^G + U_t^G \qquad (3a)$$

$$PD_t = Z_{t-1}\ \alpha^{PD} + U_t^{PD} \qquad (3b)$$

$$M_t = Z_{t-1}\ \alpha^M + U_t^M \qquad (3c)$$

The superscripts indicate the particular financing variable concerned. (3a), (3b), and (3c) are then estimated jointly with the following version of (2):

$$i_t - i_{t-1} = b_0 + \sum_{i=0}^{n} \beta_i^G\ [GE - Z_{t-1}\ \alpha^G] + \sum_{i=0}^{n} \beta_i^{PD}\ [PD - Z_{t-1}\ \alpha^{PD}] + \sum_{i=0}^{n} \beta_i^M\ [M - Z_{t-1}\ \alpha^M] + \epsilon_t \qquad (4)$$

where the αs in (4) are constrained to be equal to the corresponding αs in (3a), (3b), and (3c).[6] ϵ_t is assumed

[6] Tests of the validity of these constraints are to be conducted by estimating (3a), (3b), (3c), and (4) with and without the constraints. The test statistic is constructed in the following manner:

$$2n \log [SSR^C - SSR^U]$$

where n is the number of observations

SSR^C 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 $\chi^2(q)$ 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.

to be uncorrelated with the regressors in (4) in order to identify the β_is and obtain consistent estimates of them. ϵ_t is modelled as a first-order autoregressive process *i.e.*, $\epsilon_t = \epsilon_{t-1} + \Omega_t$.

Following Plosser .(1982), the three policy variables are the log of the monetized debt, the log of privately-held debt, and the log of government expenditures. The optimal linear forecast of a policy variable, X_t is defined as:

$$E(X_t \ / \ I_{t-1})$$

where I_{t-1} is the available information set on which the forecast is conditioned on. The innovation in X_t is defined as the difference between actual X_t and the optimal linear forecast of X_t.

Experimentation with uniform lags of 5 and 10 lags of different sets of explanatory variables in the forecasting equations indicates at least two potentially appropriate forecasting equations. The error term in each of the three policy forecasting equations is assumed to be serially uncorrelated.

In the first set of forecasting equations, uniform lags of 5 of each of the following regressors are used: log of government expenditures, log of monetized debt, log of privately-held debt, interest rate, log of the exchange rate, and the growth rate of the industrial production index. If the monetary authorities intervene in the foreign exchange market, as they allegedly do in the Philippines, the exchange rate could be useful in predicting the money supply. Industrial production index, as a proxy for GNP which is not on a monthly basis, could be useful in predicting future taxes and money demand.

In the second set of forecasting equations, each variable is regressed against uniform lags of 10 of the three policy variables.

The results of the F-test are available upon request from the author.

The data are monthly, covering the period January 1981 to December 1986. A description of the data is contained in Appendix C.

Empirical Results

Traditional theory predicts that the coefficients government spending and privately-held debt should be significantly positive. The coefficient on money should be significantly negative.

On the other hand, Ricardian Equivalence Theory posits that government bonds do not add to the net wealth of the private sector and nominal interest rates are independent of the manner in which government spending is financed. This implies that the coeficients on unanticipated privately-held debt and unanticipated money should not be significantly different rom zero. This theory, while precluding any effect of the manner of financing government spending on nominal interest rates, does not preclude the possibility that innovations in government spending affect nominal interest rates.

Table II presents the results of the joint estimation of (3a), (3b), (3c), and (4) in which the forecasting equations for the policy variables use 5 lags each of logs of the policy variables, the interest rate, the exchange rate, and the growth rate of the production index.

The last column in Table II shows the effect of a positive innovation in government spending financed by taxes, as the innovation in government spending is orthogonal to innovations in monetized debt and privately-held debt. The innovation in government spending is significantly positively related to nominal interest rate movements. This means that balanced budget increases in government spending are associated with increases in interest rates.

There are two ways in which the increase in nominal interest rates could occur: one is via an increase in the rate of inflation and the other is via an increase in the real interest rate. The correlation between the innovations in government spending and monetized debt is negative (-0.40) and seems to indicate that an increase in expected inflation is an unlikely channel. The alternative channel, in which the output effects of government spending purchase arise from changes in real rates of interest, might be worth exploring.

The second to the last column in Table II shows the effect of a surprise substitution of debt for taxes on nominal interest rates. The coefficient on the innovation in privately-held debt is significantly positive. This finding is consistent with the "crowding out" effect. It is inconsistent with Ricardian equivalence. Again, the

positive effect of privately-held debt could occur via an inflation channel of a real interest rate channel.

The coefficient on the log of monetized debt shows the effect of a fall in taxes financed by debt issue matched by an open market purchase. The coefficient is negative, as predicted by traditional theory, but it is not statistically significant.

The likelihood ratio tests indicate that the validity of the cross equation constraints cannot be rejected.[7] Although ρ, the first-order autocorrelation coefficient is significant, an ARIMA check of the residuals indicates that there is no significant serial correlation left.

Since the logs of the policy variables may be non-stationary, the estimation in Table II was repeated using growth rates, *i.e.*, first differences of logs. The results are similar to those obtained in Table I and are not reported separately.

Further Tests

Following Huang (1986), the dependent variable is specified in real terms to test for the neutrality proposition subscribed to by the rational expectations school. The dependent variable is specified as the *ex-*

[7] The results of the likelihood ratio tests are found in Appendix B.

post real rate of interest, *i.e.*,

$$(i_t - \text{inflation rate}_t) - (i_{t-1} - \text{inflation rate}_{t-1})$$

the inflation rate is measured using the monthly CPI index calculated on a year-to-year basis. If the neutrality proposition holds, none of the innovations in the policy variables should have a statistically-significant effect on movements in *ex-post* real rates.

The results using the 91-day *ex-post* real rate as the dependent variable are shown in Table III. Only innovations in privately-held government debt are significantly positive. This indicates that some financing decisions have non-neutral effects. It also strengthens the earlier finding of a significant "crowding out" effect. None of the other policy variables are statistically significant. The sign of the coefficient on monetized debt is inconsistent with that hypothesized by traditional theory.

The equations in Table II were re-estimated using the 360-day Treasury Bill rate instead of the 91-day rate to ascertain whether the "crowding out" result is discernible for bills with longer maturity. The results are shown in Table IV. None of the coefficients of the policy variables are statistically significant. These results imply that the "crowding out" effect is a short-lived phenomenon. An ARIMA check of the residuals indicates the absence of significant serial correlation. However, the appropriate-

ness of the model is questionable as the likelihood ratio test statistic is negative.

The results using the 360-day *ex-post* real rate as the dependent variable are shown in Table V. Again, none of the coefficients are statistically significant and no significant "crowding out" effect exists. This result, however, may be due to certain structural features in developing countries, such as a high rate of time preference, which could obscure the finding of a significant "crowding out" effect for longer-term bonds.

When the alternative forecasting equation with 10 lags of each of the policy variables is used, as shown in Table VI, the results are very different from those in Tables II and III. There is no statistically significant "crowding out" effect. The coefficient on innovations in government expenditures is likewise insignificant and of the wrong sign based on traditional theory and Ricardian Equivalence theory. These results, shown in Table VI, could be due to a misspecification of the forecasting equations. If the forecasting equations are misspecified, this will tend to bias the coefficients of the r.h.s. policy variables toward zero. The forecasting equations used here do not include the exchange rate as an explanatory variable. If it is true that the monetary authorities tend to fix the exchange rate, then omitting this variable may result in misspecification. The positive coefficient on monetized

debt is spurious since it implies that innovations in money are quickly translated to expectations of inflation, yet the correlation between innovations in government spending and monetized debt is quite small (0.005). The likelihood ratio test statistic is negative, indicating that the model used may be inappropriate.

Summary and Conclusions

This study is an attempt to determine the validity of the traditional "crowding out" effect versus the Ricardian Equivalence Theorem in the case of a developing country, the Philippines. The traditional "crowding out" effect is premised on the notion that the public views the issuance of bonds to finance the deficit as part of net wealth. As net wealth, consumption therefore rises, and so do interest rates. Under a regime where interest rates are free of ceilings, the "crowding out" effect may be measured by the degree to which interest rates rise as a direct result of the financing decisions of the authorities. The Ricardian Equivalence Theorem, on the other hand, implies that the public realizes that bond issuance implies future taxation and hence, bonds do not add to net wealth. Financing decisions do not matter.

The assumption of rationality of expectations, or market efficiency, in the treasury bill market is used in the empirical tests. The forecasting equations and interest

rate equation are estimated jointly with cross-equation constraints.

The results indicate that there is a significant "crowding out" effect when the first difference of the 91-day Treasury Bill rate is the dependent variable, regardless of whether the interest rate is specified in nominal or real terms. Innovations in government spending also raise nominal interest rates and there are indications that this is due to changes in inter-temporal rates of substitution rather than an increase in the expected rate of inflation. There is no support for the proposition that debt monetization mitigates the "crowding out" effect. The validity of the cross equation 'rationality' constraints cannot be rejected. The residuals are white noise.

While a significant "crowding out" effect exists, it is apparently a short-lived phenomenon. Using the first difference of the 360-day Treasury Bill rate as the dependent variable, no statistically significant "crowding out" effect is found. However, the absence of a discernible "crowding out" effect on a long-term security may be because of certain structural features present in developing economies. One such feature is the high rate of time preference. There tends to be very little lending or borrowing on a long-term basis. The earlier results confirming the presence of "crowding out" are not invariant with respect to the specification of the policy forecasting

equations, although this may be because the alternative forecasting equations are inappropriate.

In general, the results indicate that unlike the findings of numerous studies for developed countries, the "crowding out" effect is not irrelevant for some developing countries although it is apparently a short-lived phenomenon. Furthermore, the "crowding out" effect does not seem to arise because of irrationality on the part of the public as the cross-equation constraints cannot be rejected in most cases. The government can in fact create net wealth not only because of certain structural features present in developing countries such as fragmented capital markets, etc., but also because the government may act in a manner in which it disregards its budget constraint, continuously financing spending by issuing bonds which it keeps rolling over. The public sees the absence of expected tax liabilities normally associated with debt issue as well as the postponement or absence of the day of reckoning. Nevertheless, further research efforts should be directed at discovering how government issuance of bonds adds to net wealth in the case of the Philippines and other developing countries.

EXHIBIT I

Measurement of the Budget Deficit

In this study, the Treasury and IMF definition of the budget deficit is used. The data are quoted on a cash disbursement basis. The components of revenues and expenditures are shown on the following page.

CONSOLIDATED CASH OPERATIONS OF THE NATIONAL GOVERNMENT (Treasury and IMF Definition)

1. Budgetary Revenues
   - Tax Revenues
     - BIR Collections
     - Customs Collections
     - Collections of Other Offices
   - Non-Tax Revenues
     - Economic Support Fund
     - Operating and Miscellaneous Income (Fees and Other Charges)
     - Interest on Deposits
     - Interest on Advances to Government Corporations
     - Foreign Grants and Contributions (includes base rentals)
     - Other Non-Tax Revenues

2. Expenditures
   - Current Operating Expenses
     - Personnel Services - includes wages and transfer payments
     - Maintenance and Other Operating Expenses
     - Allotment to Local Government Units
     - Debt Service: Interest Payments
     - Subsidies
   - Transferred Liabilities from PNB and DBP
   - Capital Outlays
     - Infrastructure
     - Equity Investment Outlay/Capitalization (includes GFIs and government corporations)
     - Loans Outlay/Net Lending (includes GFIs and government corporations)
     - Other Capital Outlays

Note that the debt service under expenditures includes only interest payments and not amortizations, and that equity investments and lending to both government corporations and government financial institutions are included under capital outlays.

TABLE I-A
FINANCING THE BUDGET DEFICIT

	M-CREATE	AVE-MC	OPEN-MKT.	AVE-OMB	FOREIGN	AVE-FB
1981.01					0	
1981.02	-0.08295		0.09907		0	
1981.03	-0.32356		0.53125		0	
1981.04	-1.88773		-3.66158		0	
1981.05	-0.20910		-0.00864		0	
1981.06	-0.72220	-0.64510	0.22828	-0.56232	0	0
1981.07	-0.13108		0.45587		0	
1981.08	-0.23962		0.33897		0	
1981.09	0.23250		0.37455		0	
1981.10	-0.16566		0.55158		0	
1981.11	-0.10573		-0.04232		0	
1981.12	-0.40398	-0.13559	-0.00021	0.244512	0	0
1982.01	1.64485		4.59697		0	
1982.02	-0.10900		-5.36091		0	
1982.03	0.92389		4.50021		0	
1982.04	-1.47843		88.45311		0	
1982.05	-0.07429		0.07898		0	
1982.06	-0.49945	0.067928	0.02688	17.53966	0	0
1982.07	0.40406		-0.13156		0	
1982.08	-0.13315		0.28290		0	
1982.09	-0.48995		0.71846		0	
1982.10	2.40370		1.46227		0	
1982.11	-3.36958		3.14240		0	
1982.12	1.03502	-0.02498	-0.76629	0.967647	0	0
1983.01	-25.74920		17.55352		2.57746	
1983.02	-3.24743		3.07516		0.12179	
1983.03	-1.78276		2.85875		0.09661	
1983.04	4.83871		-6.33870		0.61290	
1983.05	-0.71424		1.21316		0.12347	
1983.06	-0.95130	-4.60103	-0.14012	0.133649	0.05819	0.202593
1983.07	35.80952		43.58095		6.76190	
1983.08	0.67391		-1.86272		-0.18962	
1983.09	-26.64730		9.55591		-3.27956	
1983.10	6.65882		-29.32350		7.35294	
1983.11	-5.69768		0.37217		0.73043	
1983.12	-0.31130	1.747661	-0.11319	-4.27426	-0.08951	0.904937

	M-CREATE	AVE-MC	OPEN-MKT.	AVE-OMB	FOREIGN	AVE-FB
1984.01	1.20405		0.11185		0.48636	
1984.02	-0.74671		0.05808		-0.00061	
1984.03	-0.75881		-0.31096		-0.00307	
1984.04	0.34286		-4.99789		0.15966	
1984.05	-6.67421		4.53342		-0.11842	
1984.06	8.45977	0.304490	-2.91532	-0.72653	1.37931	0.283374
1984.07	-1.78935		-0.43540		-0.02902	
1984.08	0.44920		5.03424		-0.00796	
1984.09	0.11270		2.05147		-0.07506	
1984.10	-0.40170		1.96292		0.14663	
1984.11	1.14268		18.74066		0.08804	
1984.12	-0.36710	-0.14226	1.26090	5.810035	-0.01509	0.027312
1985.01	0.92676		22.35399		0.08232	
1985.02	-0.86463		0.60703		0.00276	
1985.03	-2.23222		-7.94666		-0.23611	
1985.04	-4.10588		123.13820		0.92647	
1985.05	-0.66379		6.98595		0.15823	
1985.06	-0.37217	-1.21865	4.48736	25.45437	-0.00353	0.169562
1985.07	-41.58570		-220.51400		14.42857	
1985.08	-0.19256		0.80726		0.14412	
1985.09	0.31540		-1.34276		0.02799	
1985.10	-0.36512		0.25286		-0.08869	
1985.11	0.19787		-1.23037		-0.09857	
1985.12	-0.21559	-6.97428	-0.01110	-0.30482	0.00048	-0.00293
1986.01	0.24621		0.46415		0.03390	
1986.02	0.15870		3.19519		0.09356	
1986.03	-0.21842		3.32022		-0.05778	
1986.04	0.13574		-3.97357		0.04047	
1986.05	-0.10958		1.92828		-0.15621	
1986.06	-270.38500	-45.0287	-298.25700	-58.7573	5.28571	1.041149
1986.07	1.80794		0.58430		-0.03174	
1986.08	-0.11473		-0.38831		0.00482	
1986.09	-0.88954		3.70694		-0.00285	
1986.10	0.16621		-0.38339		0.00525	
1986.11	-0.31543		0.18334		0.00000	
1986.12	-0.12754	0.087818	0.00347	0.624408	0.00088	0.00162

Figure I-A.1

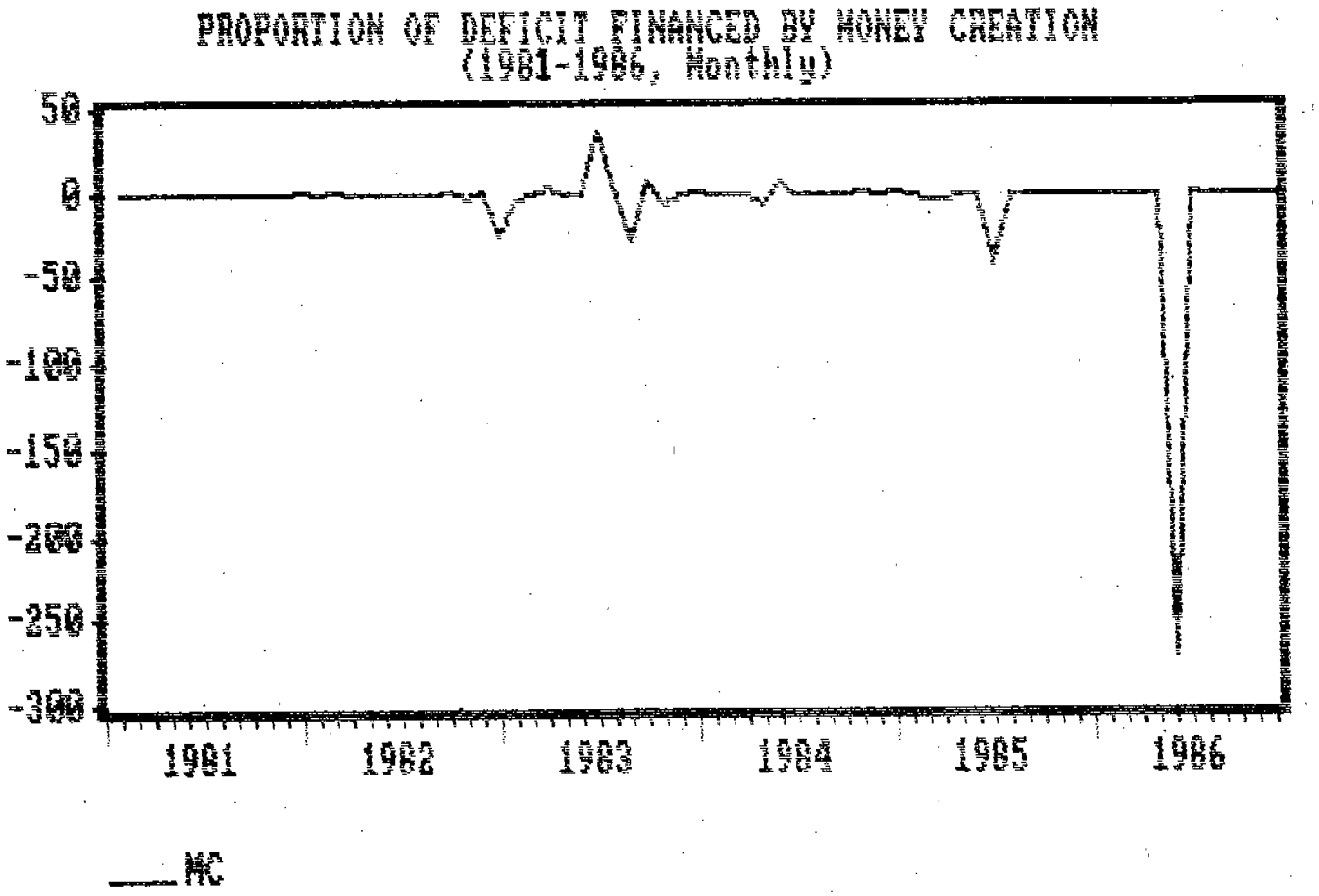

PROPORTION OF DEFICIT FINANCED BY MONEY CREATION
(1981-1986, Monthly)
50
0
-50
-100
-150
-200
-250
-300
1981
1982
1983
1984
1985
1986
MC

Figure I-A.2

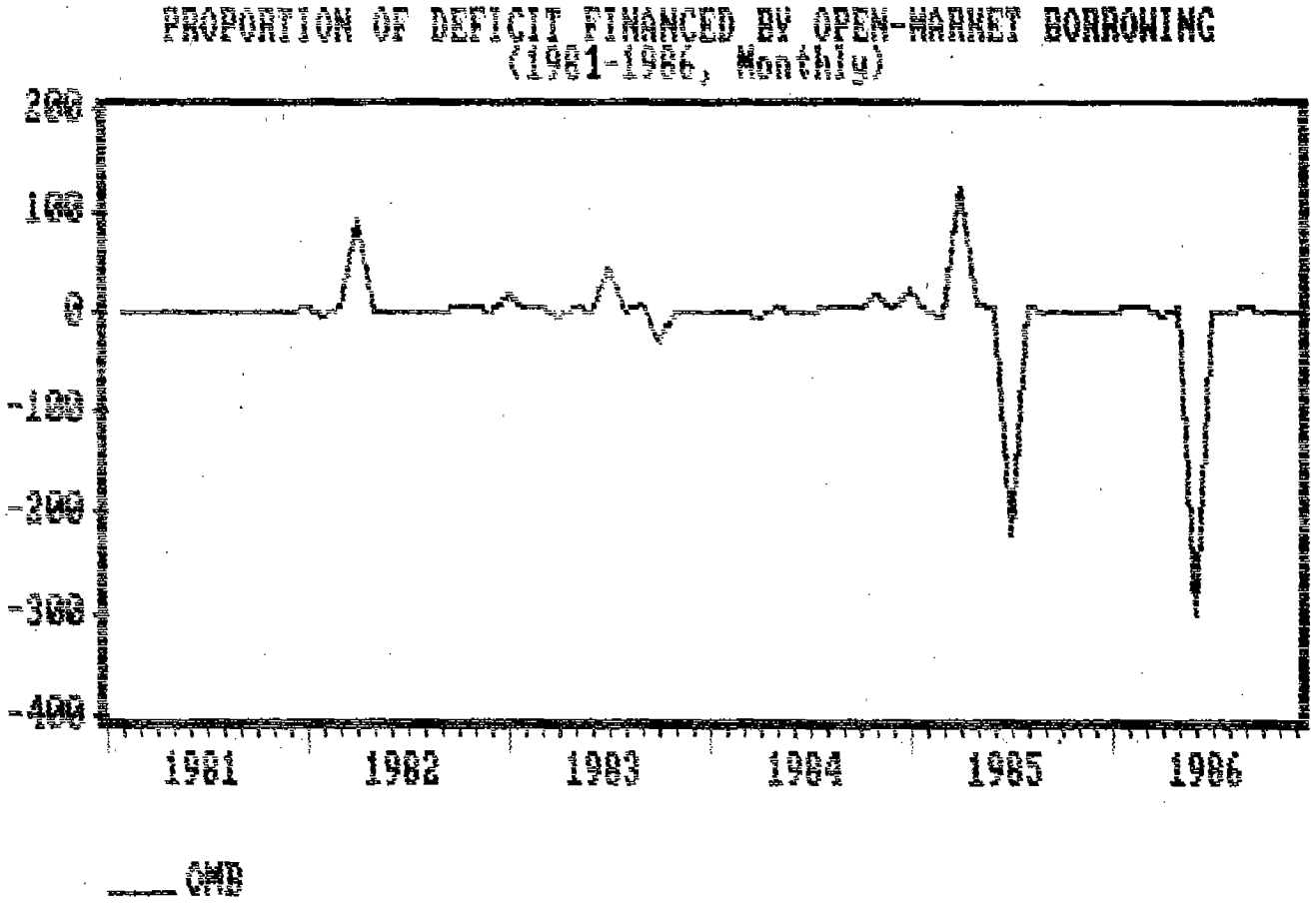

PROPORTION OF DEFICIT FINANCED BY OPEN-MARKET BORROWING
(1981-1986, Monthly)
200
100
0
-100
-200
-300
-400
1981
1982
1983
1984
1985
1986
OMB

Figure I-A.3

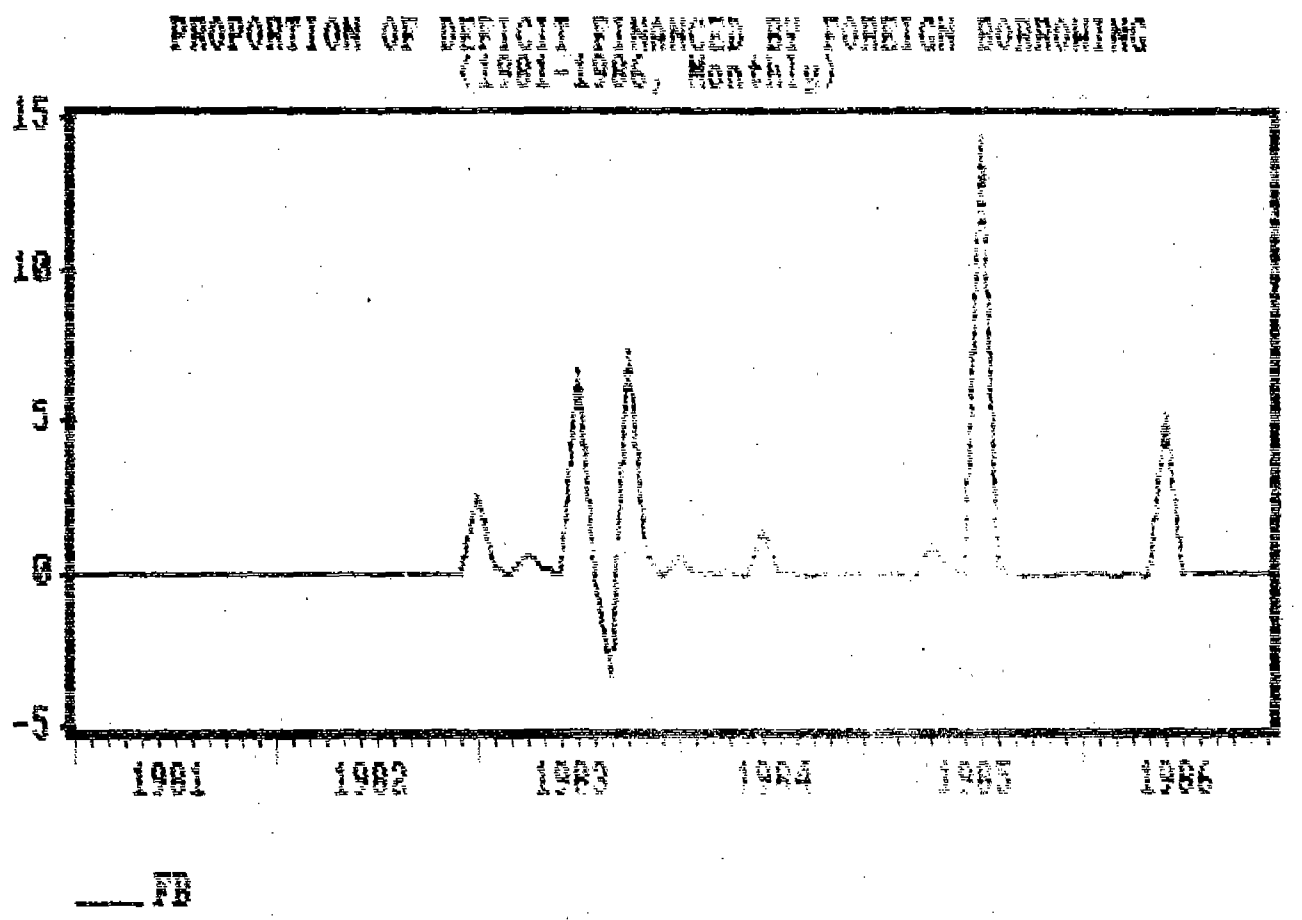

PROPORTION OF DEFICIT FINANCED BY FOREIGN BORROWING
(1981-1986, Monthly)
15
10
5
0
-5
1981
1982
1983
1984
1985
1986
FB

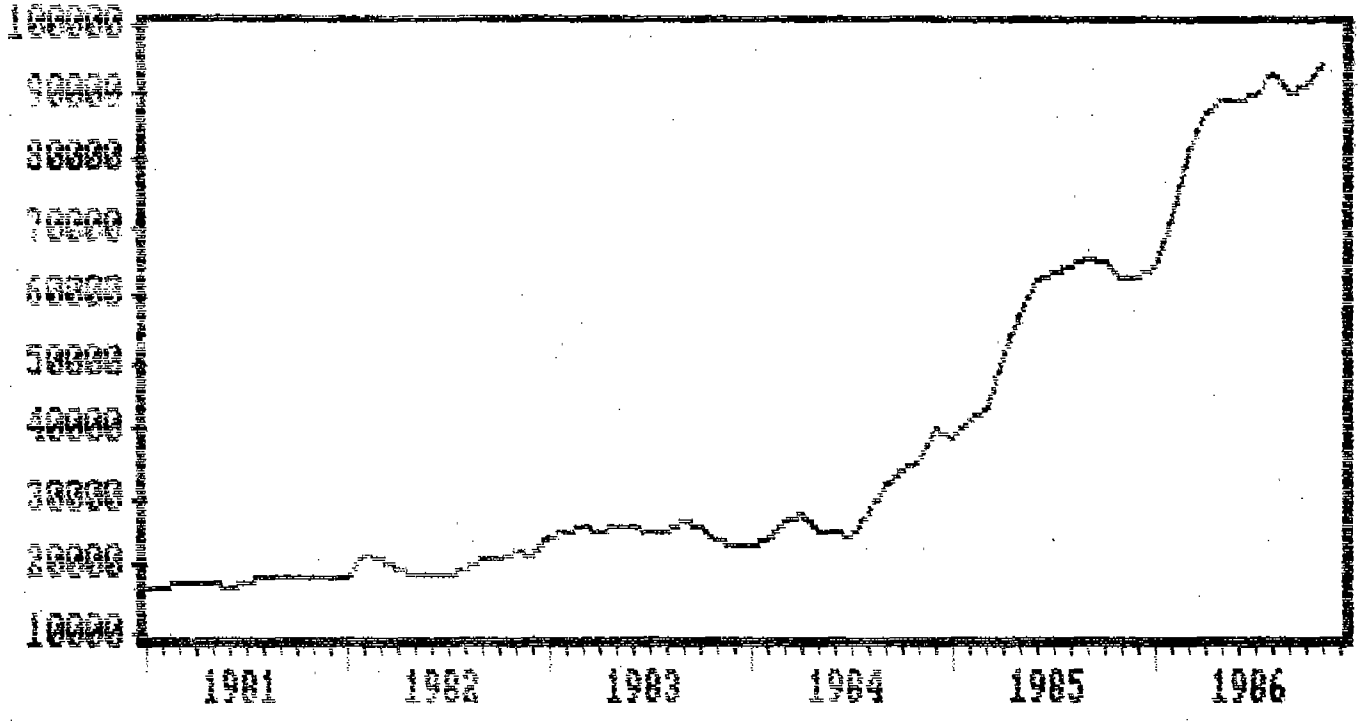
TABLE I-B
PRIVATE HOLDINGS
OF OUTSTANDING GOV'T SECURITIES
(In Million Pesos)

PERIOD	PRIVATE	AVE-PRIV	PERIOD	PRIVATE	AVE-PRIV
1981.01	16981		1984.01	23089	
1981.02	17106		1984.02	23837	
1981.03	17627		1984.03	26484	
1981.04	17672		1984.04	27731	
1981.05	17248		1984.05	25385	
1981.06	17109	17290.50	1984.06	25230	25292.67
1981.07	17654		1984.07	24572	
1981.08	18241		1984.08	27668	
1981.09	18271		1984.09	31715	
1981.10	18350		1984.10	33841	
1981.11	18246		1984.11	35559	
1981.12	18284	18174.33	1984.12	39910	32210.83
1982.01	18244		1985.01	39143	
1982.02	21944		1985.02	41485	
1982.03	21023		1985.03	43292	
1982.04	19746		1985.04	50358	
1982.05	18701		1985.05	57262	
1982.06	19042	19783.33	1985.06	62440	48996.67
1982.07	19273		1985.07	63671	
1982.08	19758		1985.08	64304	
1982.09	21273		1985.09	65433	
1982.10	20778		1985.10	64867	
1982.11	22240		1985.11	63224	
1982.12	21348	20778.33	1985.12	62701	64033.33
1983.01	24136		1986.01	64481	
1983.02	25112		1986.02	71072	
1983.03	25704		1986.03	81664	
1983.04	24808		1986.04	87021	
1983.05	25792		1986.05	88677	
1983.06	26018	25261.67	1986.06	88954	80311.50
1983.07	25287		1986.07	89566	
1983.08	25250		1986.08	92938	
1983.09	26403		1986.09	90336	
1983.10	25530		1986.10	90803	
1983.11	23995		1986.11	94521	
1983.12	23085	24925.00	1986.12		91632.80

SOURCE: Central Bank Statistical Bulletin

Figure 1-B

PRIVATE HOLDINGS OF GOVERNMENT SECURITIES (In Million Pesos)



___ PRIVATE HOLDINGS (1981-1986, Monthly)

Figure II-A

RATIO OF DEFICIT TO INTEREST OUTLAYS: Quarterly, 1979-1981

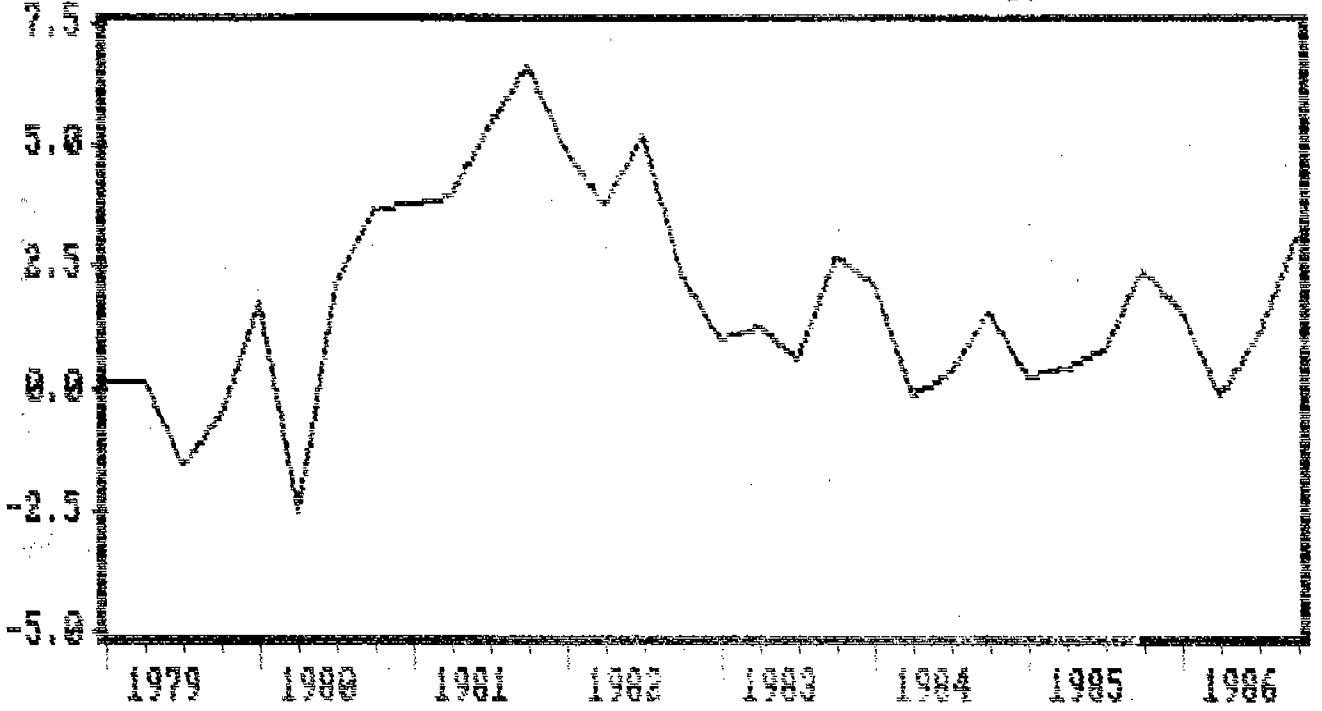


Figure II-B
RATIO OF DEFICIT TO INTEREST OUTLAYS: Monthly, 1981-1986

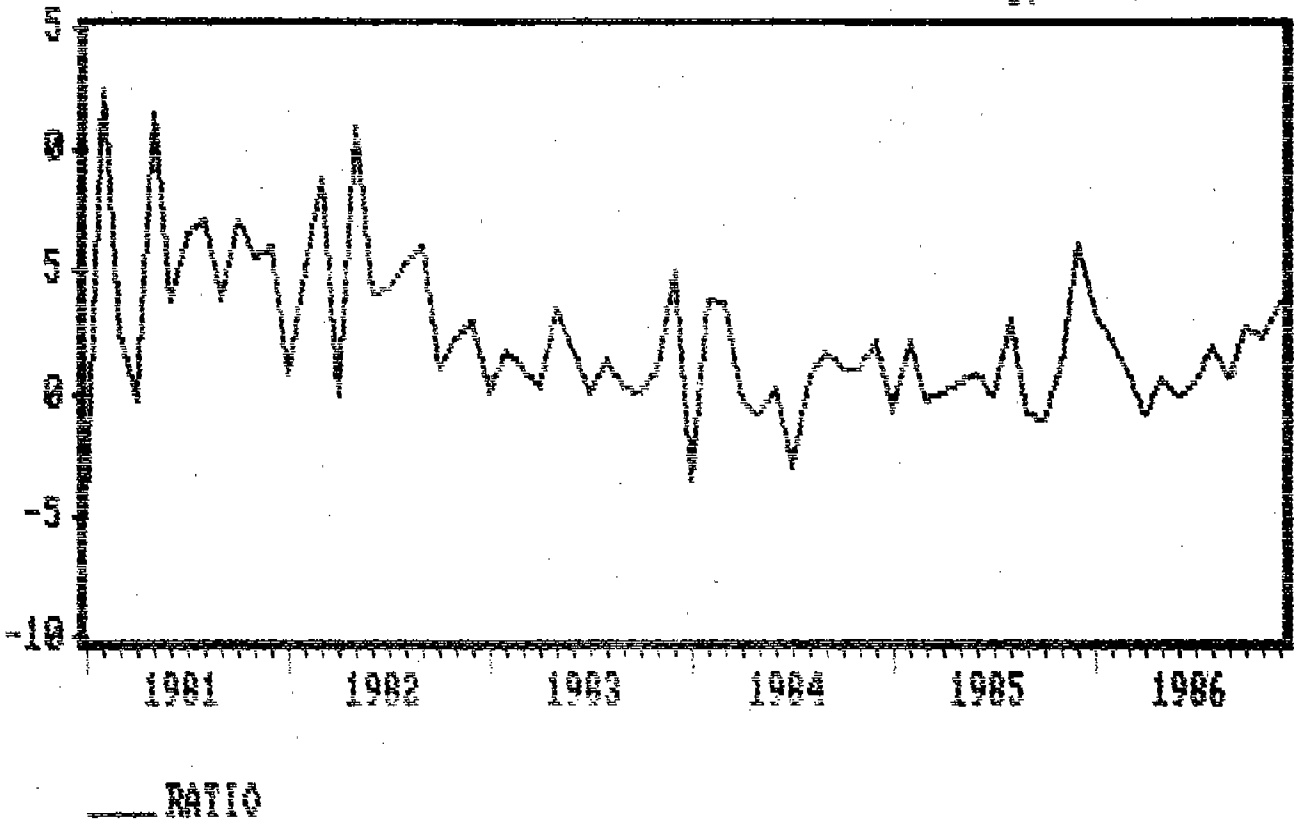


Figure II-C
BUDGET DEFICIT: Quarterly, 1979-1981 (In Million Pesos)

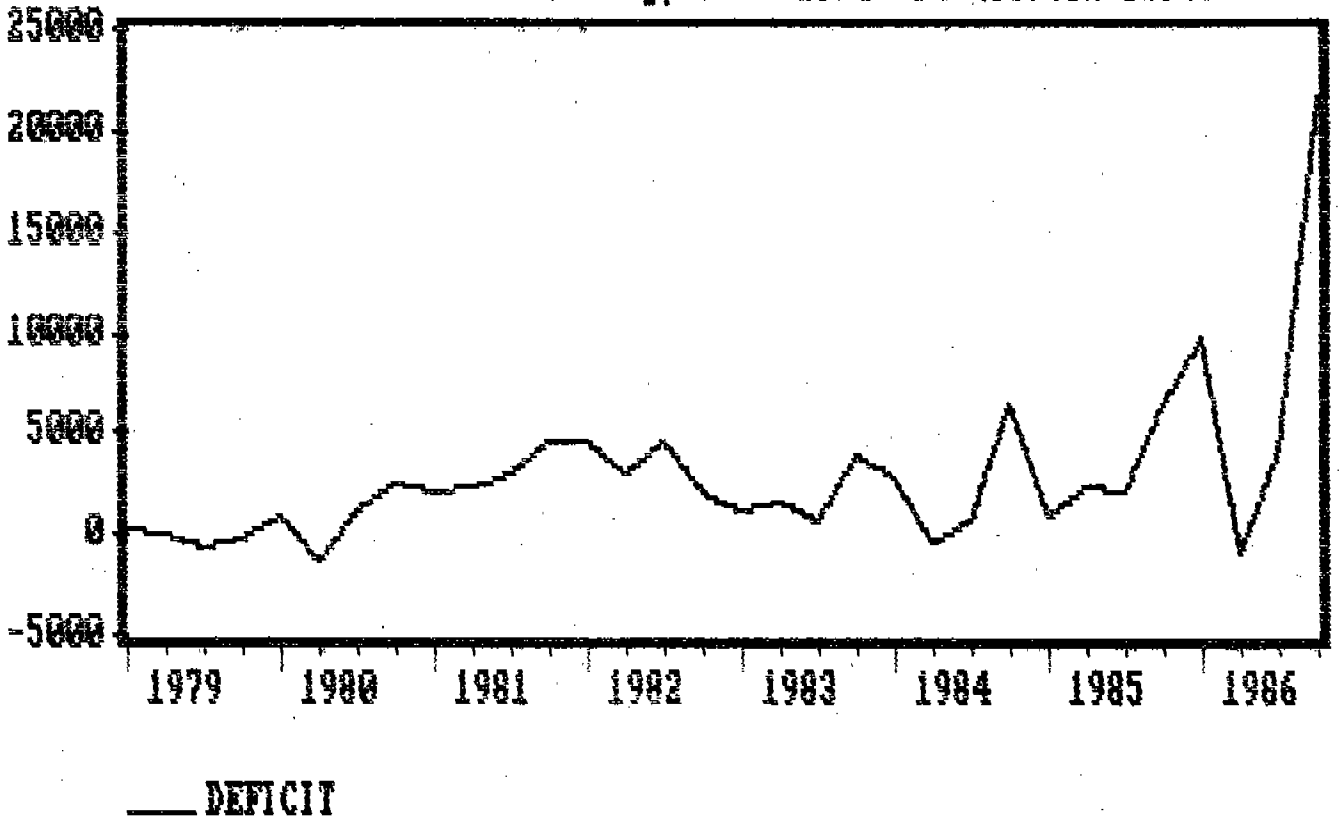


Figure II-D
BUDGET DEFICIT, Monthly: 1981-1986 (In Million Pesos)

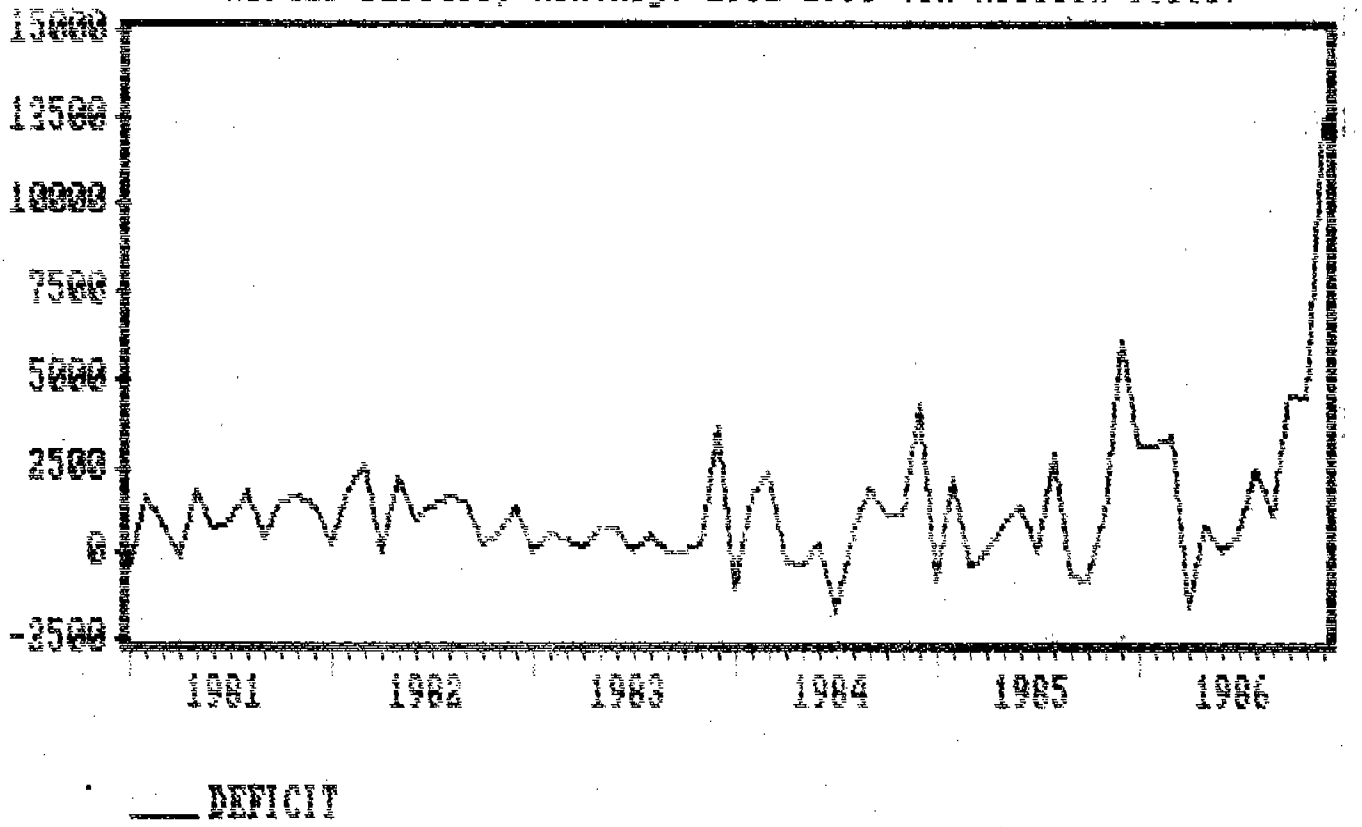


Figure II-E

INTEREST PAYMENTS, Quarterly, 1979-1986 (In Million Pesos)

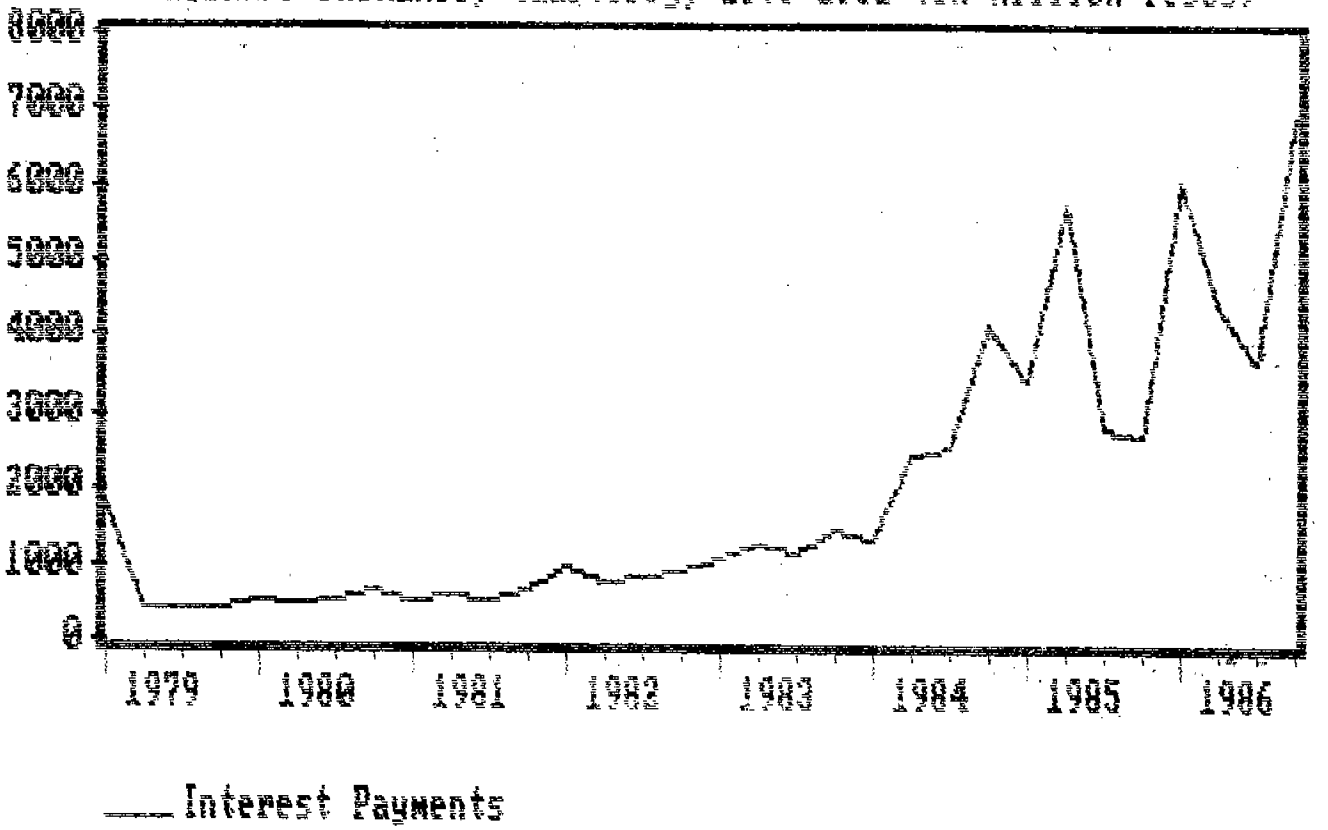


Figure II-F

INTEREST PAYMENTS: Monthly, 1981-1986 (In Million Pesos)

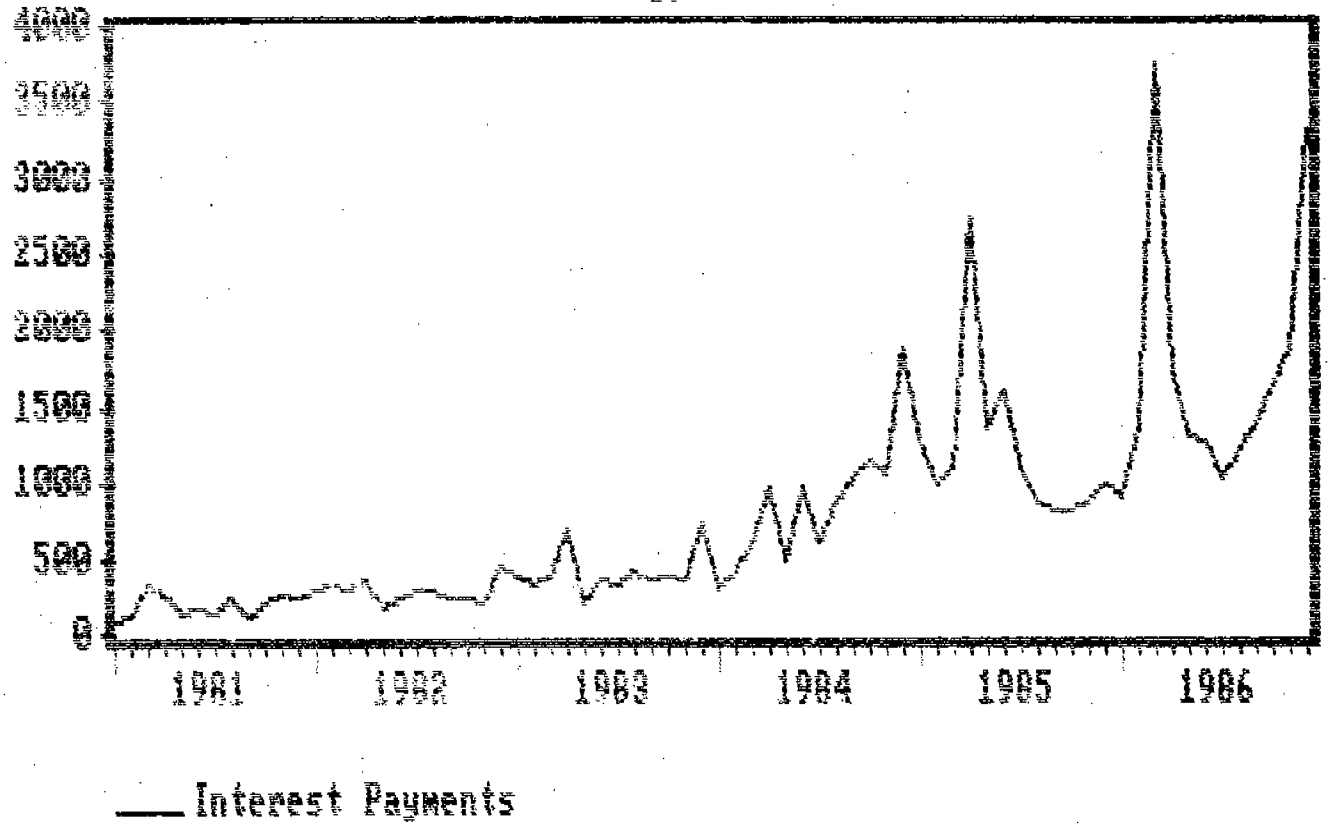


Figure III-8

FIRST DIFFERENCE OF THE RATIO OF DEFICIT TO INTEREST PAYMENTS

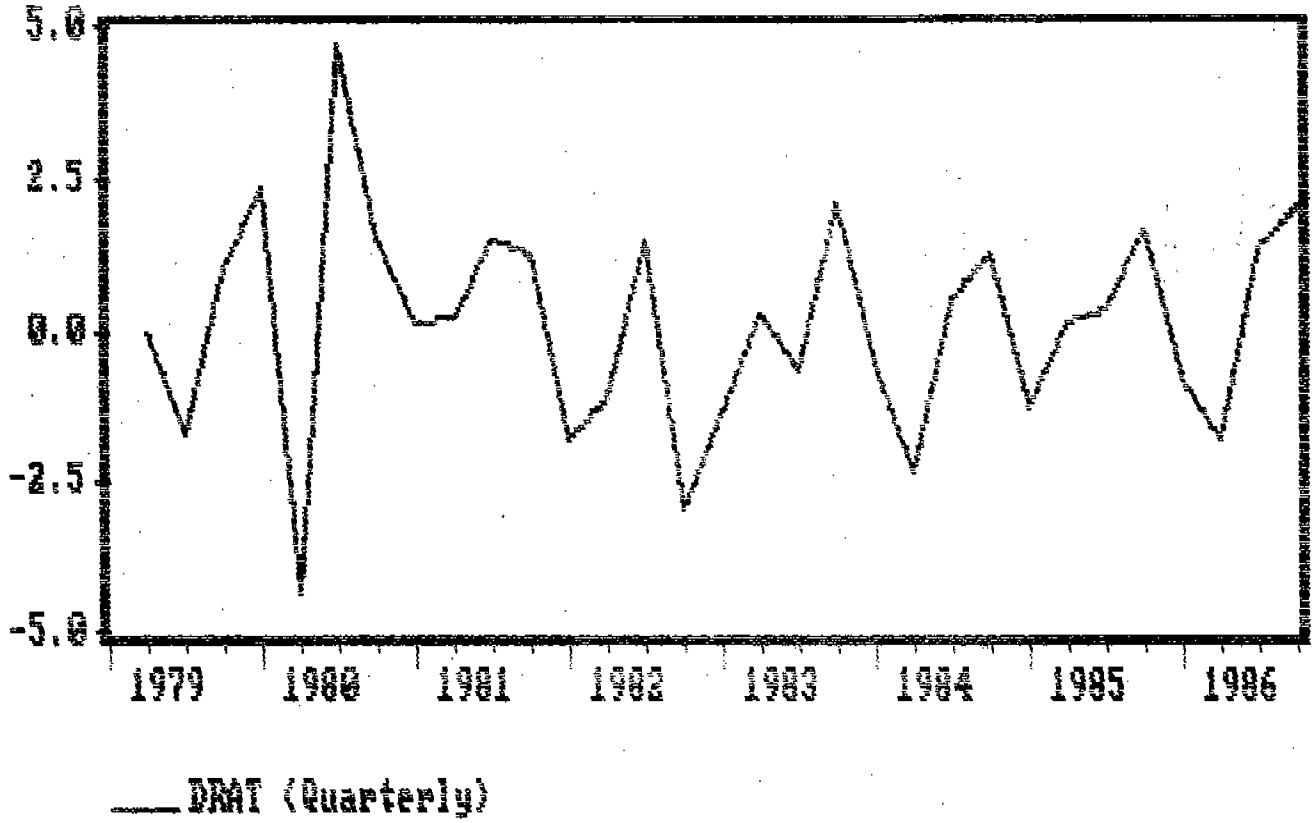
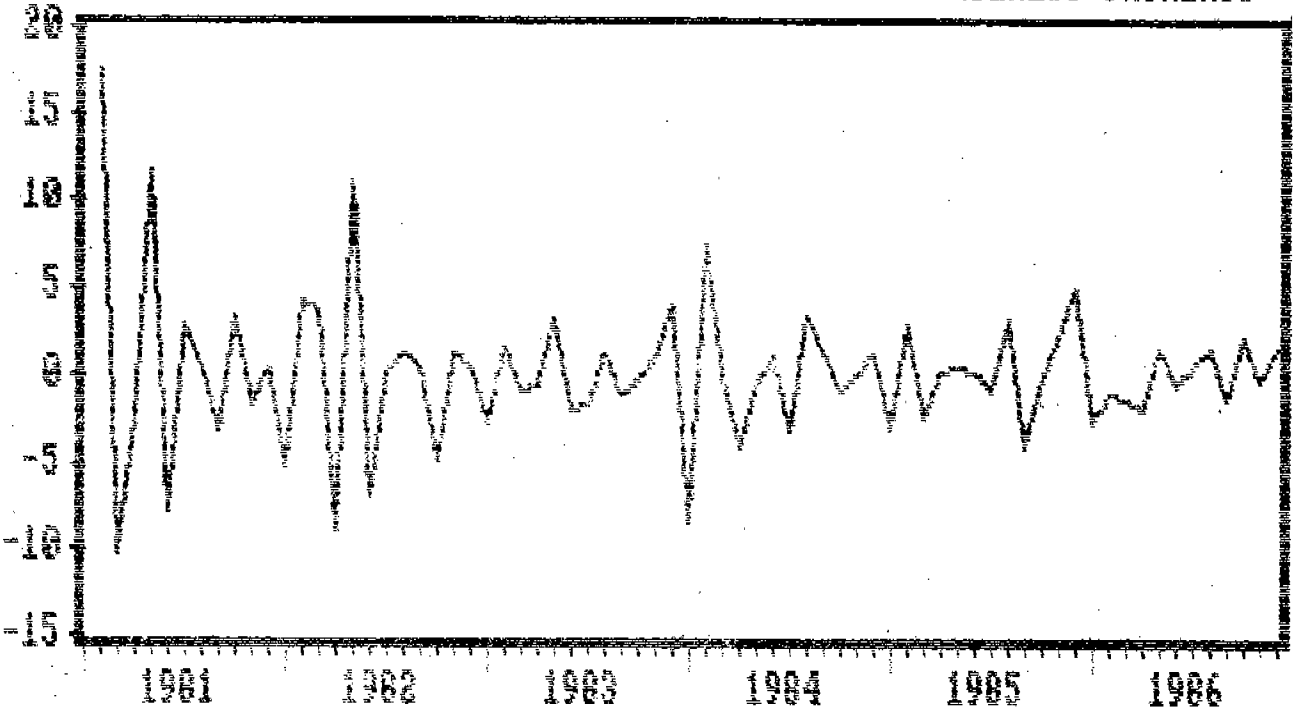


Figure III-8
FIRST DIFFERENCE OF THE RATIO OF DEFICIT TO INTEREST PAYMENTS



DRAT (Monthly: 1981-1986)

TABLE II

Results of the Joint Estimation of the Forecasting Equations and the Interest Rate Equation: January 1981-December 1986

Dependent Variable	First Differences of the Nominal 91-Day Treasury Bill Rate
Forecasting Equations include:	5 Lags each of the logs of monetized debt, government expenditures, privately-held debt, nominal exchange rate, growth rate of the index of industrial production, and 91-day Treasury Bill rate

		Innovations in the		
Constant	ρ	Log of Monetized Debt	Log of Privately-Held Debt	Log of Government Expenditures
11.184	0.92**	-1.173	18.432**	0.65**
(8.853)	(0.129)	(1.941)	(6.370)	(0.281)

NOTE: In this and in succeeding Tables, the asymptotic standard errors are in parenthesis. * indicates significance at the 5% level. ** indicates significance at the 1% level. ρ is the first-order autocorrelation coefficient.

TABLE III

Results of the Joint Estimation of the Forecasting Equations and the Interest Rate Equation: January 1981-December 1986

Dependent Variable	First Differences of the ex-post Real Rate of Interest using the 91-Day Treasury Bill Rate			
Forecasting Equations	See Table II			
		Innovation in the		
Constant	ρ	Log of Monetized Debt	Log of Privately-Held Debt	Log of Government Expenditures
9.621	0.895**	0.519	34.411**	0.526
(9.660)	(0.204)	(2.407)	(12.113)	(0.378)

NOTE: See Note in Table II.

TABLE IV

Result of the Joint Estimation of the Forecasting Equations and the Interest Rate Equation: January 1981-December 1986

Dependent Variable	First Differences of the Nominal 360-Day Treasury Bill Rate
Forecasting Equations	See Table II

		Innovation in the		
Constant	ρ	Log of Monetized Debt	Log of Privately-Held Debt	Log of Government Expenditures
2.511	0.463	1.066	5.997	0.180
(6.277)	(0.761)	(5.210)	(12.324)	(0.362)

NOTE: See Note in Table II.

TABLE V

Result of the Joint Estimation of the Forecasting Equations and the Interest Rate Equation: January 1981-December 1986

Dependent Variable	First Differences of the Ex-Post Real Rate of Interest Using the 360-Day Treasury Bill Rate
Forecasting Equations	See Table II

		Innovation in the		
Constant	ρ	Log of Monetized Debt	Log of Privately-Held Debt	Log of Government Expenditures
2.339	0.392	-0.540	1.669	0.172
(5.413)	(0.694)	(4.987)	(15.316)	(0.311)

NOTE: See Note in Table II. The estimates did not converge despite the use of a tuning option in the computer procedure.

TABLE VI

Result of the Joint Estimation of the Forecasting Equations and the Interest Rate Equation: January 1981-December 1986

Dependent Variable	First Differences of the Nominal 91-day Treasury Bill Rate
Forecasting Equations	10 lags of the growth rate of monetized debt, privately-held debt, and government expenditures

		Innovation in the		
Constant	ρ	Log of Monetized Debt	Log of Privately-Held Debt	Log of Government Expenditures
-0.060	-0.020	31.866**	2.853	-6.270
(1.145)	(0.443)	(13.602)	(2.912)	(4.629)

NOTE: See Note in Table II.

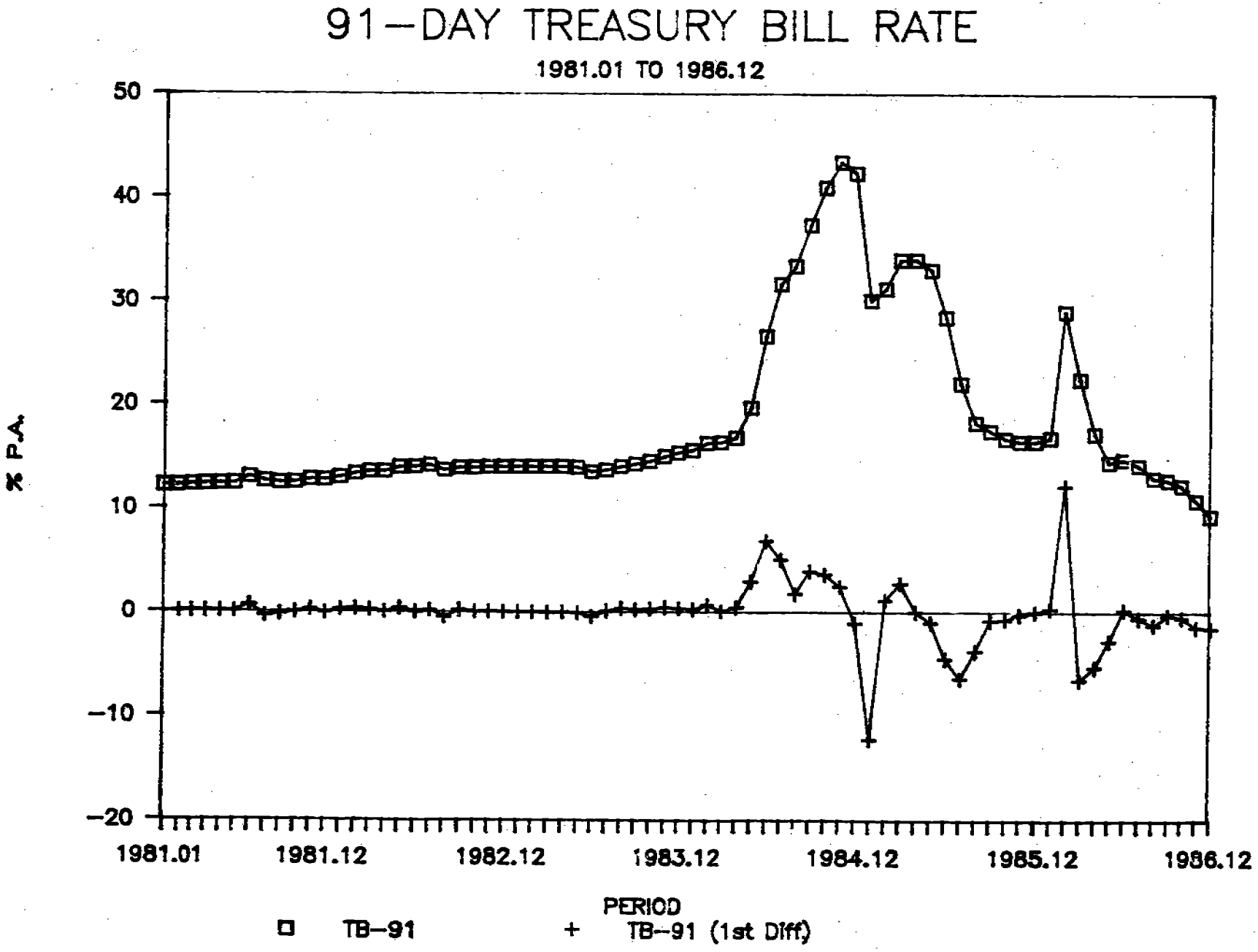

91-DAY TREASURY BILL RATE
1981.01 TO 1986.12
% P.A.
50
40
30
20
10
0
-10
-20
1981.01
1981.12
1982.12
1983.12
1984.12
1985.12
1986.12
PERIOD
TB-91
TB-91 (1st Diff)

Figure IV-A

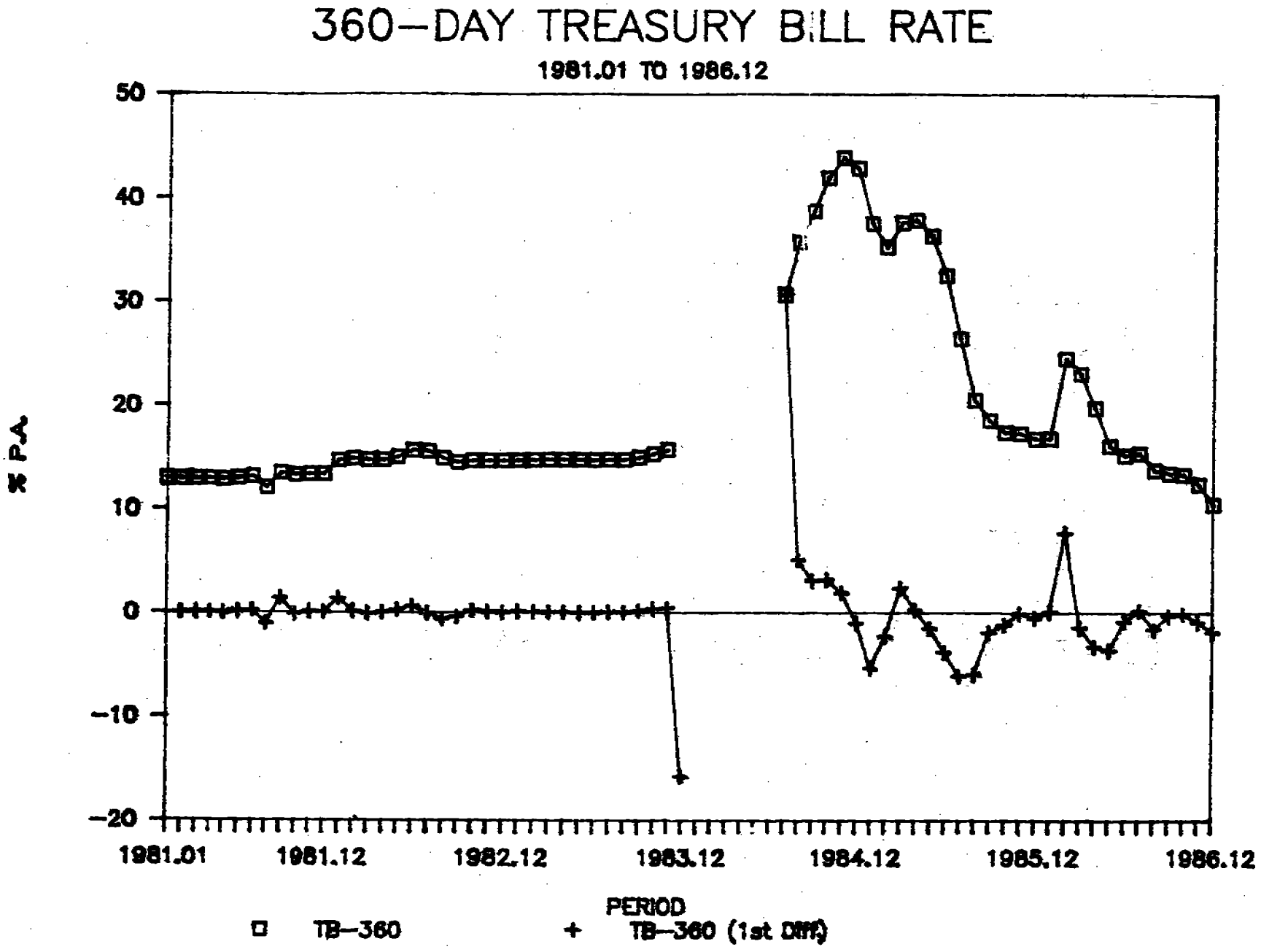

360-DAY TREASURY BILL RATE
1981.01 TO 1986.12
% PA
50
40
30
20
10
0
-10
-20
1981.01
1981.12
1982.12
1983.12
1984.12
1985.12
1986.12
PERIOD
TB-360
TB-360 (1st Diff)

Figure IV-B

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APPENDIX A.I

RATIO OF INTEREST PAYMENTS TO THE DEFICIT

Calendar Year and Quarter	δ
1979.1	0.175
1979.2	-1.551
1979.3	-0.544
1979.4	-2.337
1980.1	1.746
1980.2	-2.561
1980.3	2.156
1980.4	3.638
1981.1	3.747
1981.2	3.940
1981.3	5.418
1981.4	6.642
1982.1	4.882
1982.2	3.773
1982.3	5.227
1982.4	2.328
1983.1	0.975
1983.2	1.258
1983.3	0.645
1983.4	2.713
1984.1	2.143
1984.2	-0.148
1984.3	0.321
1984.4	1.581
1985.1	0.290
1985.2	0.397
1985.3	0.779
1985.4	2.396
1986.1	1.595
1986.2	-0.177
1986.3	1.124
1986.4	3.123

class boundaries	frequency (fi)	cum.freq. (Fi)	tally
-2.561 to -1.027	3	3	///
-1.027 to 0.507	7	10	///////
0.507 to 2.041	8	18	////////
2.041 to 3.575	6	24	//////
3.575 to 5.109	5	29	/////
5.109 to 6.643	3	32	///
	32		

---

std. deviation = 2.1672385051

(n+1)/4 = 8.25 Q1 class : -1.027 to 0.507

$$Q1 = l + c * \frac{[(n+1)/4] - F_{Q1}}{f_{Q1}} = -1.027 + 1.534[(8.25-3)/7]$$

Q1 = 0.1235

3*[(n+1)/4] = 24.7 Q3 class : 3.575 to to 5.109

$$Q3 = l + c * \frac{3*[(n+1)/4] - F_{Q3}}{f_{Q3}} = 3.575 + 1.534[(24.75-24)/5]$$

Q3 = 3.8051

Interquartile Range = Q3 - Q1 = 3.6816

pseudo-std.devn.= 2.7271111111

difference bet. hist. std.devn. and pseudo-std.devn. = 0.559872

outlying values of δ :
lower bound : -5.3989
upper bound : 9.3275

ave. value of δ: 1.7403619609

APPENDIX A.II

MONTHLY, January 1981 - December 1986

CLASS BOUNDARIES	FREQUENCY (fi)	TALLY	CUM. FREQ. (Fi)
-4.8809325 to -2.3846580	3	|||	3
-2.3846580 to 0.1116165	14	||||||||||||||	17
0.1116165 to 2.6078910	29	||||||||||||||||||||||||||	46
2.6078910 to 5.1041655	13	|||||||||||||	59
5.1041655 to 7.6004400	9	|||||||||	68
7.6004400 to 10.0967140	1	|	69
10.096714 to 12.5929880	3	|||	72
	n = 72		

n = no. of observations = 72
k = no. of classes = 7

$$k = 1 + 3.222(\log_{10} n) = 1 + 5.98 = 6.98$$

c = class width = 2.4962745

$$c = \frac{\text{range}}{\text{highest value - lowest value}}$$

Q class : 0.1116165 to 2.607891
1

Q class : 2.607891 to 5.1041655
3

x = Interquartile Range = $Q_3 - Q_1$ = 4.051371

ave. value of d:	2.334259
historical std. deviation of d:	3.199944
pseudo-std. devn..	3.001015

outlying values of d:
lower bound : -5.8412428
upper bound : 10.564241

RATIO OF BUDGET DEFICIT
TO INTEREST PAYMENTS
Monthly, 1981 - 1986

Period	δ	Period	δ
1981.01	-4.880932	1984.01	-3.440130
1981.02	12.592990	1984.02	3.911058
1981.03	2.323458	1984.03	3.787376
1981.04	-0.216155	1984.04	-0.246377
1981.05	11.480660	1984.05	-0.798316
1981.06	3.826011	1984.06	0.268519
1981.07	6.662032	1984.07	-2.861563
1981.08	7.190821	1984.08	0.700893
1981.09	3.839429	1984.09	1.888350
1981.10	7.203055	1984.10	1.001708
1981.11	5.578358	1984.11	0.989583
1981.12	6.002564	1984.12	2.265650
1982.01	0.905904	1985.01	-0.637838
1982.02	5.126977	1985.02	2.130137
1982.03	8.814388	1985.03	-0.325792
1982.04	0.038844	1985.04	0.024790
1982.05	11.080910	1985.05	0.577064
1982.06	4.086339	1985.06	0.878412
1982.07	4.265373	1985.07	-0.006375
1982.08	5.527750	1985.08	3.234823
1982.09	6.037118	1985.09	-0.784146
1982.10	1.145547	1985.10	-0.989183
1982.11	2.408244	1985.11	1.269448
1982.12	2.937626	1985.12	6.237664
1983.01	0.184416	1986.01	3.417486
1983.02	1.862687	1986.02	2.268169
1983.03	0.992228	1986.03	0.903810
1983.04	0.306931	1986.04	-0.915778
1983.05	3.577670	1986.05	0.646519
1983.06	1.793956	1986.06	0.005418
1983.07	0.060172	1986.07	0.548356
1983.08	1.455189	1986.08	2.022746
1983.09	0.258333	1986.09	0.755747
1983.10	0.042714	1986.10	2.748046
1983.11	0.977337	1986.11	2.328745
1983.12	5.010974	1986.12	3.761747

APPENDIX A.III

SMPL 1979.2 - 1986.4
31 Observations
IDENT DRAT

Autocorrelations	Partial Autocorrelations		ac	pac
***	***	1	-0.2563	-0.2583
**	***	2	-0.2398	-0.3284
***	*	3	0.2697	0.1232
	*	4	0.0464	0.1113
	*	5	-0.0483	0.1252
**	**	6	-0.1669	-0.1914
	**	7	-0.0214	-0.2030
**		8	0.1703	0.0173
**	*	9	-0.2084	-0.1131
		10	-0.0411	-0.0050
	**	11	-0.0089	-0.1759
*	**	12	-0.0591	-0.1585
**	**	13	0.2210	0.1976
*		14	-0.1488	0.0380
*	*	15	-0.1477	-0.1466
**	**	16	0.1768	-0.1696
	*	17	-0.0185	-0.1127
**	**	18	-0.1990	-0.2124
*	*	19	0.0920	0.0505
		20	0.0466	-0.0211
		21	0.0392	0.0051
*	*	22	-0.1034	-0.0668
	*	23	0.0075	-0.0751
**		24	0.1558	0.0013

S.E. of Correlations .1796053 Q-Stat. (24 lags) 16.07851

SMPL 1979.4 - 1986.4
29 Observations
LS // Dependent Variable is DRAT
Convergence achieved after 2 iterations

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	0.0969968	0.1839424	0.5273217	0.602
AR(1)	-0.3767495	0.1850491	-2.0359437	0.052
AR(2)	-0.3646029	0.1866992	-1.9528893	0.062

R-squared	0.190953	Mean of dependent var	0.161152
Adjusted R-squared	0.128718	S.D. of dependent var	1.841663
S.E. of regression	1.719054	Sum of squared resid	76.83377
Durbin-Watson stat	1.862002	Log likelihood	-55.27727

SMPL 1979.1 - 1986.4
32 Observations
IDENT RATIO

Autocorrelations	Partial Autocorrelations		ac	pac
******	******	1	0.6209	0.6209
****	*	2	0.4471	0.1002
****	**	3	0.4375	0.2064
**	**	4	0.2261	-0.2243
	**	5	0.0002	-0.2364
**	****	6	-0.2296	-0.3809
***		7	-0.2774	0.0062
***	*	8	-0.2690	0.0843
****	*	9	-0.4340	-0.0902
****		10	-0.4118	-0.0246
***	*	11	-0.3343	-0.1015
***		12	-0.2552	0.0272
**	*	13	-0.1592	0.0550
**	***	14	-0.2154	-0.2659
**	**	15	-0.1503	-0.1941
		16	-0.0105	0.0026
		17	-0.0299	0.0329
*	*	18	-0.0643	-0.0702
	*	19	0.0486	0.1051
*	*	20	0.1065	-0.0771
*		21	0.1023	-0.0282
	*	22	0.0487	-0.1295
*	*	23	0.0859	-0.0837
*	*	24	0.1315	-0.0766

S.E. of Correlations .1767767 Q-Stat. (24 lags) 55.24816

APPENDIX A.IV

SMPL 1981.02 - 1986.12
71 Observations
IDENT DRAT

Autocorrelations	Partial Autocorrelations		ac	pac
*****	*****	1	-0.5310	-0.5310
*	*****	2	-0.0747	-0.4967
***		3	0.3325	0.0173
**		4	-0.2259	0.0158
		5	0.0044	-0.0085
*		6	0.1037	-0.0230
	*	7	-0.0281	0.0886
*	*	8	-0.1268	-0.1036
*	*	9	0.1108	-0.1003
*	**	10	0.1290	0.1985
****	**	11	-0.3576	-0.1573
***	*	12	0.3311	0.0550
*		13	-0.0707	0.0122
**	*	14	-0.1999	-0.0517
***	*	15	0.2936	0.0726
*	*	16	-0.1163	0.0906
*		17	-0.0942	0.0210
*	*	18	0.0932	-0.0930
*	*	19	0.0687	0.0676
**	**	20	-0.2482	-0.2109
**		21	0.2093	0.0487
	*	22	-0.0112	-0.0898
**		23	-0.1874	-0.0238
**		24	0.2052	0.0161

S.E. of Correlations .1186782 Q-Stat. (24 lags) 77.58967

SMPL 1981.04 - 1986.12
69 Observations
LS // Dependent Variable is DRAT
Convergence achieved after 1 iterations

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	-0.0211712	0.1178648	-0.1796224	0.858
AR(1)	-0.8998889	0.0954558	-9.4272799	0.000
AR(2)	-0.5531131	0.0835280	-6.6218855	0.000

R-squared	0.577323	Mean of dependent var	0.020845
Adjusted R-squared	0.564514	S.D. of dependent var	3.633199
S.E. of regression	2.397597	Sum of squared resid	379.3992
Durbin-Watson stat	2.030102	Log likelihood	-156.7114

SMPL 1981.01 - 1986.12
72 Observations
IDENT RATIO

Autocorrelations	Partial Autocorrelations		ac	pac
*	*	1	0.0764	0.0764
***	***	2	0.2693	0.2650
*****	*****	3	0.4932	0.4954
*	*	4	0.1067	0.0603
**		5	0.2340	-0.0056
***		6	0.2819	0.0280
**	*	7	0.1757	0.1051
*	*	8	0.1242	-0.0563
***	*	9	0.2683	0.0837
**	**	10	0.2464	0.1863
	**	11	-0.0223	-0.1716
***	*	12	0.3449	0.0968
*	*	13	0.0690	-0.0827
	*	14	-0.0304	-0.1266
***		15	0.2664	0.0232
	*	16	-0.0444	-0.0626
	*	17	-0.0470	-0.1307
*	*	18	0.0555	-0.1430
		19	-0.0071	0.0301
**	**	20	-0.1780	-0.1741
*	*	21	0.0975	0.1412
		22	-0.0452	-0.0269
**		23	-0.1609	0.0363
*		24	0.0663	-0.0144

S.E. of Correlations .1178511 Q-Stat. (24 lags) 66.47027

Appendix B

Results of the Likelihood Ratio Tests on the Validity of the Cross-Equation Constraints

Table I :	Likelihood ratio statistic:	$\chi^2(93)$ =	2.82927528
	Marginal significance level:		0.010719
Table II :	Likelihood ratio statistic:	$\chi^2(93)$ =	0.752412528
	Marginal significance level:		0.010719
Table III :	Likelihood ratio statistic:	$\chi^2(93)$ =	*
Table IV :	Likelihood ratio statistic:	$\chi^2(93)$ =	0.200342304
	Marginal significance level		0.010719
Table V :	Likelihood ratio statistic:	$\chi^2(93)$ =	*

NOTE: Marginal significance level is the probability of getting that value of the likelihood ratio statistic or higher under the null hypothesis.

* The χ^2 statistic was negative.

APPENDIX C
LIST OF VARIABLES

VARIABLE	DESCRIPTION	PERIOD	UNIT	SOURCE
CB	Holdings of Outstanding Gov't Securities -- by the Central Bank	1981-1986 (monthly)	million P	Central Bank
REQRES	Required Reserves --Deposit Money Banks, Thrift Banks, Specialized Gov't Banks	1981-1986 (monthly)	million P	Central Bank
DOM	Holdings of Outstanding Gov't Securities -- by the domestic sector (Commercial Banks, Savings and Other Banks, Trust Banks, Semi-Gov't Entities, Private)	1981-1986 (monthly)	million P	Central Bank
FOR	Holdings of Outstanding Gov't Securities -- by the foreign sector	1981-1986 (monthly)	million P	Central Bank
TREGS	Reserve-Eligible Securities --Deposit Money Banks, Thrift Banks, Specialized Gov't Banks	1981-1986 (monthly)	million P	Central Bank
MC	Money Creation = CB - REQRES	1981-1986 (monthly)		generated
PD	Publicly-held Debt = (DOM + FOR) - TREGS	1981-1986 (monthly)		generated
GE	Government Expenditures	1981-1986 (monthly)	million P	Bureau of the Treasury
TB91n	91-day Treasury Bill Rates (nominal, end-of-month)	1981-1986 (monthly)	percent/ annum	Central Bank
TB360N	360-day Treasury Bill Rates (nominal, average) /*	1981-1986 (monthly)	percent/ annum	Central Bank
ER	Exchange Rate (end-of-month)	1981-1986 (monthly)	P/US$	Far Eastern Economic Review
PRODN	Index of the Value of Production	1981-1986 (monthly)	1985=100	Industry Trends (NEDA)
CPI	Consumer Price Index	1981-1986 (monthly)	1978=100	Central Bank

Note: All data are for the end of the month.
/* Point-in-time data for the 360-day T-Bill rate are not available.