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Long-Term and Short-Term Interest Rates in the United States: An Empirical Analysis

Prepared by A. Lans Bovenberg*

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Ved P. Gandhi

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Abstract

This study presents some new empirical evidence on the determination of interest rates in the United States. The empirical results generally support the view that fiscal deficits raise real interest rates. The paper offers various reasons why several previous empirical studies have failed to find a significant positive effect of budget deficits on domestic interest rates in the United States. In addition, it discusses both theoretical considerations and other empirical evidence that suggest that neither the response of private saving nor international capital mobility prevents budget deficits from raising interest rates.

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Contents

Summary

During the 1980s real interest rates in the United States have been high by historical standards. Many economists have attributed the high level of interest rates to the large current and projected budget deficits of the federal government. Several empirical studies have failed, however, to find a significant positive effect of fiscal deficits on interest rates in the United States.

This paper addresses the ongoing debate on the determination of interest rates in the United States. In particular, the paper examines whether fiscal policy has contributed to the historically high levels of real interest rates in the United States in recent years. It discusses some of the reasons why several previous studies have been unable to identify a significant positive effect of budget deficits on interest rates. Among these reasons are omission of explanatory variables, simultaneous equation bias, collinearity among explanatory variables, and misspecification of anticipated budget deficits.

In addition, the current study presents some new empirical evidence supporting the view that fiscal deficits raise real interest rates. Although the paper finds it difficult to isolate the effect of fiscal policy on short-term interest rates empirically, which may be due to frequent changes in the monetary policy regime, it finds that anticipated deficits significantly affect long-term interest rates. The specific parameter estimates suggest that the increase in projected deficits in the early 1980s accounted for most of the rise in the long-term interest rates during the period 1977-83.

The presented empirical evidence is based on a highly stylized model and needs to be viewed as preliminary. The paper, however, presents also other empirical evidence as well as theoretical considerations that suggest that neither the response of private saving nor international capital mobility has prevented budget deficits in the United States from raising real domestic interest rates.

I. Introduction

During the 1980s real interest rates in the United States have been high by historical standards. Many economists have attributed the high level of interest rates to the large current and projected budget deficits of the federal government. Some empirical studies have failed, however, to find a significant positive effect of fiscal deficits on interest rates in the United States (see, for example, U.S. Treasury (1984), Evans (1985), and Spiro (1987)). This paper presents some new evidence on the determination of interest rates in the United States and in particular on the effect of fiscal deficits on those rates. 1/ It discusses the evidence against the background of some other empirical studies that have examined this relationship. These studies are U.S. Treasury (1984) and Evans (1985), which found that budget deficits do not have a significant positive effect on interest rates, as well as Muller and Price (1984) and Feldstein (1986b), which did identify a positive relationship between deficits and interest rates.

The paper is structured as follows. Section II deals with short-term interest rates. Subsection II.1 discusses the data used and the structural equations tested and compares them with those adopted in other empirical studies, and subsection II.2 contains the empirical results on short-term interest rates. Section III focuses on long-term interest rates, with subsection III.1 outlining the framework adopted and discussing its relationship to other studies, and subsection III.2 describing the empirical results. Section IV summarizes the discussion.

II. Short-Term Interest Rates

1. Empirical framework and relationship with other studies

This section uses the loanable funds framework developed in Tanzi (1985) to explain short-term interest rates in the United States. 2/ The dependent variable is the rate of interest on U.S. Treasury bills of one-year maturity. The two nonfiscal independent variables are measures of expected inflation and economic activity. Expected inflation is measured by the survey data on expected inflation covering the next year as reported by the Livingston index. This index is the one most commonly used in empirical work relating to expected inflation (see Carlson (1977) and Tanzi (1985)).

1/ Tanzi (1987) briefly reports on some of the evidence that is described more fully in the present study.

2/ However, in contrast to Tanzi (1985), who uses annual data, the empirical results reported in this section are based on semiannual data to better identify the dynamics of the relation between short-term interest rates and fiscal variables.

a. Economic activity variable

The variable measuring economic activity, G, is defined as

$$G = \frac{\text{Actual GNP} - \text{Potential GNP}}{\text{Potential GNP}} \times 100 \qquad (1)$$

The data source for actual and potential GNP is the March 1985 issue of the Survey of Current Business, published by the U.S. Department of Commerce.

The incorporation of a variable that measures economic activity is important in order to isolate the effect of fiscal variables on short-term interest rates, because economic activity affects both short-term interest rates and fiscal deficits. To illustrate, Evans (1985) omits such a variable. At the same time, he measures the fiscal effect by the actual fiscal deficit, which tends to be negatively correlated with economic activity. The estimated coefficient for the fiscal deficit, therefore, is likely to be biased downward, because it picks up some of the interest rate effect of the excluded activity variable. Thus, the negative correlation between short-term interest rates and fiscal deficits that Evans finds may partly reflect the effect of the business cycle on interest rates and fiscal deficits rather than purely the causal effect of deficits on interest rates.

Evans omits other explanatory variables that are correlated with the actual deficit when he analyzes three war periods. 1/ The results for these periods are difficult to interpret because during wars governments affected domestic savings, investment, and interest rates through many channels other than the recorded fiscal deficits. To illustrate, implicit consumption and investment taxes were temporarily high during these periods because of the scarcity of many goods and rationing. Therefore, households and firms delayed their expenditures, thereby raising net national saving. These developments kept interest rates at lower levels than if the large fiscal deficits that were recorded during the wars had occurred during peacetime. Evans, however, does not include a variable that reflects the implicit expenditure taxes. Consequently, the coefficient for the fiscal deficit reflects the negative effect of these taxes on domestic interest rates because the budget deficit was positively correlated with these implicit taxes. The increase in net private savings, however, reflects the expenditure effect of the wartime regulations rather than a causal relationship with the large fiscal deficits. When studying the 1979-83 period, which is the only peacetime period he explores, Evans omits expected inflation as

1/ In addition to these war periods, Evans (1985) analyzes the period between October 1979 and December 1983.

an explanatory variable. Accordingly, the coefficient of the fiscal deficit, which is negatively correlated with expected inflation during this period, may also be biased downward during this period.

b. Fiscal variables

As regards the fiscal variables, the current analysis adopts cyclically adjusted measures for federal expenditures, revenues, and the deficit, all as percentages of trend GDP. These measures were prepared by de Leeuw and Holloway, of the U.S. Department of Commerce, and are based on a mid-cycle expansion trend of GNP. Holloway (1986) explains how the series were derived and updated.

U.S. Treasury (1984) does not correct the fiscal variables for the business cycle, which gives rise to two related problems. 1/ First, it is difficult to separate the effects on interest rates of fiscal deficits from the interest rate effects of the activity variable, because actual fiscal deficits are negatively correlated with the economic activity variable. To illustrate, when fiscal deficits are added as explanatory variables to the interest rate equations in U.S. Treasury (1984), the coefficient for the activity variable becomes insignificant. This suggests that the fiscal variable is collinear with the activity variable. Moreover, the coefficient for the activity variable is sensitive to the inclusion of budgetary variables. In view of the collinearity 2/ between fiscal and nonfiscal variables, therefore, the data and the specifications used by the U.S. Treasury are not sufficiently informative to support the conclusion of the study--namely, that fiscal variables are not related to interest rates.

Second, the uncorrected deficit may cause serious simultaneous equation bias. As a result, the estimations based on ordinary least squares may have produced biased coefficients. In particular, the negative correlation between interest rates and deficits found in the U.S. Treasury study may partly reflect the effect of the business cycle on interest rates and recorded budget deficits instead of the causal effect of deficits on interest rates.

1/ Evans's failure to correct for the cycle is even more serious because he does not include a variable representing activity in the private sector. U.S. Treasury (1984) includes an activity variable as an explanatory variable.

2/ U.S. Treasury (1984) fails to scale the explanatory variables for the real growth of the economy. This makes the collinearity problem even more serious.

2. Statistical results

a. Concurrent deficits as explanatory variable

As a first step, one-year interest rates were regressed on inflationary expectations, the gap variable, and the contemporaneous cyclically adjusted deficit over the sample period, 1960-80, using semiannual data. The results are reported in equation (1) in Table 1. They suggest that the coefficient on the deficit variable is significant and negative; that is, a larger concurrent budget deficit reduces the short-term interest rate. Whereas the coefficients for the independent variables are quite similar to those in the corresponding equation reported in Tanzi (1985), unlike Tanzi (1985) the Durbin-Watson statistic indicates that serial correlation may be quite serious. Equation (2) indicates that entering cyclically adjusted expenditures and revenues separately gives the coefficients for both fiscal variables the "wrong" sign. The coefficient for expenditure, however, is not significant at the 5 percent level.

Following Tanzi (1985), the equations were re-estimated for the 1960-84 period. Equation (3) shows that both the gap variable and the deficit variable are no longer significant. When cyclically adjusted expenditures and revenues are entered separately in equation (4), the gap variable remains insignificant, but both fiscal variables become significant at the 5 percent level. Moreover, the expenditure variable has the theoretically correct sign. The revenue variable, however, retains its wrong sign. The correlation between total revenues and the marginal tax rate on interest income may explain the positive relationship between federal revenues and interest rates because rising marginal tax rates on interest income cause gross-of-tax interest rates to increase as savers attempt to maintain their net-of-tax returns (see, e.g., Darby (1975) and Tanzi (1976)). Both equations (3) and (4) needed to be corrected for serial correlation. In addition, the gap variable remained insignificant in equation (4).

Tanzi (1985) argues that structural changes, such as deregulation of financial markets, changes in tax laws stimulating investment, and modified monetary policy rules, have affected the empirical relationship explaining interest rates beginning in the early 1980s. To take account of these factors, Tanzi (1985) adds, as an independent variable, a shift dummy variable that takes the value of zero for the 1960-80 period and of unity for the 1981-84 period. Adding this dummy variable to equations (3) and (4) yields equations (5) and (6), respectively. Equation (6) is the better equation: no correction for serial correlation is necessary, while the coefficient for the gap variable is positive and

Table 1. Regressions Explaining One-Year Yield on U.S. Treasury Bills

Equation	Period	Constant	PL	G	DL	E	R	DL(-2)	V	ρ	DW	$\bar{R}^2$
(1)	1960-80	3.58	0.81	0.25	-0.38						1.43	0.86
		(14.72)**	(14.29)**	(6.17)**	(-2.55)*							
(2)	1960-80	-3.38	0.72	0.24		-0.26	0.63				1.57	0.87
		(-0.79)	(9.05)**	(6.06)**		(-1.60)	(2.93)**					
(3)	1960-84	2.58	0.81	0.01	0.19					0.57	2.18	0.77
		(2.89)**	(4.94)**	(0.08)	(0.56)							
(4)	1960-84	-26.56	0.46	0.08		0.57	1.00			0.34	2.14	0.81
		(-3.48)**	(3.24)**	(1.08)		(2.13)*	(2.35)*					
(5)	1960-84	3.45	0.54	0.09	0.12				3.21		1.51	0.78
		(7.86)**	(5.71)**	(1.49)	(0.54)				(4.79)**			
(6)	1960-84	-18.88	0.34	0.13		0.29	0.92		2.44		1.91	0.83
		(-3.31)**	(3.46)**	(2.51)*		(1.49)	(2.84)**		(3.98)**			
(7)	1960-84	2.86	0.40	-0.97				0.67	2.36		1.63	0.80
		(7.39)**	(3.88)**	(-1.44)				(2.76)**	(3.69)**			
(8)	1960-84	2.97	0.47					0.57	2.76		1.61	0.79
		(7.90)**	(4.96)**					(2.49)*	(4.85)**			

Note: Semiannual data were used, with Cochrane-Orcutt autocorrelation correction in equations (3) and (4); t-statistics appear in parentheses; two asterisks indicate significance at the 1 percent level, and one asterisk indicates significance at the 5 percent level; PL is the Livingston survey inflation expectations; G is the economic activity variable defined in equation (1) in the text; DL is the cyclically adjusted federal government deficit as a percent of trend GNP; E is cyclically adjusted federal government expenditures as a percent of trend GNP; R is cyclically adjusted federal government revenues as a percent of trend GNP; DL(-2) denotes the value of DL two years ago; V is a dummy variable that is zero for the 1960-80 period and unity for the 1981-84 period; ρ denotes the coefficient of first-order autocorrelation; DW is the Durbin-Watson test statistic; and $\bar{R}^2$ is the adjusted coefficient of determination.

significant at the 5 percent level. The coefficient for inflation, however, is rather small and differs significantly from unity, which is the value predicted by the traditional Fisher hypothesis. 1/

The coefficient of the dummy variable is highly significant. Although this coefficient is somewhat smaller than in the results reported in Tanzi (1985), it suggests a substantial effect of recent structural changes. In particular, the changes peculiar to the 1981-84 period raised interest rates by about 2.5 percentage points.

b. Lagged deficits as explanatory variable

It has been argued that government deficits have a lagged effect on interest rates because of either delays in portfolio adjustment in combination with elastic foreign capital inflows (see, e.g., Hoelscher (1986) and Spiro (1987)) or the prediction of public demand for loanable funds on the basis of fiscal deficits in previous periods. In order to test this hypothesis the deficit variable was lagged by two years.

Replacing the concurrent deficit variable by the corresponding lagged variable also prevents the simultaneous equation bias caused by the endogenous feedback from interest rates to the public deficit. This feedback may occur not only if interest expenditures on public debt are sensitive to the contemporaneous interest rate but also if the stance of fiscal policy reacts to interest rates. 2/

Equations (7) and (8) in Table 1 show the results of lagging the deficit variable. Whereas the coefficient of the lagged deficit variable is significant and has the correct sign in equation (7), the coefficient for the gap variable has the wrong sign, although it is not significant at the 5 percent level. Removing the activity variable from equation (7) yields equation (8), in which the coefficient for the lagged deficit remains both positive and significant at the 5 percent level.

1/ The Fisherian theory, which ignores the effect of taxes, predicts that the nominal interest rate increases 1 percentage point for every percentage point rise in the expected rate of inflation. Darby (1975), and Tanzi (1976) amended the Fisher hypothesis for the effect of taxes on interest income. They show that in the presence of positive marginal tax rates on interest income, every percentage point rise in the expected rate of inflation causes the nominal interest rate to increase by more than 1 percentage point to compensate lenders for additional taxes on interest income. More recent studies exploring the role of both corporate and personal taxation in the determination of interest rates include Dewald (1985) and Feldstein (1986b).

2/ Kremers (1987) argues that at least until the early 1980s fiscal policy in the United States responded to interest rates because the fiscal authorities pursued a target for real interest payments on federal debt.

III. Long-Term Interest Rates

The relationship between long-term interest rates and fiscal deficits is of particular interest for at least three reasons. First, economists generally theorize that long-term interest rates transmit most of the crowding out effects of fiscal deficits to the real side of the economy because interest-sensitive components of private spending, such as business fixed investment and home construction, are more sensitive to variations in long-term interest rates than to variations in short-term rates. Second, fiscal deficits may have larger effects on long-term interest rates than on short-term rates because the foreign supply of short-term credit is more elastic than the foreign supply of long-term credit. This is because long-term foreign investment in the United States is generally riskier than short-term foreign investment in view of the high costs of foreign exchange cover for long-term investments. 1/ Third, fundamental fiscal effects may play the most important role in the determination of long-term interest rates. In the explanation of short-run rates, in contrast, monetary factors and transitory factors may dominate. Consequently, short-run rates may be more volatile and more difficult to explain, particularly when the monetary policy regime is changing. In fact, Kaufman and Lombra (1986) and Peek and Wilcox (1987) suggest that changes in the monetary policy regime have substantially affected the determination of short-term interest rates in the United States. 2/

1. Empirical framework and relationship with other studies

In order to accommodate the analysis of long-term interest rates, this study modifies the specific framework that was used by Tanzi (1985) to explain short-term rates. The only independent nonfiscal variable is the rate of inflation that is expected over several future years. The analysis excludes the gap variable, which reflects short-term economic fluctuations, because cyclical fluctuations are much less likely to affect yields on long-term bonds than those on shorter-term financial instruments (see, e.g., Tanzi (1985), p. 571).

As regards the fiscal explanatory variable, the anticipated future deficits rather than the deficit in any given year affect long-term interest rates in forward-looking financial markets. This is because current long-term interest rates adjust whenever financial markets

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1/ Hoelscher (1986) provides additional reasons for why the supply of long-term credit is least elastic.

2/ This finding is consistent with the significant positive sign for the dummy variable in the equations explaining short-term interest rates in subsection II.2.

anticipate that future changes in asset supplies and demands will affect short-term interest rates. 1/

Muller and Price (1984) show how the failure to include forward-looking expectations of budget deficits in equations explaining long-term interest rates can give rise to misleading results. In order to explain long-term interest rates, Muller and Price (1984) formulate a general equilibrium model for financial markets and goods markets. They arrive at a reduced form equation, which contains two fiscal variables: the ratio of the expected structural fiscal deficit to private savings and the ratio of government debt to private wealth. They treat the procedure that adjusts these fiscal variables for both the business cycle and expectations as an empirical matter. They find that they need to take a centered moving average over seven to nine years of the ratio of budget deficits to savings in order to find a significant positive effect of the deficit variable on long-term interest rates. When only using backward-looking averages of the deficit-savings variable, they find a significant negative effect. They find no effect when adopting contemporaneous values for the deficit variable. In contrast to the equations using forward-looking variables, the equations adopting either backward-looking or concurrent variables suffer from serious autocorrelation, which suggests that a forward-looking deficit variable belongs in an equation explaining long-term interest rates. 2/

2. Statistical results

The regression results for the 1961-85 period are contained in Table 2. Equations (9) to (12) adopt the rate of interest on ten-year U.S. Treasury securities as the independent variable. In these equations, the expected rate of inflation from 1979 onward is measured by a survey on ten-year ahead expected inflation conducted by A.C. Becker, Aribas, Inc. Prior to 1979, a four-quarter moving average of the University of Michigan's survey of one-year ahead price expectations is used. The anticipated fiscal deficit variable is constructed as the average ratio of the cyclically adjusted federal budget deficit to trend

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1/ Feldstein (1986b) discusses extensively why regressing long-term interest rates on current deficits leads to misleading results. Feldstein (1986a) criticizes the procedure adopted in Plosser (1982). The latter study relates long-term interest rates to "surprises" in fiscal deficits, which are calculated as the residuals from vector autoregression predictions, rather than to the sequence of expected future deficits. Blanchard (1985) and Frenkel and Razin (1987) also emphasize the role of anticipated future budget deficits in the determination of long-term interest rates.

2/ Both Evans (1985) and U.S. Treasury (1984) use concurrent fiscal deficit variables rather than anticipated future deficits in equations explaining long-term interest rates. Their estimated coefficients associated with fiscal deficits, therefore, are likely to be biased downward.

Table 2. Regressions Explaining Yield on Long-Term U.S. Treasury Bonds

Equation	Period	Dependent Variable	Constant	P	DE	ρ	DW	$\bar{R}^2$	r(DE, P)
(9)	1961-85	R(10)	1.25 (1.56)	0.44 (3.17)**	1.74 (6.09)**	0.59	1.89	0.91	0.58
(10)	1961-85	R(10)	1.17 (1.37)	0.51 (5.33)**	1.59 (3.37)**	0.32	1.94	0.87	0.60
(11)	1961-85	R(10)	9.6 (2.66)*	0.24 (1.35)	0.09 (0.62)	0.93	2.24	0.85	0.07
(12)	1961-85	R(10)	1.45 (2.56)*	0.64 (5.27)**	1.13 (6.36)**		1.49	0.86	0.55
(13)	1961-85	R(3)	1.99 (2.51)*	0.64 (4.55)**	1.19 (3.90)**	0.57	2.08	0.86	0.52
(14)	1961-85	R(3)	1.85 (1.94)	0.97 (6.48)**	0.55 (3.22)**	0.54	1.91	0.87	0.13
(15)	1961-85	R(3)	1.91 (2.76)*	0.76 (6.25)**	0.86 (4.14)**	0.37	1.99	0.88	0.48

Note: See Table 1. Annual data were used in all equations except in equations (9) and (13) in which semiannual data were used. All equations have been adjusted for serial correlation by using a first-order Cochrane-Orcutt correction procedure except for equation (12); R(10) is the ten-year yield on U.S. Treasury bonds; R(3) denotes the three-year yield on U.S. Treasury bonds; P is inflation expectations (see the text); DE represents anticipated fiscal deficits as a percentage of anticipated GNP (see the text); r(DE, P) represents the correlation coefficient between P and DE.

GNP for the five subsequent years including the current year. The five-year forecast horizon corresponds to the institutional circumstances in the United States where the authorities prepare forecasts for the federal budget on a five-year basis. Although five-year forecasts of the deficit and of GNP have been prepared in recent years, they do not exist for the entire sample period. Following Feldstein (1986a, 1986b), this paper generally assumes, therefore, that the actual deficit to trend GNP ratio is the best estimate for the value of this ratio that participants in financial markets previously anticipated. For the years 1985 and beyond, the projected deficit to GNP ratio is measured by the February 1985 forecasts of the Congressional Budget Office (CBO).

Both equation (9), which uses semiannual data, and equation (10), which uses annual data, indicate that the deficit variable raises the interest rate and is highly significant. Equations (11) and (12) make more extensive use of the deficit projections of the CBO. Equation (11), which uses the CBO projections from the time they were first prepared in 1976, yields disappointing results. Equation (12), in contrast, uses these projections only from 1982 onward because the projections that were prepared by the CBO prior to 1982, and in 1980 and 1981 in particular, were generally regarded as unduly low by financial markets. Comparing equation (12) with equation (10), it appears that the coefficient for the deficit variable, although somewhat smaller, is more significant.

The size of the coefficient for the anticipated deficit in equation (12) implies that, ignoring feedback effects on expected inflation, a sustained reduction in the fiscal deficit on the order of 1 percent of GNP would reduce long-term interest rates by almost 115 basis points. The equation can also be used to interpret the factors behind the increase in the ten-year bond yield from 7.7 percent in 1977 to 11.8 percent in 1983. Since the expected deficit-GNP ratio rose by 2.5 percentage points during this period, rising fiscal deficits accounted for about two thirds of the observed increase in long-term interest rates. These results are consistent with those reported in Feldstein (1986b). 1/

Equations (13), (14), and (15) adopt the rate of interest on U.S. Treasury bonds of three years to maturity as the independent variable and use annual data. The Livingston index on one-year ahead expected inflation measures expected inflation in the equations. The fiscal variable in equation (13) is the average ratio of the actual cyclically adjusted federal budget deficits to trend GNP for the three subsequent years, which is constructed in a way analogous to the fiscal variable in

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1/ Feldstein (1986b) estimates that the rise in projected deficits in the early 1980s was responsible for about two thirds of the observed interest rate increase during the 1977-83 period. Muller and Price (1984) find that fiscal policy accounts for almost the entire rise in long-term interest rates during this period.

equations (9) and (10). As regards the construction of the deficit variable, equations (14) and (15) correspond to equations (11) and (12), respectively; equation (14) adopts all available CBO forecasts, while equation (15) uses only those prepared since 1982. The estimated effect of anticipated deficits on three-year interest rates as estimated by equations (13) and (15) is highly significant although it is somewhat smaller than the effects in the corresponding equations for the ten-year rates of interest. This result is consistent with the smaller effects of deficits on one-year yields found in Section II: fiscal deficits appear to have larger effects on longer-term interest rates than on shorter-term rates.

In contrast to the coefficient for the deficit variable in the corresponding equation for interest rates on ten-year securities (equation (11)), the coefficient for the anticipated deficit variable in equation (14) is highly significant. This may be partly because the pre-1982 CBO forecasts for one, two, and three years ahead were better approximations for expectations in financial markets than the four- and five-year ahead projections, which may have been largely discounted by financial markets as too low.

The results on long-term interest rates are stronger than those reported in Hoelscher (1986), who examines the determination of long-term interest rates over the period 1953-84. Hoelscher (1986) includes the short-term yields as an explanatory variable. His results, therefore, indicate only that fiscal deficits increase the slope of the yield curve by raising long-term yields relative to shorter-term yields. The results reported here, in contrast, indicate that fiscal deficits raise long-term interest rates in an absolute rather than a relative sense.

IV. Conclusions

This paper has addressed the ongoing debate concerning the relationship between fiscal deficits and interest rates. In particular, the paper has examined whether fiscal policy has contributed to the historically high levels of real interest rates in the United States in recent years. It discussed some of the reasons why several previous studies have been unable to identify a significant positive effect of budget deficits on interest rates. Among these reasons were omission of explanatory variables, simultaneous equation bias, collinearity among explanatory variables, and misspecification of anticipated budget deficits. At the same time, the current study presented some evidence supporting the view that fiscal deficits raise interest rates. In particular, anticipated deficits appear to affect long-term interest rates significantly. The specific parameter estimates suggest that the increase in projected deficits in the early 1980s accounted for most of the rise in the long-term interest rates during the period 1977-83.

The presented empirical evidence, however, is based on a very simple model and needs to be viewed as preliminary. Future research should be extended in at least three directions. First, an explicit model of consumer behavior could underlie the empirical tests along the lines of Leiderman and Razin (1986). Second, it would be useful to explicitly explore how financial markets form expectations concerning future fiscal policies. In this connection, future investigations could incorporate empirical studies on fiscal policy rules. 1/ Third, and related, interest rates and exchange rates should be viewed as jointly determined variables. 2/

Notwithstanding the preliminary nature of the empirical results presented in this paper, other empirical evidence together with theoretical considerations generally confirm the view that deficits do raise interest rates. Some economists have denied the existence of a relationship between fiscal deficits and interest rates on theoretical grounds. Barro (1974), for example, used the Ricardian equivalence hypothesis to claim that budget deficits arising from temporary tax cuts would affect neither national saving nor interest rates. 3/ Poterba and Summers (1987), however, argue quite convincingly that the recent U.S. experience casts significant doubt on the assumptions underlying the Ricardian equivalence view. They provide evidence that national saving declined in the face of rising fiscal deficits. Their analysis reveals that these increasing fiscal deficits played a crucial role in reducing national saving because factors other than the fiscal deficit, such as cyclical conditions, inflation, or the behavior of the stock market, failed to explain the reduction in national saving.

Others have maintained that fiscal deficits do not affect interest rates, even if deficits reduce national saving, because budget deficits can be financed by capital inflows from abroad. Whereas large capital inflows moderated the effect of the recent large budget deficits in the United States on domestic interest rates, for at least three reasons,

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1/ An interesting example of such a study is Kremers (1987). He shows that the recent experience of large fiscal deficits in the United States represents a departure from historical patterns. Leiderman and Blejer (1987) emphasize the importance of examining the signaling role of observed variables for anticipated future fiscal policy.

2/ See Ize (1987) for a discussion of the role of fiscal policy rules in determining interest rates and exchange rates.

3/ Ricardian equivalence is based on the premise that debt financing represents only a change in the timing of lump-sum taxation. Households, therefore, offset the effects of changing public savings on national saving by saving the movements in disposable income that are associated with changes in the public deficit. The literature on the Ricardian equivalence hypothesis is extensive. For a survey of this literature and a detailed discussion of the implications of relaxing the restrictive assumptions underlying the hypothesis, see Leiderman and Blejer (1987).

they did not completely eliminate this effect. First, U.S. assets and foreign assets are imperfect substitutes. Therefore, to attract foreign capital interest rates in the United States had to rise relative to those abroad. Second, the size of the U.S. economy is so large that its fiscal deficit affects interest rates in world capital markets. For this reason alone, the United States faced an upward sloping supply-of-funds schedule. Third, even in integrated world financial markets, national saving-investment imbalances put pressure on domestic resources and, therefore, on domestic real interest rates because trade flows were imperfectly elastic with respect to real exchange rates so that the purchasing power parity conditions failed to hold (see, e.g., Frankel (1985) and Bovenberg (1987)).

In conclusion, most evidence, including that presented in this paper, suggests that neither the response of private saving to budget deficits nor the international mobility of capital seems to prevent fiscal deficits from raising interest rates.

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