The Effect of Deficits

on Prices
of Financial Assets:

Theory and Evidence

The Office of the Assistant Secretary
for Economic Policy
U.S. Treasury Department

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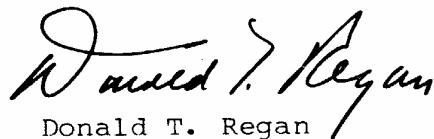for Economic Policy
U.S. Treasury Department**

FOREWORD

This study represents the U.S. Treasury Department's efforts to deal with the various economic issues associated with the Federal budget deficit. I am confident that we have researched the topic thoroughly and that the findings contained herein have significantly improved the stock of knowledge on budget deficits and economic policy.

Probably the most important single conclusion to be drawn from this study is that there are no simple answers about the effects of Federal deficits. For example, the notion that higher deficits cause interest rates to rise and the dollar exchange rate to appreciate is not at all certain. The direction in which interest rates and exchange rates move as deficits increase depends on a complex set of factors such as whether deficits are accompanied by tax rate reductions, slower money supply growth, government spending increases, or political and economic instability abroad. And, even when all of these factors are accounted for, it is still not possible to establish statistically a systematic relationship between Federal budget deficits and interest rates.

These findings, however, should not be construed as implying that deficits don't matter. Federal deficits do absorb private savings that could be better utilized by business firms for investment in the production of goods and services most desired by consumers. Yet because taxation also absorbs private savings and creates disincentives for production, the only unambiguous way to reduce the government's claim on these savings is to restrain Federal spending.

I take pleasure in making this research project available to the public and hope that scholars, writers, and policy makers will find the contents of this document as useful as I have.

Donald T. Regan

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INTRODUCTION

With the approach of the Williamsburg summit meeting last spring, Treasury Secretary Regan became increasingly aware that the finance ministers from the major industrial nations would ask the United States to reduce its deficits even if such reduction required a major tax increase. Those finance ministers put forth the thesis that the large U.S. deficits caused high U.S. real interest rates, which in turn caused investment funds to flow from their countries to the United States. They argued that if the United States would raise taxes and lower its deficits, its real interest rates would decline, the flow of investment funds to the United States from these other industrial countries would slow, and their economies would be better off.

Secretary Regan was also concerned about the high projected U.S. deficits. But with Federal budget outlays running at about 24-25 percent of GNP and tax revenues at about 19 percent of GNP, he took the position that the deficit reductions should be achieved by slowing the growth of outlays. In his analysis, spending reductions are much more effective than tax increases in promoting real growth and reducing interest rates, and monetary policy also has an important role to play.

To prepare for the Williamsburg meetings he asked Treasury staff to include in his briefing materials a background paper that reviewed the issue concerning the relationship between deficits and interest rates. Press reports of the meetings indicated that Secretary Regan, in reply to assertions that large deficits are the cause of high interest rates, remarked that economic theory showed that the effect of deficits on interest rates was ambiguous and that empirical studies of the relationship were inconclusive. In that connection, he noted that the Treasury staff briefing paper, "Government Deficit Spending and its Effects on Prices of Financial Assets," reviewed the major areas of controversy in the discussion and concluded that the issue remained open.

In October, I was asked to testify on the subject before the Joint Economic Committee. My testimony, drawn largely from the briefing paper, indicated that an annotated bibliography and the results of econometric tests of the relationship between deficits and interest rates would be submitted for the record.

To fulfill that commitment I submitted this three-part document. Part I contains the original background paper entitled, "Government Deficit Spending and Its Effects on Prices of Financial Assets." Part II is a paper entitled, "The Effect of Federal Deficits on Interest Rates: A Survey of the Literature." Finally, Part III is a paper entitled, "Interest Rates and the Federal Deficit: Some Empirical Tests."

The literature survey indicates some principal sources in mainstream macroeconomic analysis of the extent to which deficits affect interest rates. In reviewing this literature, the paper considers the measurement of the real deficit and public debt and the real interest rate; summarizes some econometric tests of the relationship between deficits and interest rates; and discusses briefly some major unsettled issues in the macroeconomic theory underlying the deficit/interest rate analysis. The conclusion from the literature reviewed is that the deficit/interest rate relationship remains an unsettled question.

"Interest Rates and the Federal Deficit" presents Treasury's empirical tests of the hypothesis that higher Federal deficits raise real interest rates. The tests make use of a particular type of equation for the determination of interest rates which is presented in a well-known 1970 article by Martin Feldstein and Otto Eckstein. The Feldstein-Eckstein equation is estimated over the same sample period as in the original article using the same data concepts, and then reestimated for the period 1965:I through 1983:II, the sample used in this paper. The reestimation indicates that the equation fits poorly in the latter period, and therefore needs to be respecified if it is to be used in the latter period. This is done and the results of the tests indicate that high deficits have had virtually no relationship with high interest rates in this time period.

Finally, I would like to acknowledge the contribution of the staff of the Office of the Assistant Secretary for Economic Policy in developing this document. Special thanks go to Jacob Dreyer, Ronald Hoffman, and James Girola.

Manuel H. Johnson
Assistant Secretary for Economic
  Policy
U.S. Treasury Department

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PART I

GOVERNMENT DEFICIT SPENDING AND ITS EFFECTS
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GOVERNMENT DEFICIT SPENDING AND ITS EFFECTS
ON PRICES OF FINANCIAL ASSETS

BACKGROUND AND COVERAGE

The current international concern among policymakers with
present and projected levels of budget deficits is of relatively
recent origin. Following the first oil crisis there was a general
increase in budget deficits, but no great anxiety about their
economic effects was evident initially. However, in 1975, as the
industrial economies were emerging from the world-wide slump, the
term "crowding out" gained popularity in the financial press.
The celebrity of this term was a gauge of heightened public
uneasiness about the ill effects that growing budget deficits
might have on economic performance.

In response to these concerns, beginning about 1976, budget
policy was directed toward bringing government deficits relative
to GNP down to pre-1973 levels. Success has been only partial.
Restrictive fiscal policies in 1976-77 resulted in a reduction of
budget deficits within the OECD area by about 1 percent of GNP.
But, in 1978, the sluggish recovery of the world economy prompted
the adoption of a program of coordinated fiscal action among OECD
countries and the Bonn Summit agreement on more expansionary
policies (the "locomotive" initiative). Further modest increases
in deficits began in that year, so that on the eve of the second
oil shock in late 1978 the general government deficit in the OECD
area was some 2 percent of GNP more than at the beginning of the
decade.

The overall policy response to the second oil shock was
meant to be less accommodative than to the first one. That is,
the policy was designed to prevent higher oil prices from being
built into domestic price expectations, even at a short-run cost
of reduced output and employment. But while monetary policy in
many OECD countries turned restrictive in 1979-80, success in
reducing government expenditures proved much more elusive, in
part because of the downturn in output and employment. Combined
budget deficits of the seven Summit countries which dropped to
their late 1970's low of 1.7 percent of GNP in 1979, started
climbing rapidly to reach 3.7 percent in 1982. The OECD forecast
for the current calendar year for these countries is a deficit
of about 4.5 percent of their GNP.

Rising concerns with deficits center, however, not so much on
current deficit-to-GNP ratios (which are virtually the same as in
1975 -- the first year of the recovery from the previous recession),
but on the prospective deficits. In popular discussions deficits
have been traditionally viewed as primarily affecting macroeconomic
targets of aggregate demand and price stability. But, whatever

are the merits of these rather restrictive interpretations of the role of budget deficits as automatic or discretionary stabilization tools, questions about the effects of government deficit spending on long-term real economic growth recently have become a focus of attention and controversy.

These effects of government deficits are by no means unambiguous, for even on a most rudimentary level of analysis the answer would depend, for instance, on whether deficits are caused by spending increases or tax cuts, or whether they are financed by monetization of the debt or by sale of government debt to the public. Similarly, conclusions may vary with such considerations as the composition of government spending that the deficits in question are supposed to finance; the kind of taxes contemplated as a substitute for deficit financing; the openness of a country's capital markets to foreign investors; public expectations generated by a prospect of continuing deficits; behavioral attitudes as reflected in, among others, saving habits; and a host of institutional arrangements determining the adaptability of labor, product and asset markets to changing economic conditions, all of which influence the effects of deficits on the allocation of resources within the private sector.

Although the relationship between budget deficits and economic growth is complex, the problem may be made analytically and empirically tractable by phrasing the discussion in terms of prices. Thus, often the analysis is reduced to the question of the link between budget deficits and the rate of inflation and the prices of financial assets, as exemplified by interest or exchange rates. Such analyses imply that the connections between interest rates and investment or saving (or between the exchange rate and exports or imports), and between real capital accumulation and economic growth are thought to be fairly well understood. Therefore, if a link between budget deficits and prices of financial assets could be established, a conceptual short-cut supposedly would allow the analyst to deduce the effects of budget deficits on selected macroeconomic aggregates themselves.

The main purpose of this paper is to review the issue concerning the effects of government deficit spending on interest rates, and to some extent on exchange rates. Frequently encountered assertions about the causal links between deficits and prices of financial assets will be critically examined and evaluated. More specifically, an attempt will be made to demonstrate that theoretical conclusions about these links have no universal validity but depend crucially, instead, on the time horizon of the analysis, the institutional and behavioral assumptions underlying the analytical model used, the accompanying circumstances and policies postulated and the size of various economic parameters estimated or assumed. In reviewing assertions about the economic effects of budget deficits, some of the concepts frequently (and rather loosely) used in popular discussion will be clarified,

empirical evidence, to the extent that it exists and is germane to the issues discussed, will be presented and the relationship between budget deficits and a number of economic variables will be examined rather extensively within alternative frameworks of economic analysis.

SOME ASSERTIONS ABOUT THE EFFECTS OF DEFICITS ON THE ECONOMY

Assessments of the impact of budget deficits on interest (and exchange) rates vary from "crucial" to "none." As indicated earlier, contradictory assessments can result from a number of causes.

For example, one analytical framework maintains that there is absolutely no difference between higher deficit spending and spending fully financed by additional taxes. According to this line of argument government borrowing is a perfect substitute for taxation: personal income that is not taxed enters the saving stream, rather than being consumed, thus giving rise to an increase in supply of loanable funds equal to the incremental increase in demand for such funds attributable to additional government spending. The argument is, of course, symmetrical. An increase in taxes accompanied by a reduction in government borrowing requirements of the same amount shifts both the supply and demand curves for loanable funds to the left equally. Therefore, there is no impact on the interest rate whether government spending is financed by taxes or borrowing.

At the other extreme is the claim that there is no substitu- tion whatsoever between taxes and government borrowing. This assertion relies on the supposition that personal income that is not taxed is devoted in its entirety to increased consumption. As a consequence, additional government borrowing is not accom- panied by increased private savings. Thus, an incremental demand for loanable funds in conjunction with their unchanged private supply inevitably results in an upward pressure on interest rates.

In the same vein, an assertion is frequently heard that the existence of arbitrage in international financial markets ensures that capital flows respond instantaneously to incipient interest rate differentials among otherwise similar financial instruments denominated in various currencies. Therefore, to the extent that government borrowing does exert upward pressure on interest rates, it must also contribute to an appreciation of a currency generated by interest-rate-induced capital inflows.

A competing line of reasoning, which introduces expectational elements into the analysis, leads to the opposite result. Since deficit spending, as a reflection of lax fiscal discipline, gives rise to fears about future monetization of public debt, expectations

of a currency depreciation in the future cause capital outflows
into other currencies, thus making these expectations self-
fulfilling.

°   Short-term financial effects

     The impact of budget deficits on prices of financial assets
is often explained in terms of very short-term financial flows.
Although they have superficial plausibility and internal logic,
such explanations are, as a rule, based upon extremely simplified
and partial analyses. Thus, blatantly contradictory conclusions
about the effect of government borrowing on interest and exchange
rates can result because of the extremely short-run focus of the
analysis and reliance on the "other things being equal" simplifi-
cation. For instance, it cannot be denied that, generally, a
surge in Treasury financing on a given day or week is likely to
push up interest rates higher than they would be otherwise. It is
also likely that higher interest rates may attract capital from
abroad and result in appreciation of the currency. Similarly,
higher disposable income or larger corporate cash flow resulting
from a personal or corporate tax cut, respectively, can be expected
to be translated into larger cash balances held in the form of
demand deposits. This would mean an increase in banks' liquidity
and, consequently, a downward pressure on interest rates.

     However, it must be recognized that these effects, even if
they do in fact occur more or less systematically, are of very
short-lived and reversible nature. At most it can be said that
they describe reactions of financial markets to short-term excess
flow demand or supply that must eventually (and rather rapidly)
be eliminated by adjustments in the size and composition of
holdings of financial and real assets by the private sector. In
other words, the assumption of "other things being equal" can be
justified in this context only in the very short run. As soon as
people realize that the government's fiscal policies have changed,
they will attempt (not always successfully) to adjust their eco-
nomic behavior accordingly.

     A failure to take account of the inherently short-term nature
of the "other-things-being-equal" simplification can lead to
absurd inferences. It has been observed, for instance, that tax
refunds tend to coincide with a marked reduction in consumers'
gross credit outstanding, implying that these refunds are used to
improve consumers' net financial position. It would be patently
incorrect, however, to infer from the observed pattern that tax
cuts, i.e., additions to consumers' disposable income, always
result in an equal increase in saving and have no effect whatso-
ever on consumption. Even in the very short run the elasticity
of spending with respect to income is neither zero nor infinite.
Thus, even using the most simple short-term partial equilibrium
framework of analysis in which expectations play no role, one can-
not make theoretically supportable assertions about the magnitude

or perhaps even the direction of the effect of increased government borrowing on interest rates.

The same is true, perhaps even more so, with respect to the short-run determinants of exchange rates. For example, even if one should uncritically accept that increased government borrowing does contribute to higher interest rates, it is by no means self-evident that a currency appreciation follows. The theory of international financial arbitrage (as reflected in the so-called "Fisher open" formula) recognizes only that interest rate differentials among currencies tend to equal the corresponding annual-ized forward exchange rate premiums or discounts. If the interest rate differential, say, between the dollar and the yen, widens in favor of the dollar, the only thing certain is that the dollar forward premium will increase (forward discount will contract). This very definitely does not mean that the dollar will appreciate relative to the yen. In fact, in order to satisfy the interest parity condition, while the forward dollar appreciates, the spot dollar may have to depreciate relative to the yen. But, in any event, the short-term impact of increased government borrowing on the exchange rate cannot be unambiguously established by theoretical reasoning alone.

Direct examination of data on deficits and interest and exchange rates has not helped much to establish the effects of government borrowing on the prices of financial assets. There is simply no discernible correlation between changes in government borrowing and changes in either interest or exchange rates. This lack of correlation is not particularly surprising. One reason is that, in fact, things do not remain equal for very long. While changes in government borrowing requirements are relatively mild and occur rather slowly, a variety of constantly shifting factors influence interest and exchange rates, thus accounting for their much greater volatility. Furthermore, monetary authorities customarily try to suppress or moderate the volatility of prices of financial assets by intervening in money and foreign exchange markets, thus rendering the task of discerning a short-term empirical relationship between budget deficits and interest or exchange rates even more difficult.

Finally, whatever these short-run effects are, they have minimal influence on the longer-term evolution of real economic variables. While clearly of great significance to participants in financial markets, the causal link between short-term changes in government borrowing requirements and transitory responses of prices of financial assets is of a relatively minor importance for formulation of economic policy.

° <u>Effects of deficits on cyclical recovery</u>

Some analysts assert that high current deficits will prevent or abort the ongoing economic recovery. The argument behind this assertion is that big deficits cause high interest rates;

high interest rates depress expenditures for business investment, housing, autos, and output of other interest sensitive industries; and the economy cannot recover unless those industries recover. The conditions under which big deficits do or do not cause high interest rates will be examined at length in later sections.

But even if big deficits cause high interest rates, this argument is very questionable because inadequate demand for some categories of output need not prevent a recovery if expenditures for other categories of output (such as consumption of nondurables or defense spending) are sufficiently large. Recovery depends on total production and sale of goods and services, rather than particular categories of goods and services. Large deficits do not reduce total economic activity. Depending on economic conditions (including the rate of money growth), the current deficit may put some upward pressure on interest rates or other prices, but this would indicate that there is more than enough, rather than too little, demand for the available supply.

There is no economic theory to support the assertion that a large current deficit will depress the economy. At most, a large deficit that puts upward pressure on the interest rate may contribute to a bias in the composition of total demand against the output of interest sensitive industries. The extent to which this bias will be pronounced is an empirical matter.

Another assertion is that large expected <u>future</u> deficits will prevent the recovery. The argument behind the assertion is as follows. Future deficits make expected future interest rates high. That keeps present long-term interest rates high, because today people will not lend long term at rates that are below the rate they expect to obtain several years from now. This argument implies that interest rates are higher than the level required to finance the current deficit, given current available loanable funds (savings).

One version of the argument is that prospective deficits result in higher <u>expected</u> inflation, which results in expected higher nominal interest rates in the future, thus causing higher nominal rates now. But even if future deficits cause higher expected inflation (which is by no means self-evident), this argument claims that nominal -- not real -- interest rates rise. However, in a rational world high nominal rates should not restrain investment unless expected real rates also rise.

Another version of the argument, in terms of real interest rates, is rather convoluted. It goes as follows. The current (i.e., FY 1984) deficit does not depress the 1983 economy, and the expected 1988 deficit will not depress the 1988 economy. But the expected 1988 deficit is so large, given the expected 1988 private demand for loanable funds, that it results in an expected interest rate in 1988 that is so high it impedes a return to full

employment in 1983. Arbitrage between present (1983) and future (1988) interest rates then keeps 1983 long-term interest rates higher than is consistent with economic recovery in 1983.

This argument is questionable for two reasons. First, it assumes that lenders and borrowers make very different predictions. Lenders are influenced by the prediction of future high interest rates in a strong economy. In contrast, borrowers who would invest in plant and equipment are assumed to reject that prediction -- acceptance of it would lead them to invest today, even though rates are high, because of the good prospect ahead in 1988. Second, if lenders will not lend at long term then it would appear they would lend their funds at short term, thus driving down short-term rates and contributing to the recovery that way. In any case, these arguments that current or future deficits prevent recovery are flawed.

EFFECTS OF DEFICITS ON INTEREST RATES

The foregoing discussion of the likely effects of government deficits on the prospects for recovery assumes, albeit not without caveats, that government deficits cause high interest rates. The validity of this assumption will now be examined. The following sections will reveal that the extent to which deficits affect interest rates in the medium term is a question for which mainstream conventional economic theories have only ambiguous answers.

°   <u>Deficits and Interest Rates in a simple Keynesian framework</u>

Perhaps the most widely-used approach for analyzing short- and intermediate-run effects of deficits on interest rates is Keynesian economic theory. The Keynesian tradition of economic analysis has produced a set of conceptual tools which provide a framework for analyzing the links between government policy and other macroeconomic variables.

Apart from the special case of the liquidity trap, which is discussed below, the basic Keynesian approach gives the result that an increase in the deficit brought about either by an increase in government spending or a reduction in taxes has the effect of raising interest rates. The logic of this result is as follows. First, the increase in the deficit increases aggregate demand for final output. In the case of more government spending, the additional spending adds directly to demand. In the case of a tax cut, the income that people do not have to pay in taxes increases their spending.

Thus, the larger deficit increases final demand and raises nominal GNP. In the Keynesian analysis if the economy is operating at a low level of activity the nominal increase will come primarily

through an increase in real GNP, while if the economy is near
full employment of resources the increase will primarily be in
prices. With a higher nominal GNP the volume of economic trans-
actions in nominal terms is greater, with the result that people
need more money to carry out the transactions. Hence, the expansion of
the deficit increases the demand for money.

Assuming that the central bank does not accommodate this
increase in money demand by increasing the growth rate of the
money supply, it is necessary for the velocity of money to rise
to meet the enlarged transactions demand for money. This comes
about through a rise in interest rates. The enlarged transactions
demand for money causes interest rates to rise as transactors are
willing to pay more for the use of money. At the same time, an
increase in interest rates makes money less attractive as an
asset relative to other interest-bearing assets, because the
interest rate on money is generally less than that on other
assets, so money demanded for asset holdings falls. This decline
in money demand induced by higher interest rates offsets the
increase in money demanded for transactions, and so interest
rates stop rising when the demand for money is brought into
balance with the money supply.

°   The role of bonds

The discussion presented above shows that in the most basic
Keynesian framework an increase in the deficit brought about by a
more expansionary fiscal policy without an increase in the money
supply tends to raise interest rates. The basic Keynesian frame-
work can be elaborated by introducing government bonds into
the analysis in at least two ways. In both cases the bonds are
regarded as wealth and the bond effect reinforces the tendency of
the higher deficit to raise interest rates.

First, the bonds are assumed to be a form of wealth which
substitutes for the wealth embodied in real capital. Under this
assumption, additional government bonds issued to finance an
additional deficit thus are perceived to increase wealth. As
wealth (substitutes for capital), the new bonds have the effect
of increasing aggregate private consumption spending (reducing
saving). This increase in consumption is another addition to
final demand, and following the same logic as before, the increase
in aggregate demand raises the demand for money and causes an
increase in interest rates. This bond effect reinforces the
increase in government spending or the reduction in taxes to
raise demand and thereby raise interest rates.

A second way in which the increase in bonds can raise inter-
est rates is that the bonds can affect money demand directly.
The presence of additional bonds in the economy increases the
ratio of bonds to money in investors' portfolios. In response,

people attempt to increase their money holdings relative to their bonds by selling bonds. This drives up interest rates, and interest rates continue to rise until the bonds have become so attractive that people are willing to hold them.

The foregoing analysis shows that the typical Keynesian result of an increase in the deficit is a rise in interest rates. However, a special case in which the fiscal expansion does not raise rates is the case of the liquidity trap. The liquidity trap is a situation in which people believe that interest rates are so low that they cannot fall further. Indeed, in this situation, interest rates are expected to rise and the prices of assets (such as bonds) are expected to fall so low that an asset purchaser can expect to sustain a capital loss which counterbalances the interest earned on the asset. Fearing capital loss, people hold money and other very liquid assets rather than long-term assets. Thus, an increase in the demand for money for transactions purposes can be met simply by drawing down enlarged holdings of money without any rise in interest rates. Hence in this case an increase in the deficit does not raise interest rates. The practical significance of the liquidity trap, which is believed to occur mostly in depressions, is a subject of dispute.

° Some modifications of the Keynesian framework

The value of the Keynesian paradigm for practical policy analysis depends upon the extent to which it accurately and completely models economic reality. To the extent that the Keynesian model abstracts from important relationships, it may offer inaccurate predictions about the effect of deficits upon interest rates.

Indeed, it appears that the Keynesian model excludes important economic effects that may well dominate the results in certain circumstances. For one, the demand for money may decline when there is a rise in inflation expected in the near future. This is because inflation reduces the real value of money holdings. Given this effect, an increase in aggregate demand brought about by expansive fiscal policy and higher deficits need not raise interest rates, since people may perceive the additional aggregate demand as potentially inflationary and reduce their demand for money to be held as an asset. In essence the rise in expected inflation has the same effect as an increase in the money supply.

Another effect upon the demand for money is the effect of the business cycle. An increase in demand for output stimulated by fiscal policy may induce a cyclical expansion. In an expansion people have more confidence in their immediate future; hence they are more willing to invest in long-term capital and they have

less need to hold money or other short-term liquid assets to protect themselves against risk. In such a situation the demand for money to be held as an asset falls, and this tends to reduce interest rates.

A very important set of considerations comprises incentive effects of a marginal tax rate cut. Even though taking these effects (sometimes referred to as "supply-side" effects) fully into account is certain to affect radically the conclusions yielded by traditional Keynesian analysis, this paper can give such incentives only the most rudimentary treatment rather than thorough analysis.

Incentive effects of tax rate cuts can operate not only in the long run, but over shorter periods such as a business cycle as well. The influence of supply-side effects on real interest rates is ambiguous. For instance, a marginal tax rate cut which raises the deficit can stimulate the supply of real output and induce a cyclical expansion in which the demand for money falls and consequently interest rates fall too. This supply-side effect complements the demand-side effect outlined in the previous para-graph in which a tax cut or other fiscal measure was perceived to stimulate a cyclical expansion by raising demand.

Another possibility is that the marginal tax rate cut could lower real before-tax interest rates by raising the after-tax real rate of return. The rise in the after-tax return can be expected to induce increased investment, which increases the intensity of capital and lowers its marginal productivity, thus tending to reduce real before-tax interest rates.

In contrast, a marginal tax rate cut can raise the profita-bility of capital investment and the after-tax return to capital, and have the effect of stimulating innovation. Additional inno-vation raises the marginal productivity of capital, and since the real before-tax interest rate is ultimately determined by the productivity of capital, a tax cut which raises capital productivity leads to a higher real interest rate, both before and after tax.

°   The treatment of wealth

The foregoing discussion has dealt mostly with extensions to and modifications of the basic Keynesian framework. However, another school of thought derives significantly different con-clusions regarding the effects of deficits on interest rates, even in the short or intermediate run. As mentioned earlier, some economists argue that bonds issued by the government are not perceived as net wealth by those who hold them. As discussed below, if these bonds are not considered to be wealth, a large part of the traditional Keynesian approach must be called into question.

The argument that government bonds are not wealth is based upon the fact that the bonds must be redeemed or refinanced at a later date. If the bonds are redeemed by a general increase in taxes, taxpayers, on average, face a future tax liability, and this liability offsets, at least in part, the wealth embodied in the bonds. Similarly, if the bonds are monetized in the future, the money created to redeem them will create future inflation, and this will reduce the future purchasing power of money and offset the wealth embodied in the bonds. In these cases rational individuals will adapt their saving behavior to achieve their desired accumulation of real assets. It is only if the bonds are indefinitely refinanced by more bonds that the future tax liabilities or the inflation and its attendant loss of purchasing power are avoided.

While in the aggregate government bonds are certainly not wealth, many researchers argue that in practice, for a number of reasons, bonds may be perceived as wealth by their holders and therefore the bonds should be regarded as wealth for the purpose of analysis. For one thing, people may not recognize the future tax liability implied by the bonds. Or they may consider it to be so far into the future that they either discount it substantially, or they presume they will not be alive and future generations will have to bear the burden of paying off the liability. Moreover distributional effects may be important; people other than those who own the bonds may have to redeem them. In particular, those who hold bonds may have a higher propensity to save and invest than those who will pay future taxes to redeem the bonds. To the extent that government bond-holders do not face a future liability, they will tend to regard the bonds as a form of wealth substituting for real capital, and in the aggregate the bonds will elicit behavioral responses having the same effect as an increase in wealth.

When the idea that government bonds are not considered wealth is incorporated into the Keynesian model the results change significantly. For example, if bonds are not viewed as wealth, the effect (discussed earlier) of additional bonds in increasing consumption spending, and thereby increasing overall spending and interest rates, disappears, since this effect is based upon the bonds being perceived as wealth. Similarly the effect of additional bonds in raising directly the demand for money and interest rates also disappears, since if bonds are not wealth they do not affect people's portfolios, and there is no need for individuals to adjust their portfolios when the number of bonds in the economy increases.

If bonds are not perceived as wealth by their holders, the basic Keynesian conclusions about tax cuts unaccompanied by spending reductions also change. For if bonds are not considered wealth, a tax cut has little effect upon aggregate demand, and

its effects are felt almost entirely on the supply side. The
logic of this result follows from the fact that the bonds issued
to finance the increased deficit brought about by the tax cut
create an equal offsetting future liability. A cut in current
tax liability, accompanied by a future tax liability of equal
present value and a current bond purchase equal in amount to the
tax cut leaves financial positions unchanged in the aggregate.
Since aggregate financial positions have not changed, aggregate
demand will be little affected, and so interest rates will also
be little affected through this channel. The primary effect of
the tax cut is through incentive effects on the supply side. As
analyzed above, such supply-aide effects can lead under different
assumptions to either a rise or a fall in interest rates.

The assumption that government bonds are not wealth similarly
alters the Keynesian conclusion about the effect of an increase
in the deficit brought about by an increase in government spending
without a balancing increase in the level of taxation. However,
in the case of government purchases there are additional effects,
since the government demand preempts real output, and that real
output is not available for private consumption or investment.
Insofar as that output is no longer used for private capital for-
mation, capital intensity will be lower, and this will tend to
raise the productivity of each unit of capital and raise real
interest rates. On the other hand the productivity of capital and
real interest rates are also affected by the uses made of output
bought by the government; so depending upon these uses the pro-
ductivity of private capital can be either enhanced or diminished.

°   Comments on Empirical evidence

The theoretical analysis presented so far indicates that the
effects of an increase in the deficit upon interest rates are
ambiguous; a situation of rising deficits can coincide with a
situation of either rising or falling interest rates. In addition
to the reasons given so far, deficits cannot be expected unam-
biguously to be causally related to interest rates, because a
deficit is a residual obtained by subtracting two items, govern-
ment expenditures and revenues, which usually have very different
effects upon the economy.

The same deficit can arise with many different levels of
expenditures and revenues, and the economy will behave differently
when expenditures are large than when they are small even if the
deficit is the same in either case. Similarly the effect of the
deficit depends on whether it arises from a tax cut or an expen-
diture increase. An increased deficit brought about by a tax
cut targeted toward stimulating investment may lower pre-tax
real interest rates while the same deficit increase brought about
by new unproductive government expenditures would probably raise
the pre-tax real interest rates. Similarly, the same deficit can

arise with the same levels of expenditures and revenues but with
different compositions of the expenditures and revenues, with
consequent different effects on the economy and real interest
rates. Hence for the deficit per se to have an effect on real
interest rates it would also have to vary systematically with the
level of revenues and expenditures and their composition. However,
it is unlikely that such a systematic relationship, if it exists
at all, has been very strong, so deficits cannot be expected to
be related to interest rates.

    Attempts to discern systematic relationships between deficits
and interest rates by examining statistical correlations among
historical data confirm the ambiguity of conclusions arrived at
through theoretical speculation. Studies of these relationships
strongly indicate that there is no systematic connection between
high deficits and high interest rates over the cycle. If anything
the opposite relationship appears to obtain, in which interest
rates rise in expansionary phases of the cycle when deficits con-
tract, and fall in contractionary phases when deficits tend to
expand. The historical relationship between deficits and interest rates
is pictured in Chart 1.

    One could argue that this evidence merely reflects the sub-
stitution between public and private demand for real credit in
consecutive phases of economic cycles, as is depicted in the
accompanying Chart 2. Consequently, the argument goes, if it
were not for government deficits (especially during expansionary
phases) interest rates would have been even lower and the attend-
ant economic expansion stronger. In order to test hypotheses
like this, and to examine more precisely the relationship between
deficits and interest rates, it is necessary to control for other
influences upon interest rates so that the effects of deficits
can be isolated. Such other influences include the effect of the
growth rate of money, general business cycle effects, and the
effects of risk in markets as induced by volatility in money
growth. Numerous econometric studies have tried to isolate the
effects of deficits, and they have failed to establish reliable
evidence that government deficits have a noticeable effect on
interest rates.

DEFICITS AND EXCHANGE RATES

    The effects of deficits on exchange rates may be even more
complex than the effect upon interest rates. In a basic Keynesian
model the exchange rate is implicitly determined by net exports
which, in turn, essentially depend upon the income propensities
to import at home and abroad. In such a model, without the
capital account specified, an increase in the government deficit
leads to an expansion of aggregate demand. For a given domestic

propensity to import, this worsens the trade balance and sets the stage for a depreciation of the domestic currency. But since in this model an increase in the deficit also causes the interest rate to go up, a higher interest rate is associated with a weaker, not a stronger, currency.

This Keynesian result stands in stark contrast to widely held views, especially in financial circles, about the relation-ship between interest and exchange rates and, by extension, between government deficits and exchange rates. These contrast-ing views are apparently derived from monetarist models of exchange rate determination. In a basic monetarist model the exchange rate is dependent upon the ratio of money supplies of two curren-cies per unit of output in the corresponding countries. The exchange rate is therefore essentially a monetary phenomenon. If, however, the money supplies are held constant and in one country, fiscal expansion stimulates aggregate demand or incen-tives induce higher aggregate supply, the money supply per unit of output is reduced in this country and its currency would appreciate. The exact mechanism which brings about this appreci-ation can be given alternative interpretations. A reduction of the money supply relative to output may be translated into current or expected lowering of prices, including the prices of exportables and import-competing goods. The drop in prices, by improving the country's competitiveness, then should bring about an improve-ment in the trade balance and the resulting strengthening of the currency -- just as in a Keynesian model. Alternatively, expan-sion of output in conjunction with a non-accommodating monetary policy may be interpreted as a liquidity squeeze resulting in higher interest rates that would induce capital inflows from abroad and make the currency appreciate.

Thus, the monetarist analysis can lead to a trade (or current account) surplus and a capital account surplus. Of course these results are incompatible, or at least unsustainable over a longer period of time, because the only way a trade (or current account) surplus can be financed is by a capital account deficit. Further-more, monetarist models disregard income effects on trade flows which are the focus of Keynesian analysis, as indicated earlier. When the analysis of fiscal expansion combines these income effects in a basic Keynesian model with the price depressing and interest rate boosting effects imbedded in monetarist models, the result is ambiguous. While the income effects would tend to worsen the trade balance and thus weaken the currency, the price effects would tend to improve the trade balance and thus strengthen the currency, and the interest rate effects would tend to improve the capital account and thus strengthen the currency even further.

The actual outcome of a fiscal expansion would depend on the potency of exchange rate responses to these effects. Empirical estimates of the relevant parameters are very imprecise and even

the most sophisticated quantitative models of exchange rate determination are notoriously unsuccessful in explaining past, let alone predicting future, exchange rate movements.

There is no reliable empirical evidence to support the contention that large government budget deficits cause appreciation of the country's currency, at least as far as the dollar is concerned. Although deficits tend to rise during periods of economic contraction and fall during expansion, the real multilateral trade-weighted value of the dollar declined during both the contraction of 1974-75 and the expansion of 1976-79, before rising over the period 1980-83 during which the economy both contracted and expanded. This pattern of exchange rate changes occurred despite frequent efforts of governments, including the U.S. Government, to counter cyclical exchange rate movements.

DEFICITS, INFLATION AND THE MIX OF OUTPUTS

Can the deficit affect inflation? The answer is that although deficits can be observed to rise while the inflation rate falls, it is possible that an increase in the deficit can put some temporary upward pressure on the price level even if the deficit is not monetized. In other words, although monetary policy is the dominant influence on inflation, the deficit (as well as changes in inflationary expectations, and exogenous supply shocks) has the potential for affecting the price level.

When taxes are cut and government borrowing increased by an equal amount, some of the tax cut will be spent on the new government bonds. According to the earlier detailed analysis, the total amount of the tax cut will be used to purchase the new bonds if the taxpayers/bond buyers assume that the bond interest received will be used to pay the future tax required to service the government debt, and that the return of the principal of the bond will be used to pay the future tax required to retire the bond

In any other case -- unless the debt is monetized, and assuming that the tax cut does not take a form which changes savings incentives and causes a change in the percentage of income saved -- it would appear that some of the tax reduction will be saved and some will be spent on private consumption. Relative price (incentive) effects aside, because not all of the tax cut is saved, the demand for bonds rises by less than does the supply. With the growth of money unchanged, the shift in the demand and supply of bonds puts upward pressure on real interest rates.

Thus, real interest rates rise and discourage investment demand unless a tax cut is of a type which raises the after-tax rate of return to capital or lowers the user cost of capital. But higher interest rates also encourage asset holders to shift some money balances into bonds (financial assets). Therefore, the real interest rate increase does not reduce investment demand by as much as the increase in consumption, so total demand rises. To the extent that total demand increases relative to the total supply of goods and services, (still assumed, for analytical simplicity, to be unresponsive to the tax cut), upward pressure is exerted on prices. The pressure will stop once prices have risen by enough to restrain total demand from exceeding total supply.

The price pressure will be self-terminating if monetary policy remains unchanged. Because the higher prices reduce the real value of money balances, asset holders shift some of their wealth out of bonds (financial assets) and into money. As a result, there is a secondary rise in real interest rates which discourages investment demand by enough to offset the initial increase in consumption demand.

Thus, in this analysis with no supply-side effects considered, a tax reduction accompanied by an equal increase in the deficit causes a temporary increase in inflation, a permanent rise in the price level and in real interest rates, and a permanent decline in investment.

Acceleration of money growth in an attempt to counter the upward pressure on real interest rates would prolong and accelerate the rate of inflation. But eventually real interest rates would rise by enough to reduce investment to equal the increase in consumption. Evidence on the extent to which deficits have been monetized is mixed, but there are some data that at least suggest that in recent U.S. history there has been a positive relationship between the percentage increase in the privately held Federal debt and the rate of growth of the monetary base.

If, in contrast, monetary policy maintains a disinflationary path for the economy, the growth of money may be reduced to forestall any inflationary pressure from the deficit. In the current U.S. experience the reduction in money growth has been more than the required offset, thus excessively depressing the demand for financial assets and causing higher real interest rates without the occurrence of any observable upward pressure on prices.

The deficit can affect the mix of output, but the process may be a complicated one. As is indicated in the foregoing analysis of the process by which the deficit can affect inflation, in the absence of supply-side effects, the deficit increase will discourage investment to the extent that it results in a direct increase in current consumption. The adjustment occurs as the

increased deficit causes the supply of bonds (financial assets) to exceed the demand, thereby putting upward pressure on real interest rates. Higher real interest rates then crowd-out private (and state and local government) borrowing in the competition for available loanable funds.

°   <u>A digression on crowding out</u>

The term "crowding out" is used loosely in popular discussions to convey the notion of a displacement of private investment by government borrowing at high interest rates. But this notion is misleading and the concept of crowding out is murky.

Because credit is scarce it is rationed by capital markets, and so even if government is totally absent from capital markets, some potential borrower is crowded out at <u>any</u> level of interest rates. More precisely, producers whose expected rate of return on new investment is less than their cost of borrowing to finance this investment, or consumers who delay their purchase rather than pay the cost of borrowing to finance present consumption, will be crowded out. Crowding-out thus refers to the financial market process of allocating limited credit to the users able to pay the highest prices. To the extent that the scarcity of credit is alleviated, for example by an autonomous increase in savings, room is made for less profitable investment projects (or less desirable consumption expenditures) that would be crowded out if the supply of loanable funds were less abundant.

If the government were just another borrower in the credit market, its role would not be materially different from that of, say, AT&T, which because of the sheer size of its credit demands presumably displaces many small businesses. The unique role of the government in crowding out other potential borrowers does not, however, have to do so much with the size of its claims on the pool of available credit, as it does with (a) the fact that the government borrowing is interest rate insensitive, and (b) the fact that the government borrows to finance predominantly activities that do not add to future productive capacity. In these two respects the government is indeed different from any other borrower.

The first distinction appears to imply that for a given supply schedule of loanable funds, borrowing by the government raises the interest rate thereby crowding out some marginal borrowers. However, several qualifications deserve mention in discussing this process of financial crowding out. First, if for instance, increased government borrowing finances a corporate tax cut, cash flows internally generated by corporations will increase and demand for credit by these corporations will decrease commen-surately. Thus, increased borrowing by the government will coincide with decreased borrowing by the private sector. Second, insofar as the supply of savings expands as the interest rate

rises, the amount of credit foregone by potential private borrowers will be smaller than the increase in government borrowing. Third, the concept of financial crowding out does not contain any normative implications; that is, for a given level of government spending no general assertion can be made that financial crowding out is more deleterious to the economy than alternative methods of financing this level of government expenditures.

The implications of the second distinction between the government and other borrowers are more clear cut and also more important for proper evaluation of the consequences of government spending on credit markets. Since government spending is, from the standpoint of generating future growth, mainly nonproductive, it preempts some resources which otherwise would have been used for investment purposes. Even though the lower rate of investment results from interest rate adjustments in the bond market, this result is not essentially a financial phenomenon. The reduction in investment reflects the resource allocation required when increased government expenditure demands compete with private investment and private consumption for limited amounts of labor, capital and other productive inputs. Preemption of these productive factors by the government is sometimes labeled real, as distinct from financial, crowding out and its effect on the economy in the medium term is the same independently of whether this preemption is financed by borrowing or by taxes. This conclusion may be altered, however, when incentive effects are recognized.

INCENTIVE EFFECTS

Incentive effects -- that is, the increase in the supply of productive factors caused by improved incentives resulting from cuts in marginal tax rates -- are most important when the tax cuts are permanent rather than temporary. Permanent tax cuts provide permanent incentives to alter the supply of labor and capital. A temporary tax cut provides only the incentive to alter the timing of that supply; if more is offered now, less will be offered later when the temporary tax cut is removed. A tax cut financed by government borrowing may be viewed as temporary to the extent that the borrower expects that tax <u>rates</u> will be raised in order to retire the debt issued to finance the tax cut in the first place. This is the reason why a tax cut accompanied by a reduction in government spending is more likely to be viewed as permanent than a tax cut not matched by a reduction in government outlays.

To the extent that a tax cut enhances economic growth, government borrowing to finance the tax cut will be less likely to crowd out private investment. This is because more growth means more saving, that is, more available loanable funds to meet

the new supply of bonds. In this case, there would be less upward
pressure on real interest rates and on prices, resulting in more
private investment and a different consumption pattern than would
occur without a tax cut and the corresponding increase in govern-
ment borrowing.

POTENTIAL GROWTH AND THE STRUCTURAL DEFICIT

     The extent to which a tax cut enhances <u>potential</u> economic
growth has important implications for estimating and interpreting
the effects of a deficit increase associated with a tax cut.
Potential output growth is a concept used to characterize the
performance of an economy that is operating on its long-run output
trend with all available resources fully employed in their best
uses. The concept is rather subjective because it is defined with
terms such as available, fully and best. Furthermore, it is not
defined in terms of relevant alternative dimensions of policy --
e.g., a disinflation path or a certain income distribution
pattern, etc. -- taken as a first priority of economic policy.

     However, the concept of potential economic growth is estimated
for some specified time period assumed to be policy relevant, as
the sum of the growth rates of the labor force, productivity per
worker, and annual hours of work per worker. Given this standard
of potential economic growth, an estimate of the Federal deficit
can be separated into a cyclical component and a noncyclical or
structural component. The cyclical component of a given deficit
is the portion that exists because the economy is operating at
a level of activity below potential -- the assumed high or full
employment level. The difference between the estimated total
deficit and the estimated cyclical component is defined as the
structural deficit.

     By definition, the faster is the projected rate of <u>actual</u>
economic growth (given the assumed potential rate of growth,
that is, the closer to the prespecified level of full employment
the economy is projected to be, the smaller is the cyclical
component of the deficit and the larger the structural component.
Thus, given an estimate of the total deficit, if the economy is
projected to be at full employment (however defined) in 1988, all
of the estimated deficit would be labeled, by definition, as
structural.

     For this reason it has been said that economic growth cannot
close the structural deficit. This statement is tautologically
true but misleading because it is not fully informative. A more
complete statement would note that the assumed potential rate of
growth is rather arbitrary, and a higher potential rate of growth
generally would be consistent with a smaller total deficit and
therefore at full employment with a smaller or zero structural
deficit.

Some commentators suggest that the long-run trend (or the trend over some particular time period) of the structural deficit should average out to be zero. But this prescription would appear to depend in part on the extent to which government spending is used for such purposes as: to pay interest on that part of the nominal increase in the Federal debt that, during a period of expected inflation compensates debt holders for loss in the real value of the principal; to make loans to the private sector; and to purchase items that are appropriately financed by borrowing -- for example, highways, buildings, research, development and education come to mind.

Chart 3 illustrates the ambiguity inherent in definitions of potential GNP (from which the notion of structural deficit is derived) as well as the dangers of treating the structural deficit as the main policy goal or even as an indicator of successful policy. For illustrative purposes, two alternative growth paths of potential real GNP are drawn. The first alternative corresponds to a potential GNP associated with the full employment unemployment rate of 5.1 percent, the second alternative to 7.0 percent. Hence, in 1982 the GNP gap, that is the difference between potential GNP and estimated actual GNP, is larger for the first definition of potential GNP than it is for the second. Under the first alternative it is assumed that a tax increase, prescribed to reduce the structural deficit, holds the rate of growth of potential GNP to 2.5 percent per year. Under the second alternative, in the absence of such a tax increase it is assumed that the growth rate of potential GNP is still a modest 3.7 percent. Actual output grows 4.1 percent per year under the first alternative and 4.4 percent under the second.

By 1988, under the first alternative (lower potential growth) the GNP gap is closed (actual growth has exceeded potential during the period) and, by definition, the cyclical component of the deficit is eliminated. Under the second alternative (higher potential growth) the GNP gap still equals 1.0 percent of GNP (actual growth has exceeded potential, but not enough to close the gap by 1988) and the cyclical component of the budget deficit is not eliminated. Furthermore, again by the very nature of the constraints employed, in 1988, the structural deficit is larger under the first alternative, associated with a lower rate of potential growth and a lower rate of full employment unemployment than under the second one, associated with a higher rate of potential growth and a higher rate of full employment unemployment. The latter outcome would appear to be preferable to the former one because it results in a faster actual growth and a higher actual level of output by the end of the period.

An inference can legitimately be drawn from this example that, insofar as tax increases have a recognized depressing effect on economic growth while the effects of deficits on growth are not necessarily depressing, at least not under all circumstances, it would be prudent, as a matter of policy, to be cautious -- even

to err on the side of restraint -- in trying to eliminate structural
deficits by raising taxes.

The effects of deficits on economic growth are difficult to
identify, isolate, and measure. Indeed, as indicated above,
there is some controversy about the proper way to measure the
<u>actual</u> deficit. And certainly the <u>structural</u> deficit is a con-
troversial and arbitrary concept which can be estimated only in
a subjective and imprecise way.

But even leaving such difficulties aside, there remains the
forbidding task of attempting to draw conclusions about the
economic effects of structural deficits. These effects would
depend on a great variety of factors, among which the level and
composition of government spending and the structure of the tax
system would play a particularly important role in determining
the path of economic growth, while the course of monetary policy
would play a crucial role in determining the level of prices,
nominal interest rates and exchange rates.

A SHORT NOTE ON THE LONG RUN

The connection between government deficits and prices (includ-
ing interest rates and exchange rates) in the long run is analy-
tically very interesting, empirically intractable and extremely
important from the standpoint of formulating appropriate policy
responses. It is in the long run that rational economic
agents will, by definition, have made the necessary adjustments
to new economic circumstances.

In the present discussion, long-term changes in habits
affecting the supply of labor, the supply of savings and the
attitudes toward enterpreneurial risk are particularly important
because these factors will have a decisive influence on prices,
real wages, interest and exchange rates. While it is beyond
dispute that some tax regimes are bound to elicit a larger supply
of labor and savings and be more encouraging toward entrepreneur-
ship than others, magnitudes of these responses cannot be known
in advance. The very notion of a different environment in the
long run logically prevents using estimates of relevant parameters
based on historical data, that is, those pertaining to an old
environment. Therefore, one can only speculate on what might
be the effect of continuing deficits (and therefore a growing
Federal debt) on prices of financial assets and, more fundament-
ally, on economic growth.

In brief, for some combination of elasticities of supply of
labor and private savings, marginal output-to-labor and output-to-
capital ratios, a given structure of marginal taxes, and a compo-
sition of government expenditures (in terms of growth-enhancing

and growth-retarding categories), there will be some sustainable
level of secular budget deficits (and the implied Federal debt)
relative to GNP. It is not possible to state a priori what that
level might be but it need not necessarily be zero. The sustain-
able deficit-to-GNP ratio (and implied Federal debt-to-GNP
ratio) would be higher the higher are

     -- responsiveness of supply of labor and savings to net
        rates of return,

     -- marginal output-to-labor and output-to-capital ratios,

     -- average marginal taxes (at unchanged elasticities of
        supply of labor and capital),

     -- the proportion of productive expenditures (investments)
        by the government in its total spending.

The question of what a tolerable deficit-to-GNP ratio (and
the implied Federal debt-to-GNP ratio) might be cannot be answered
without having some idea about the magnitudes of parameters speci-
fied above. Estimation of these parameters by means of traditional
econometric methods does not produce satisfactory results. How-
ever, pertinent simulations (performed by IMF economists among
others) which are based on a range of possible values of relevant
parameters indicate that the supply effect of budget deficits
attributable to tax rate cuts, while rather weak in the short
run, dominates the demand effect in the long run for a variety
of plausible combinations of parameters in question. What can
be deduced, therefore, is that the secular trend of deficits, if
kept at a sustainable level (that is, not resulting in an explosive
growth of debt-to-GNP ratio) may be more conducive to economic
growth than if the corresponding amount of funds were raised by
taxing the productive factors in the economy.

Finally, even if one were to accept the proposition that a
continuing high deficit-to-GNP ratio(and the implied Federal
debt-to-GNP ratio) causes high interest rates, one could not con-
clude that these high interest rates will unavoidably result in
slow economic growth. If tax cuts and tax reforms geared toward
creating economic incentives, rather than increases in non-pro-
ductive government spending, are the prime reason for deficits,
high real interest rates may have no discernible effects on the
rate of economic growth. In fact, evidence abounds that during
periods of economic buoyancy and optimistic expectations, as, for
instance, in the 1920s and 1960s, high investment levels and
concomitant high growth rates may prevail for long stretches of
time despite high (real) interest rates and, vice-versa, low
(real) interest rates prevalent, for instance in the 1930s and
1970s, by no means guarantee high investment levels or robust
growth.

CONCLUSIONS

The main purpose of this study was to review the issue
concerning the effects of government deficit spending on interest
rates and, to some extent, on exchange rates. Frequently encoun-
tered assertions about the causal links between deficits and
prices of financial assets were critically examined and evaluated.

Contrary to some widely publicized opinions, these effects
of government deficits are by no means unambiguous. The outcome
depends, among other things, on the assumption made about the
saving behavior of the private sector. When taxes are cut and
government borrowing increased by an equal amount, some (perhaps
all) of the tax cut will be spent on new government bonds.

The total amount of the tax cut will be used to purchase the
new bonds if the taxpayer perceives that future taxes will be
required to service the government debt and retire the bonds.
In this case, aside from incentive and distributional effects,
there should be no difference between higher deficit spending
and spending fully financed by additional taxes -- there is no
impact on the interest rate whether government spending is
financed by taxes or borrowing.

The extreme opposite assumption is that there is no substi-
tution whatsoever between taxes and borrowing by the government;
extra after-tax personal income is devoted entirely to increased
consumption, none is saved. Thus, no increase in private saving
accompanies the additional government borrowing. With no increase
in the supply of loanable funds, the additional demand for loanable
funds inevitably results in upward pressure on interest rates.

Other facts that exert a crucial influence on the outcome are
the extent to which: deficits are caused by spending increases
or tax cuts; financing is accomplished by monetization of the
debt or by sale of government debt to the public; the tax cut
reduces marginal tax rates thus improving incentives to supply
productive labor and capital; the outlays financed by the deficits
change the composition of government spending. The results are
also influenced by the magnitudes of the private sector's various
responses to the specifics of the policy changes -- responses
which, for instance, depend on the openness of a country's capital
markets to foreign investors, public expectations (about inflation
and interest rates, for example) generated by a prospect of con-
tinuing deficits, and a host of institutional arrangements deter-
mining the adaptability of labor, product and asset markets to
changing economic conditions.

In examining these relationships, the paper shows that many
widely-advanced conclusions about the macroeconomic effects of
deficits are not universally valid; as indicated above, they
depend crucially instead, on the time horizon of the analysis,

the institutional and behavioral assumptions underlying the
analytical model used, the accompanying circumstances and policies
postulated and the size of various economic parameters estimated
or assumed. Also, it is pointed out that there is no conclusive
empirical evidence to support firmly the contending analyses. If
anything, the existing empirical evidence points toward no system-
atic relationship between government budget deficits and interest
rates or exchange rates.

Chart 1

REAL INTEREST RATES AND REAL DEFICITS

Aaa Bond Rate

Real Deficit

Real Bond Rate

Percent

18 — 16 — 14 — 12 — 10 — 8 — 6 — 4 — 2 — 0 — 2 — 4

1953 '55 '57 '59 '61 '63 '65 '67 '69 '71 '73 '75 '77 '79 '81
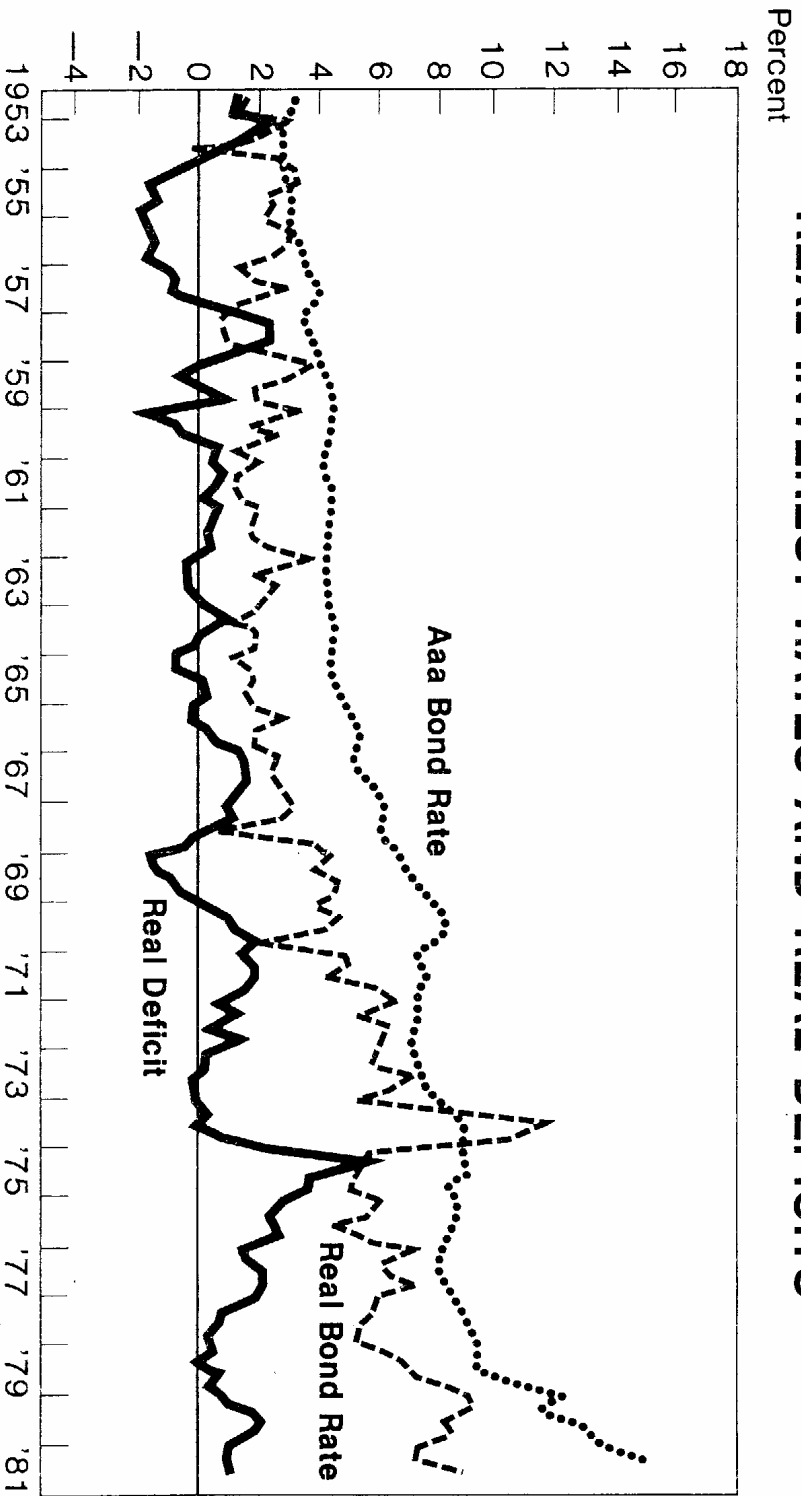
Chart 2

GOVERNMENT SECTOR AND PRIVATE SECTOR BORROWING*

Percent of GNP

Percent of GNP

Private

Total
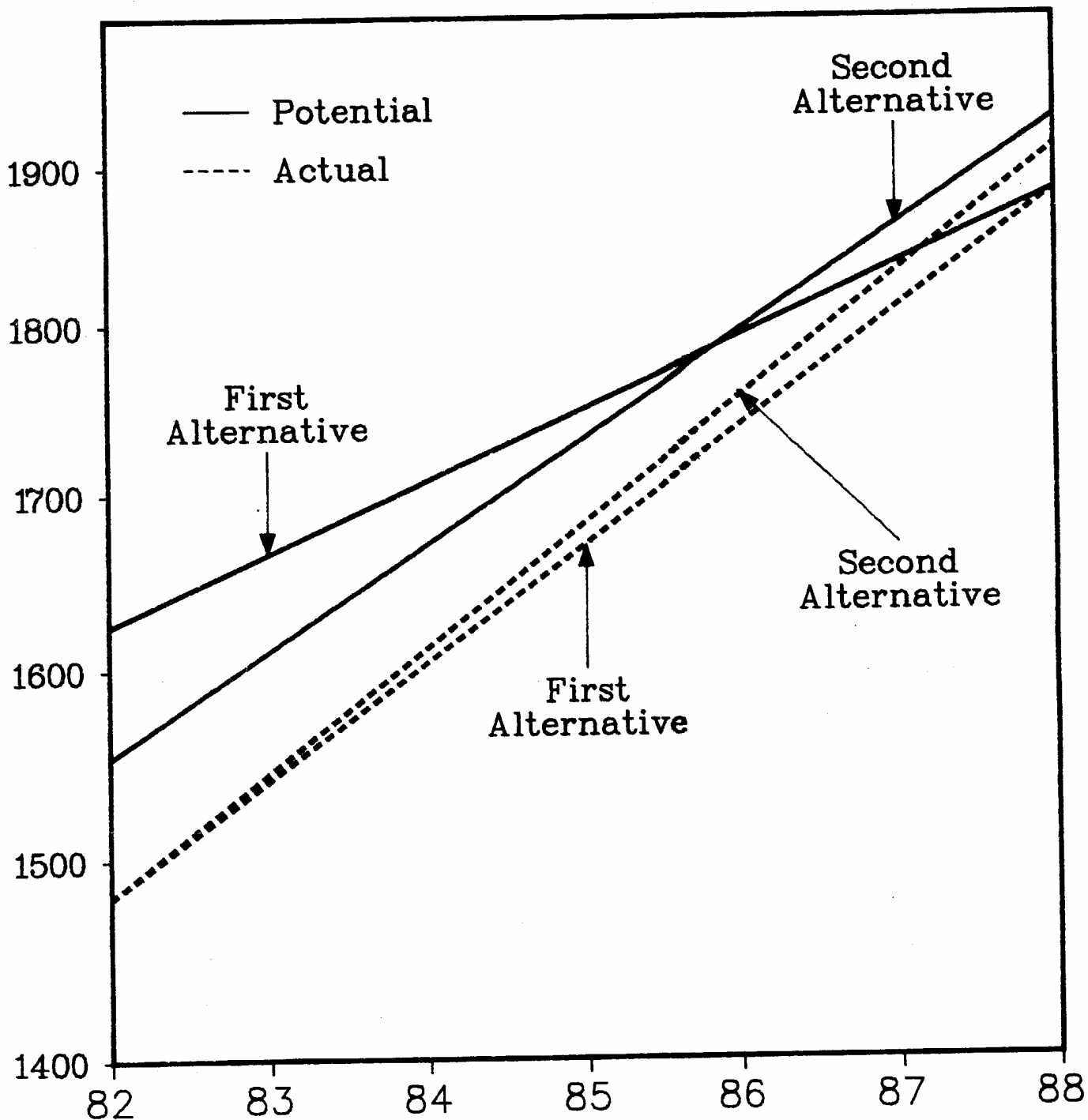
Government
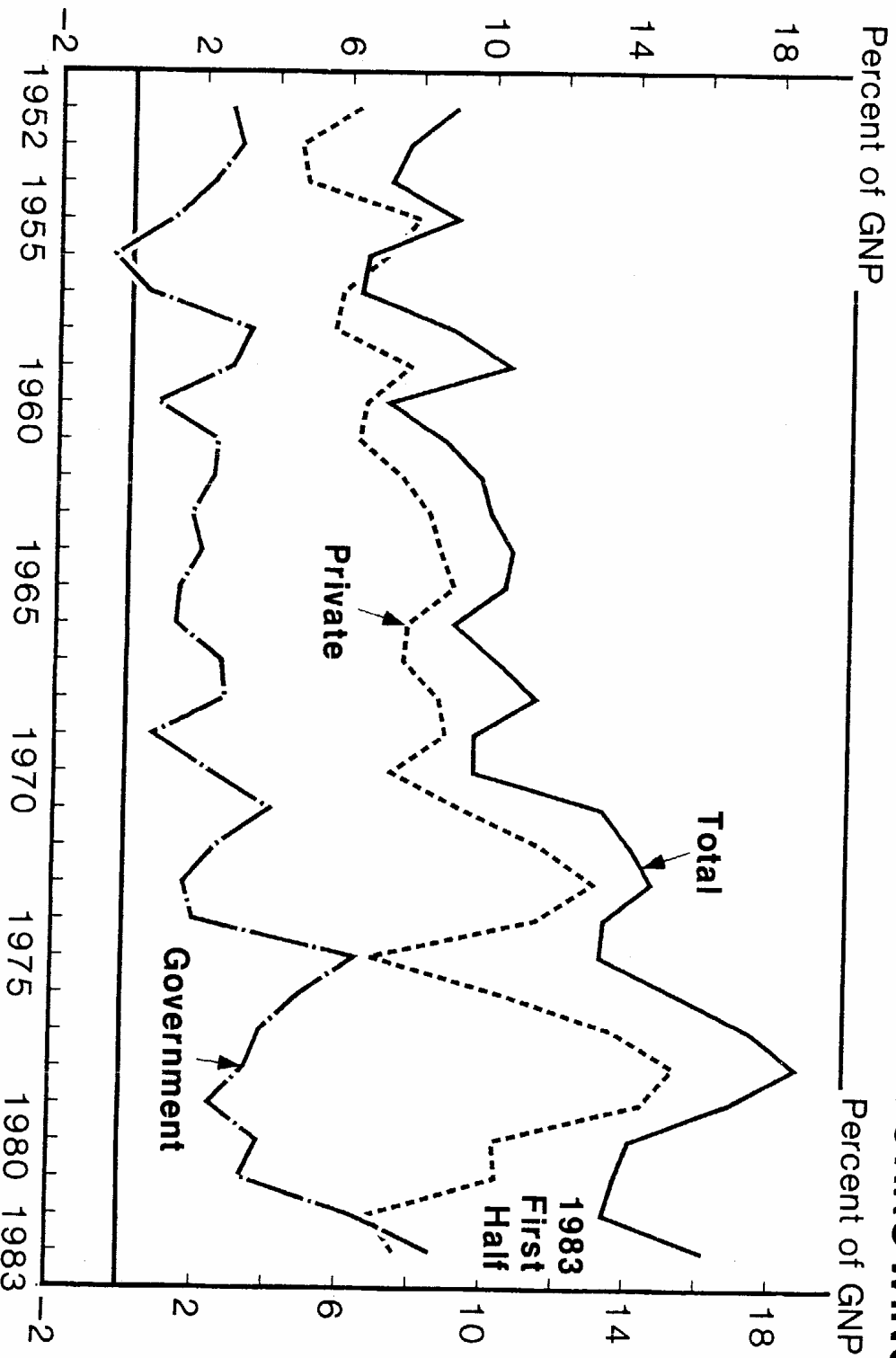
1983
First
Half

*By Nonfinancial Sectors

October 24, 1983-A244a

Chart 3

Alternative Paths
of Real GNP

**Billions of
1972 Dollars**

PART II

THE EFFECT OF FEDERAL DEFICITS ON INTEREST RATES:

A SURVEY OF THE LITERATURE

THE EFFECT OF FEDERAL DEFICITS ON INTEREST RATES:
A SURVEY OF THE LITERATURE

INTRODUCTION

There is much current discussion about the potential
disadvantages of the large projected deficits. These perceived
risks include, among others, interest rate increases that cause
short-run reduction in aggregate demand and longer-run reduction
in the rate of capital accumulation and economic growth, Federal
interest payments that grow to require ever more Federal borrowing
to meet them, and the expectation that the increased pressure of
an ever growing Federal debt would lead the Federal Reserve to
monetize the deficit and thus re-ignite inflation.

The discussion of the potentially harmful interest rate
effects lodged in the large deficits is motivated in part by a
lack of consensus as to whether an increase in taxes would reduce
the emerging risks. This disagreement reflects the fact that
neither theoretical nor empirical analysis provides a clear-cut
guide for decisions about either the urgency of reducing the
deficits or the advisability of raising taxes to do so.

The purpose of these bibliographic notes is to indicate some principal
sources in mainstream macroeconomic analysis of the
issue. The notes are organized to present the most general find-
ings first, and then to proceed with more specific and technical
considerations. After mentioning some recently published surveys
of the debate about the relationship between deficits and interest
rates, the paper proceeds to consider measurement of the real
deficit and public debt and the real interest rate. Next is a
concise review of some econometric tests of the effect of Federal
deficits and debt on interest rates. Finally, some major unsettled
issues in the macroeconomic theory underlying the deficit/interest
rate analysis are discussed briefly. The conclusion from the
literature reviewed here is that the deficit/interest rate rela-
tionship remains an unsettled question.

SOME RECENT SURVEYS OF THE DEBATE

Several recent publications survey major issues in the dis-
cussion of the effect of deficits on interest rates. An accurate
characterization of the state of the debate can be found in a
paper by Rudolph Penner (1982) in which he reviews the literature
on macroeconomic policy and domestic saving, and concludes that
economic research on the issue is in a primitive state, precise
answers are far beyond our grasp, but nevertheless the projected
ratio of deficits to GNP is so high that it poses a risk to
economic growth. Recognizing that there is no consensus on such
issues as: the effect of changing levels of Federal deficits,
the effect of changing after-tax rates of return on aggregate

savings, whether monetary policy should be loosened, or whether
growth in Federal spending on defense, retirement, and health can
be cut, he recommends a tax increase which emphasizes base
broadening measures (to avoid adverse supply-side consequences)
and would have its major effect after 1985 (to avoid adverse
short-run demand-side consequences).

Commenting on Penner's paper, James Tobin (1982) casts doubt
on assertions of near-term adverse effects of the current and
projected deficits and on the current benefits to be achieved by
current actions to reduce future deficits. He notes that the
main impact of the 1982 TEFRA tax increase was to reduce business
saving and investments by repealing about half of the concessions
to capital income enacted in the 1981 ERDA tax cut. Tobin
expresses concern that future deficits during periods of prosper-
ity will combine with high interest rates to raise the ratio of
the Federal debt to GNP, but, he says that hysteria appears to
be premature and overdone, and offers calculations that suggest
that the debt-to-GNP ratio in the next 10 years would return to
its level of the 1950s, about 50 percent. He revises downward
that estimate to about 32 percent in a subsequent, more detailed
analysis for the Conference Board (1983). Tobin notes, however,
that if the defense build-up is not simply a bulge, [more] taxes
will be required to pay for it. Tobin emphasizes that monetary
policy is the key to recovery, that tightening fiscal policy
would help provide a policy mix more favorable to capital forma-
tion, but that the effort would be wasted "unless the Fed engi-
neers low enough real interest rates to absorb in investment the
resources released by government, its taxpayers and its transfer-
ees -- plus a big fraction of the resources made idle by the
recession." He says that macroeconomic policy is immobilized by
an irrational fear that a temporary burst of money supply growth
would be entirely dissipated in renewed inflation and have no
real effects.

Four recent volumes which contain collections of current
research bearing on the subject of the effects of deficits on
interest rates are: The Boston Federal Reserve Bank 1983 conference
volume, The Economics of Large Government Deficits (to be published
in 1984), the Washington University (St. Louis) 1982 conference
volume, The Economic Consequences of Government Deficits, the
Conference Board report of the December 1982 conference, Toward a
Restructuring of Federal Budgeting (1983), and The Deficit Puzzle,
a special issue of the Economic Review, Federal Reserve Bank of
Atlanta, August 1984. References to some of the papers in these
volumes appear below.

As indicated above, empirical research on the deficit/interest
rate relationship is inconclusive. In part, this is because it
is difficult to construct suitable measures for the key concepts.

MEASURING THE REAL DEFICIT AND DEBT

The relationship between the deficit and interest rates, investment, and growth, is analyzed best in real rather than nominal terms. Empirical studies of the effect of the real Federal deficit on the real interest rate require a correct measure of the real deficit (the nominal deficit less some portion of interest payments on the Federal debt). Measurement issues include the difference between the NIA and unified budget concepts, the advisability of relating the absolute size of the deficit to a measure of the size of the economy (such as GNP or population), and adjustments for cyclical effects. In addition, the appropriate valuation of the real market (rather than par value of the Federal debt and therefore of the real deficit, the annual flow that reflects the change in the stock of Federal debt) is crucial to the analysis and empirical estimate of the macroeconomic effects of the financing of government expenditures.

Phillip Cagan (1981) notes that it is customary to put the nominal deficit into real terms by deducting the product of the amount of publicly held Federal debt multiplied by the inflation rate (per the fixed weight GNP deflator). To the extent that interest payments on the debt include an inflation premium equal to the inflation adjustment (or depreciation) of the debt, and to the extent that debt holders regard these additional interest payments as a return of principal (rather than income to be consumed), the reinvestment of the additional interest will finance, without "crowding-out," an equal amount of deficit.

But, Cagan points out that the additional interest due to inflation (the inflation premium) may differ from the depreciation in the value of the debt. The difference arises when expected inflation is an inaccurate forecast of actual inflation. The inflation premium reflects the additional interest required to compensate for the inflation rate expected when the debt was issued, rather than the actual inflation rate that occurs when the depreciation in real value of the debt is calculated. If expected inflation has been less than actual, the additional interest (premium) will be less than the depreciation of the debt.

Thus, Cagan concludes that a proper measure of the deficit would not exclude the entire decline in the real value of the debt, rather only the extra interest viewed by lenders as repayment of principal (and thus available to finance new Federal deficit without absorbing new saving) should be excluded. In other words, the deduction from the interest cost of servicing the debt should equal the amount of the so-called Fisher effect (i.e., the inflation premium in nominal interest rates, reflecting inflation expected over the life of the debt instrument).

Cagan also notes that uncompensated declines in the real value of the debt result in capital losses to the private holders of the debt. These losses are a source of a further effect of inflation on debt financing, to the extent that the losers gradually attempt to save more to replace the loss to their financial capital stock. Cagan notes that estimates of this wealth effect range between 2-1/2 to 5 percent per year of the change in wealth; an uncompensated decline in the real value of the debt would add to the annual saving flow about 2-1/2 to 5 percent of the decline. He estimates that from the mid-1960s through FY 1982, the uncompensated decline was about $275 billion in 1981 dollars. Thus, according to these calculations, this effect adds about $7 billion to $14 billion per year to the flow of saving (and does not change much year-to-year because it reflects accumulated capital loss on the debt).

William Fellner (1984) estimates that during the period 1954-1982, total private net worth underwent a positive real revaluation (in excess of the PCE deflator) -- measured as the algebraic sum of overlapping three-year spans -- of about $3.5 trillion. Then, based on a regression estimate, he finds that consumption would rise -- or, equivalently, saving would fall -- by about 2 to 3 percent of the revaluation ($70 to $90 billion). Since he estimates personal saving was about $1.5 trillion over the period (personal income was about $22 trillion), the revaluation would result in a 5 to 6 percent reduction in personal saving.

In an attempt to focus on the revaluation of financial assets, Fellner notes that the revaluation estimate should be taken as a "package," and that only a shaky estimate can be made for a decomposition of the total revaluation. However, he estimates that the real revaluation of net fixed dollar positions and corporate equities is a negative $0.4 trillion and the positive effect on savings is about $20 billion. This estimate is rather modest in size. But Fellner's revaluation takes the PCE deflator as the basing point (revaluation does not begin until after the change in the PCE deflator is applied). And because the government debt is taken at par value his revaluation estimate includes no adjustment to government debt.

To the extent that interest rates change, the par value of debt is an inaccurate approximation to its market value. John Seater (1981) has constructed several series on the year-end market value of outstanding government debt. His series are exact measures of market value in that they are based on actual price quotes for each specific issue. The series include data on bonds, notes, certificates of indebtedness, and bills, for the period 1919 to 1975. He compares his results with existing data series constructed by other methods and shows that his are a considerable improvement.

W. Michael Cox and Eric Hirschhorn (1983) extended Seater's
data by calculating the market value of outstanding Federal debt
monthly from 1942-1980. They provide separate series for Treasury
bills, bonds, certificates of indebtedness, notes, and total
Treasury debt, along with estimates of privately held Treasury
debt and gross Federal debt.

James Butkiewicz (1983) notes that the data series constructed
by Seater and by Cox and Hirschhorn are costly to calculate.
Therefore, he developed an alternative technique to estimate the
market value of outstanding Federal debt. His approach is based
on the assumption that all debt may be aggregated into a single
issue of average maturity and average coupon interest rate. His
method is less costly than direct calculation, with only a marginal
reduction in accuracy.

Robert Eisner and Paul Pieper (1984), following the three
studies just mentioned, and others by Horigan and Protopapadakis
(1982), and the Economic Report (1982), revalue the Federal debt
to adjust for the effect of inflation and for differences between
par and market values. Of course, these valuations in the stock
of debt imply revaluations in the annual flow of deficit --
revaluations from what would be observed as either the unified
budget or the NIPA budget deficit estimate.

The Eisner and Pieper revaluations indicate that the real
(constant dollar) market value of net Federal debt (net Federal
debt equals gross debt minus financial assets) has fallen by half
from 1946 to 1980, while budget deficits have occurred repeatedly.
Eisner and Pieper also calculate the real market value for other
liabilities of the government and its assets and conclude that
Federal net worth has risen during the period.

They incorporate their inflation and par-to-market (i.e.,
interest-rate-related) gains and losses into the calculation of
the high employment budget noting that without these adjustments
the data would confuse nominal flows with changes in real stocks.
Since the revaluations apply to the net debt, they are less than
those for the gross debt.

In the opinion of Eisner and Pieper, a deficit that does not
increase the net debt of the government does not increase the net
income or the net wealth of the private sector and therefore does
not have, per se, an expansionary effect on aggregate demand.
They find that after their adjustments the recent official esti-
mates of high employment deficits become surpluses. Thus, they
conclude that fiscal policy on a full employment basis during
the 1981-1982 recession was quite tight rather than quite loose,
as suggested by the published official data (both unified and
NIPA).

As will be indicated below, although some econometric estimates of the effect of the deficit on the interest rate refer to the real deficit, it appears that the change in the Federal debt is adjusted only for inflation and not for the change from par to market value. The use of market value would probably introduce simultaneous equation bias into a regression equation used to estimate the real interest rate as a function of the deficit. However, it would appear that this problem can be solved by deriving a reduced form equation from a system where the interest rate is a function of the deficit, and a second equation where the deficit is a function of the interest rate.

Research to improve the estimates of an appropriate valuation of the Federal debt and the deficit continues. A major area of open inquiry is the estimation of expected inflation. This subject is also closely related to the measurement of the real interest rate.

MEASURING THE REAL INTEREST RATE

To estimate the relationship between the real deficit on real interest rates, it is necessary to have a data series for each variable. The real interest rate (r) is an unobservable concept defined as the difference between the nominal interest rate (i -- which is observable) and the expected rate of inflation (p^e -- which is unobservable) over the period of the loan. The basic reference on this topic is Fisher (1930), and further discussion is in Mundell (1963), Tobin (1965), Sargent (1973), Joint Economic Committee (1981), Santoni and Stone (1981), and Wood (1981).

Since expected inflation cannot be observed, it must be estimated in order to calculate the real interest rate. One way to do this is to assume that expectations about the future rate of inflation are formed on the basis of past inflation experience, such as observed (historical) inflation rates. This approach comprises a variety of hypotheses including the so-called extrapolative, the adaptive, and the distributed lag, which in some cases involves a form of learning or error correction in the formation of expectations. Turnovsky (1970) and Tanzi (1980), and the references cited there will acquaint readers with the large literature on this subject. Papers containing work using distributed lag models include Yohe and Karnosky (1969), and Feldstein and Chamberlain (1973), in addition to those noted below in the section on econometric tests of the effect of deficits on interest rates.

Another approach to modeling the formation of inflation expectations is to attempt to implement empirically the concept of rational expectations. The concept assumes that individuals use all of the information available, including information about

economic policy variables such as money growth, and do not make
systematic mistakes in their expectations. Thus, as regards
inflation, most versions of this theory would imply that, apart
from a pure random error which is serially uncorrelated, people's
estimates of inflation are correct. Mishkin (1981) and Plosser
(1983) are examples of studies that employ the rational expecta-
tions hypothesis. For more on rational expectations in general,
see Muth (1961), Shiller (1978), and other references listed
below in the section on rational expectations.

Some recent studies concerning the real interest rate,
including Wilcox (1983), Peek (1982), Reza (1983) and others use
Livingston survey data. These data are gathered in surveys of
people's actual expectations about inflation. The data and their
use are discussed in papers by Gibson (1972), Lahiri (1976),
Mullineaux (1980) and Tanzi (1980).

Assuming a satisfactory measure of the expected inflation
rate, some investigators have questioned the Fisher hypothesis
that i responds by an amount equal to the change in p^e, that is,
that the real rate is determined by real factors and is not
affected by inflation. Thus, a growing number of studies consider
the reasons why and the extent to which the real rate varies over
time (aside from random fluctuations). Sources on this topic
include, in addition to the papers mentioned earlier in this
section, the basic study by Fama (1975), Carlson (1977), Nelson
and Schwert (1977), and very recent studies by Peek (1982),
Summers (1983), Makin (1983) and Wilcox (1983).

Some empirical estimates of the relationship between i and
p^e indicate that although they move in the same direction, the
change in i may be larger or smaller than the change in p^e.
Given the Fisher hypothesis, such an outcome might arise from any
one of several sources. The result can be interpreted as evidence
of irrational behavior by investors, or of statistical instability
of the coefficients estimated from an inadequate specification of
the relationship between i and p^e, or that the data series on p^e
measures factors other than the expected inflation rate. Several
examples of such factors have been examined. One is the Mundell
(Tobin/Sargent) real balances effect which implies that i responds
by less than the change in p^e. Mundell's result occurs because
inflation reduces the value of real money balances, and hence
wealth, thus increasing saving and reducing the real interest
rate. A second factor is the income tax effect, which would
cause i to respond by more than the change in p^e, because a
tax must be paid on the inflation induced increase in interest
income. Supply shocks constitute a third factor.

Makin (1983) and Peek (1982) discuss, cite literature about,
and offer empirical evidence confirming the Mundell effect. The
Peek paper provides the same information regarding the tax effect.
Makin says his analysis (which controls for the effects upon the
expected real interest rate that result from money surprises,

anticipated inflation, inflation uncertainty, and the impact of taxes) suggests that market interest rates reflect an efficient inflationary premium, and notes that this result is largely contrary to recent findings by Summers (1983). Also he doubts that an "uncertainty premium" elevates market interest rates. Over the full sample period he found the premium to be negative, reflecting negative pressure on market rates from depressed real investment that outweighs the possible positive impact from depressed real saving.

The latter conclusion may be compared with the Mascaro and Meltzer (1983) analyses that increased variability of unanticipated money growth raises demands for debt and money and reduces the demand for real capital. In contrast to Makin, they find that interest rates on both short- and long-term debt rise by a risk premium. They estimate that, on average, over the period 1980 to 1981, the risk premium was 3.3 percent in short-term and 1.3 percent in long-term rates, and that the size of the risk premium rose after the October 1979 change in Federal Reserve procedures.

Wilcox, in addition to recognizing the Mundell and tax effects, tests the hypothesis that supply shocks (e.g., an oil price increase) have an effect on the nominal interest rate over and above the effect of inflation expectations. He finds that real interest rates fell in the latter 1970s in response to a reduction in the supply of energy, because as input prices rose, the profitability of, and demand for, capital fell, and the decline of investment and the lowered growth rate of the capital stock dragged down the real rate of interest. His estimates suggest that by 1978 supply forces had pulled real pre-tax interest rates down 1.7 percentage points from their 1972 level. The shock probably reduces net real after-tax return to some existing capital, while new fuel efficient capital would have a higher return. However, the output contraction effect of the increase in the relative price of oil is a real loss in income and wealth which reduces the desired capital stock and thus depresses the demand for investment, and therefore tends to reduce real interest rates.

Thus, Wilcox's model would predict that expansionary fiscal policy, coupled with a reduction in the long-run money growth rate that depressed the expected inflation rate, would raise real after-tax interest rates (in the short run, lower money growth would raise real interest rates even further). Increases in the supply of energy would likewise tend to raise the real rate.

Wilcox's hypothesis refers to permanent real supply shocks that operate in the longer run. He notes that in the short run, with imperfectly flexible nominal wages, supply shocks (e.g., material price increase) raise output price -- i.e., the aggregate supply schedule shifts up and to the left -- and (other factors

considered unchanged) this lowers real cash balances, increasing the demand for money, thereby temporarily raising real interest rates and lowering investment and output. But in the longer run, permanent real supply shocks reduce the return to and demand for capital (and labor), and thus drive down real and nominal interest rates (ceteris paribus). Wilcox recognizes that real rates may fluctuate with the business cycle -- e.g., an upward shift in the labor supply function (withdrawal of labor) caused by misperceptions would have the same effect as a supply shock (driving down the real rate of return to capital).

As noted above, the Fisher hypothesis is that the real interest rate is not affected by inflation, rather, it is ultimately determined by the real factors that are the source of the marginal productivity of real capital. Neoclassical macroeconomic growth and capital theory, and also microeconomic general equilibrium theory, analyze the relationship between the real interest rate and the marginal productivity of real capital. Good sources for macroeconomic growth theory are Solow (1956) and Burmeister and Dobell (1970). References for microeconomic theory are Malinvaud (1972) and Samuelson (1947).

Investigations into the validity of the Fisher hypothesis are motivated in part by the conviction that the level of the real interest rate rather than the nominal rate is directly related to the rate of investment. In general, holding constant the rate of innovation or technological change, a higher real interest rate is associated with less investment and lower capital intensity. Hence, other things being equal, to the extent that larger deficits raise real interest rates, they also depress investment.

ECONOMETRIC TESTS OF THE EFFECT OF DEFICITS ON INTEREST RATES

Econometric tests are a means of analyzing data in an attempt to shed light on the validity of a theoretical insight about economic events. These tests are an essential part of a scientific approach wherein questions are confronted with data, and they can be especially useful when theoretical analysis provides only ambiguous results. However, such tests cannot prove that a specified action causes a certain result. Rather, they provide quantitative estimates (statistically significant within certain confidence limits) of the extent to which variation in one variable is associated with variation in other variables. These probability-based estimates of the strength of such a relationship are the basis for a decision to accept or reject the theoretical insight about the way in which the world works.

A number of empirical studies bearing on the relationship between real deficits and real interest rates have appeared in the last dozen or so years, and the flavor of the debate is conveyed by summarizing a sample of this literature. Comparison of the

results of these studies is difficult because of a number of
differences including: the time periods examined; the theoretical
assumptions; the statistical/econometric methods; the variables
employed in the analysis; and the data used to measure the
variables. However, a reasonable conclusion from these studies
is that there is no consensus regarding the relationship between
real interest rates and deficits.

In an article that recently has been subject to reconsidera-
tion, Feldstein and Eckstein (1970) attempt to isolate and
estimate the economic forces that explain the long-term interest
rate. Their analysis, which combines Keynesian liquidity prefer-
ence/portfolio balance theory with Fisher's model of the role of
anticipated inflation, identifies four types of variables --
liquidity, inflation expectations, privately held government
debt, and short-run expectations about interest rate changes --
as important determinants of long-term interest rates (on seasoned
corporate Aaa bonds with about 25 years to maturity).

They conclude that throughout the entire period from 1954:I
to 1969:II the decline in the real per capita publicly held
Federal debt (i.e., the relatively slow growth of the nominal
debt) put downward pressure on interest rates; but that the
Federal deficit (measured by the change in the public debt) is
not significant in explaining interest rates. However, it is
important to note that the Feldstein-Eckstein estimate of the
relationship between the Federal debt and the real interest rate
is weak in that it is of only marginal statistical significance
and therefore is not robust enough to endure data revisions.
They also estimate that nominal rates responded on approximately
a one-for-one basis with expected inflation, and that the short-
run interest expectation effect was relatively small.

More recently, Sinai and Rathjens (1983), in an approach
similar to Feldstein-Eckstein, examined quarterly data for the
period 1960:I to 1982:III and concluded that their attempt to
link the per capita deficit -- measured by current changes in the
publicly held Federal debt -- over their sample period was not
successful.

However, they estimated that between November 1979 and
October 1982, a $1 increase in the projected real per capita
deficit (the average NIPA deficits for eight quarters into the
future) was associated with a 0.67 basis point (6.7 percentage
points per $1,000 of real per capita deficit) increase in the
long-term corporate bond rate. (A $200 billion nominal deficit
deflated by the GNP deflator is about $95 billion in 1972 dollars,
about $410 per person, which in their estimate would increase the
interest rate by about 2.7 percentage points.)

They note that this result does not apply to the earlier
period of their data. Thus, their conclusion, that changes in
future budget deficits have a significant impact now on long-term
interest rates, is based on a single episode and therefore deserves
equivocation. The fact that the deficit variable "works" only
for the last 3 of the 22 years in the sample period indicates
that the relationship is not strong enough to counter the "noise"
during the period from 1960 to 1979. In contrast, the variable
representing relative volatility of the bond and stock markets
(the standard deviation of interest rates?) did "work" for the
entire sample period, indicating that this volatility variable
has a stronger relationship with the real interest rate than does
the deficit.

The strength of the volatility relationship suggests a line
of investigation worth pursuing. The risk factor, represented by
the volatility variable, portrays heightened fluctuation (and
uncertainty about it and reduced ability to predict it) which
could be reflected in increased variance in the error term of the
estimating equation. To the extent this characteristic, hetero-
skedasticity, is present, the statistical tests of significance
are adulterated. Thus, it might be advisable to see whether the
results are robust enough to survive an adjustment for this
characteristic.

Also, the econometric estimates indicate enough serial cor-
relation to warrant the reporting of their results after autocor-
relation correction, but this was not done. And, their estimate
indicates that nominal interest rates rise only enough to cover
about half the expected future inflation, which in turn implies
that (other factors considered unchanged) real interest rates
decline in response to expected future inflation.

William Dewald (1983) presents data that suggest to him that
real deficits, per se, have not been a critical factor in high
real interest rates. Dewald's conclusion stems from an analysis
that employs the deficit variable -- the real deficit relative
to full employment output -- during the entire sample period.

Dewald's examination of the cycle average data for both long-
term and short-term real interest rates and for real deficits
relative to high employment GNP shows no strong association
between real interest rates and real deficits. In the most recent
cycle (1980:I through 1981:III) the long-term real interest rate
averaged 4.5 percent, and the short-term rate average 4.7 percent,
very high relative to earlier periods, but the relative real
deficit was about the same as in the preceding cycle. In prior
cycles the long-term real interest rate hovered in the 2-3 percent
range, while the short-term real rate was much more variable but
remained rather low (ranging from -0.3 percent to 1.2 percent).
The relative real deficit was about 1/3 of 1 percent through the
1960s, about 0.8 percent in the early 1970s, and about 1.4 percent

from then on through the early 1980s (the largest relative real
deficit in the sample period was in 1975:II). Thus, Dewald says
this evidence tends to refute the conventional wisdom; the
comparatively high real deficit during the period 1973:IV to
1980:1 was not accompanied by comparatively high real interest
rates.

Dewald's econometric estimates with cyclical-average data
indicate a positive relationship for both the long-term and the
short-term real rate with the real relative deficit, but the
relationship was insignificant for the short rate and only mar-
ginally significant for the long rate. In addition, measuring
real rates and the deficit based on actual inflation, he found
the real deficit had no significant effect on either the long or
the short rate. He notes that a percentage increase in the rela-
tive real deficit was estimated to have nearly the same 1 percent-
age point effect on both long- and short-term real rates, but
warns that the results are not very robust with respect to small
changes in the sample period and in the definitions of the varia-
bles, and that only a fraction of the variation in the real
interest rates is explained, suggesting that the results are
biased because of variables left out of the analysis. However,
his results indicate that when the relative real deficit is about
1 - 1.5 percent, as in 1981-1982, it could account for only about
1 - 1.5 percentage points of the real interest rate, which was
averaging about 4.5 percent.

Alan Blinder (1982) examines annual data for fiscal years
1952-1981. On the basis of this time series evidence (a' la
Granger and Sims), he cannot reject, in either of his regressions,
the hypothesis that growth in the publicly held government debt
(measured by the unified on- and off-budget deficit) does not
help predict real GNP growth. The estimated percentage change in
real income in response to a 1 percent change in the debt is a
small (between .06 percent and .13 percent) and statistically insignificant
number. Therefore, he concludes that the growth in
the national debt does not carry much information that is useful
in predicting future real GNP growth. This result suggests that
growth in the national debt does not carry much information that
helps predict real interest rates.

The context of Blinder's study is the question of the extent
to which monetization of the deficit matters. His conclusion
that the deficit does not help predict real GNP growth is derived
from an estimate in which the growth of bank reserves is held
constant. He notes that his measure of the Federal deficit is
nominal, in that it is not adjusted for the inflation related
decrease in the real value of the outstanding debt, and that when
he reestimated some of the regressions using the inflation corrected
deficit, the explanatory power of the equations deteriorated
enormously.

Makin (1983) examines quarterly data on the 3-month Treasury bill rate from 1959-II to 1981-IV to detect an impact upon the real interest rate arising from an exogenous (i.e., as distinct from cyclically induced) rise in fiscal deficits. He says his results regarding the possible significance of "crowding-out" can only be judged as "mixed to weak"; and that over the entire sample period the positive relationship found was only marginally significant.

Several aspects of Makin's paper are interesting. He develops a macroeconomic model in the IS-LM format with some modifications and an aggregate supply function. He uses the model to show that tests of the possible impact of fiscal deficits on interest rates conducted by inserting a measure of the fiscal deficit directly into an interest rate equation result in estimates biased downward and possibly negative, because deficits are endogenous and typically countercyclical, while interest rates are typically procyclical.

Thus, correct procedure tests the impact on interest rates of the exogenous (i.e., policy induced) portion of the deficit. Makin notes that since the measured impact on interest rates of an exogenous shift in any spending component, such as exports, should be identical to that of an exogenous shift in government expenditure, shifts in exports can measure the potential crowding-out impact of exogenous shocks to aggregate demand.

Using a direct measure of the deficit, he estimates that a $100 billion deficit would elevate short-term interest rates by only about 10 basis points, an estimate he regards as biased downwards. Reestimation using exports as an exogenous addition to demand indicated that a $100 billion exogenous rise in the deficit could elevate short-term interest rates by about 110 basis points (an estimate that is relatively close to the 70 basis points he reported in an earlier study). However, he notes that the statistical significance of this result is weak; it just barely avoids the judgment that these data reveal no relationship between the interest rate and the deficit.

Ali Reza (1983) examines quarterly data on the average market yield of 1-year Treasury bills during the period December 1959 through December 1982. He takes the Feldstein-Eckstein (1970) study as his point of departure, introduces some changes in the model and measurement of the variables, and comes to rather opposite conclusions.

His results suggest that the Federal deficit does not cause changes in either the real rate of interest or real output, and clearly does not increase either of them. Reza's analysis differs from Feldstein-Eckstein in that Reza bases his estimates on a more general model -- he uses an IS-LM model with an aggregate supply function; he adjusts the interest rate for the effects of the marginal tax rate to obtain an after-tax rate of return; and

he uses the Livingston series as a measure of anticipated inflation rather than a distributed lag of past inflation.

Although Reza's results are not conclusive, they are an interesting counterpoint to the Feldstein-Eckstein and the Sinai-Rathjens studies. Reza says the implication of his results is that the private sector fully discounts future tax implications of government deficits -- rational behavior in view of the recent experience when the 1981 tax cut was followed by the 1982 tax increase in response to the large deficits experienced in 1981 and forecast for subsequent years. Reza finds that exogenous government spending is the culprit in keeping interest rates high.

Charles Plosser (1982) tests the hypothesis that a substitution of debt for tax financing crowds-out private investment by driving up the required rate of return -- i.e., driving down the value of existing assets with fixed cash returns (e.g., bonds). He finds that there is little evidence that the way in which government expenditures are financed (taxes versus debt) is systematically related to movements in rates of return; unanticipated changes in government financing decisions appear to have no impact on asset values. In contrast, he finds consistent evidence that increases in government purchases are associated with higher interest rates.

Plosser's analytical approach and basic assumptions are controversial. His investigation assumes capital markets are efficient (that is, expectations are rational) and examines asset price response to a shift from debt financing to tax financing of a given level of government expenditures. Thus, his empirical analysis of fiscal policy is from a different perspective than the more traditional studies which attempt to estimate structural models of the financial sector or aggregate consumption and saving behavior in response to fiscal policy shifts.

The relationship he estimated is most significant for bonds with less than a year to maturity, a result he says suggests that such fiscal policy innovations have only a temporary impact. He notes that these findings may be interpreted as evidence of potentially interesting intertemporal substitutions induced by government spending. This interpretation, from the so-called rational expectations viewpoint, is that fiscal policy changes cannot effect permanent changes in macroeconomic behavior.

William Fellner (1984) focuses on the fact that empirical estimates of the investment-reducing effect of deficits are overstated if they fail to account for a rise in savings that occurs in response to downward revaluations of the public's real net worth -- revaluations that in fact have accompanied deficits. He examines data for the period 1954-1982, under the assumption of a given level of aggregate nominal income -- that is, given a monetary policy that offsets any additional expansionary or

restraining effect of fiscal policy. From these data he estimates
that the factors which moderate the investment-reducing effect of
budget deficits are more than negligible but are probably insuf-
ficient to neutralize the extent to which Federal deficits shift
savings away from private investment. Thus, he views the size
of the projected future structural deficits to be troublesome,
and suggests that deficit reduction measures should be directed
at tilting the consumption-investment mix back toward investment,
and that if additional taxes are needed they should be broadly
based consumption taxes. This policy judgment is based on esti-
mates that are admittedly crude, but are interesting nevertheless.

On the basis of cycle-average data, he observes that compared
to earlier years, the peak-to-peak period 1973-1979 has a sig-
nificantly lower savings ratio while real public indebtedness
was rising rapidly. While recognizing that, because of inadequate
controls this comparison is not conclusive, he notes that the
observation is contrary to the prediction of the Ricardo/Barro
theorem of the equivalence of tax and deficit finance.

The foregoing sampling of recent econometric tests of the
effect of real Federal deficits on real interest rates indicates
that empirical studies of the issue are inconclusive. It is not
surprising that it is difficult to isolate and measure a strong,
clear-cut effect. As indicated above, even the task of measuring
the essential concepts is as yet incomplete. Furthermore, there
remains considerable controversy about fundamental questions that
must be addressed in modeling the complex economic relationships.
Much of the theoretical and empirical research on the relationship
between the Federal deficit and the interest rate is based on one
or another variant of a Keynesian macroeconomic model. The
Keynesian framework has been expanded, tested, and criticized
over the past half century. To the extent that this model is
unable to explain reality, it is questionable as a basis for establishing
valid conclusions about the deficit/interest rate
issue. To indicate the many issues about which serious scientific
research continues to seek answers, the following pages are
devoted to some of the more important parts of the ongoing debate
about so-called mainstream macroeconomic relationships.

THEORETICAL RESULTS FROM BASIC KEYNESIAN ANALYSIS

The basic Keynesian approach gives the result (except for
the special case of the liquidity trap) that an increase in the
deficit brought about either by an increase in government spending
or a reduction in taxes has the effect of raising interest rates.
Both the model and its result are subject to numerous and varied
qualifications. An introduction to this voluminous literature
can be found in a macroeconomics textbook such as Dornbusch and
Fischer (1981) or Gordon (1982). Other general treatments can be
found in Allen (1968), Evans (1969), and Lerner (1951).

One of the basic analytical tools of Keynesian-type analysis is the IS-LM apparatus, which consists of equations showing equilibrium conditions in the money market and the product market. The IS-LM equations are often used in theoretical and empirical analyses of the effects of deficits on interest rates and other variables. A primary source for the IS-LM apparatus is Hicks (1937).

THE KEYNESIAN INVESTMENT AND CONSUMPTION FUNCTIONS

The Keynesian investment and consumption (savings) functions underlie the IS relation. Milton Friedman and David Meiselman (1963) produced evidence that cast doubt on the importance of investment as a determinant of cyclical behavior and on the stability of the Keynesian multiplier. Two major analyses of the consumption function are Ando and Modigliani (1963) and Milton Friedman (1957). Franco Modigliani and Richard Brumberg (1954) developed the life cycle hypothesis of individual saving behavior, which implies that the lifetime path of consumption is smoother than the lifetime path of disposable income. Further examinations of, and some disputes about, this theory appear in Modigliani (1966), Robert Hall (1978), and Sheldon Danziger, et al, (1980). A good source of numerous contributions (pro and con) to the debate about the Keynesian-type investment, consumption and saving functions (including, for example, the controversy about the extent to which saving responds to interest rate changes) can be found in various issues of the Brookings Papers on Economics (1972 to the present).

EFFECT OF WEALTH IN DEFICIT/INTEREST RATE ANALYSIS

Explicit consideration of the effects of changes in the stock of wealth has proven to be significant for macroeconomic analysis. Models which fail to consider the roles of stocks of various types of wealth are suspected of being a biased basis for addressing the deficit/interest rate issue. Simple Keynesian models contain at most only an unsophisticated treatment of wealth. In such models changes in taxes affect disposable income, but the resulting changes in government debt implied by the change in the deficit are largely ignored.

In the ongoing development of the Keynesian framework, the effects of wealth on macroeconomic variables such as consumption, and the demand for money, have been given increasing attention with explicit consideration given to wealth in the form of government bonds, privately issued bonds, real physical capital, and the money supply. Important sources for the treatment of wealth in Keynesian style models include Leijonhufvud (1968), Metzler (1951), Patinkin (1965), and Tobin (1961 and 1969).

The standard IS-LM analysis is that substitution of deficit for tax financing (of a given level of government expenditures) increases aggregate demand. Examples of this approach are

Modigliani (1961) and Blinder and Solow (1973). In this analysis
it is assumed that the government bonds issued to the public to
finance the deficit increase private wealth, and because increases
in wealth increase current consumption, aggregate demand is
given a further boost. However, because of this boost to current
consumption, the increase in private saving is less than the bond
issue and, therefore, real interest rates rise and crowd out some
private investment. As a result, the rate of capital accumulation
falls and future generations have a smaller capital stock.
Researchers have found several bases for casting doubt on this
analysis and conclude that deficit increases result in a rise in
real interest rates and crowd-out private investment.

Barro (1974) argues that the standard analysis is incorrect
because it does not recognize that future taxes required to
service and retire the debt imply that there is no net wealth
effect associated with the issue of government debt. This implies
that there is no difference between financing government spending
by taxes or by debt. Empirical studies attempting to settle the
theoretical dispute remain controversial.

Some of these studies work within the IS-LM structure.
These include Buiter and Tobin (1979) and Feldstein (1982), who
conclude that the public considers the government bonds they hold
to be wealth, but the findings of Kochin (1974), Kormendi (1978),
and Tanner (1979) find that the data suggest that government
bonds are not wealth (do not influence aggregate consumption).
As indicated earlier, Plosser (1982) considers the issue from a
different perspective and investigates the response of asset
prices in an efficient capital market. He estimates the extent
to which a substitution of debt financing for tax financing is
associated with an increase in interest rates. He concludes that
the evidence suggests that asset prices are unrelated to how the
government finances its expenditures, and thus that government
bonds are not wealth.

DEMAND FOR MONEY IN KEYNESIAN MODELS

The behavior of the demand for money, especially as a function
of interest rates, is the heart of the LM relation and thus is
critical in the Keynesian analysis of the effects of an increased
deficit on interest rates. The primary means by which an increase
in the deficit raises interest rates in the basic Keynesian model
is by increasing nominal demand, and thereby increasing the demand
for money to support the higher volume of nominal transactions.
Given an unchanged supply of money, if the demand for money is
very insensitive to variations in interest rates, that is, if a
bigger increase in interest rates is needed to bring money demand
down a given amount, the degree to which interest rates rise in
the Keynesian model for a given increase in the deficit will be
larger.

There is theoretical disagreement as to whether the interest rate affects the demand for money. Econometric tests generally show there is an effect, but the magnitude remains a matter of controversy and studies continue.

A substantial volume of literature has been written about theoretical and empirical aspects of the demand for money. Three articles containing theoretical material are Baumol (1952) and Tobin (1956 and 1958). Empirical literature on the demand for money is also extensive. Three references are M. Friedman (1959), Goldfeld (1973), and B. Friedman (1978).

QUANTITY THEORY CRITICISM OF KEYNESIAN MODELS

Milton Friedman and other "monetarists" question Keynesian theory on monetary grounds. Friedman (1956) presents the elements of this theoretical approach.

In a number of NBER studies during the nineteen-sixties, Friedman and Anna J. Schwartz investigated the relationship between money and cyclical behavior. They found that the changes in money income and prices that marked every major episode (deep depressions or major inflation) in U.S. economic history were "accompanied by a change in the rate of growth of the money stock, in the same direction and of appreciable magnitude." Inasmuch as this "cannot consistently be explained by the contemporary changes in money income and prices," either it must stem from coincidence or "it must reflect an influence running from money to business." (Friedman and Schwartz, 1956).

A symposium on Friedman's theoretical framework was published in the Journal of Political Economy (1972). This symposium included contributions by Brunner and Meltzer, Tobin, Patinkin, and a reply to his critics by Friedman.

Brunner and Meltzer (1972) also develop an alternative to the standard IS-LM framework. Their model includes two asset markets (rather than just a money market) and the prices of real assets, financial assets, and output. Thus they can analyze the substitutions between money, bonds, real capital, and current consumption that occur as adjustments to changes in monetary or fiscal policies or by autonomous changes in the productivity of capital. They can analyze also the interrelation of asset prices, output prices, and interest rates.

In addition, they develop an analysis of the credit market and its interaction with the rest of the economy and use it as a price theory explanation of persistent or "involuntary" unemployment. In their model the credit market is the main link between the government and the private sector, and they explicitly consider the effects on assets and output of financing the government's budget. In contrast to the Keynesian paradigm, the

relative responses to monetary and fiscal policy in their model
do not depend on the interest elasticities of the IS or the LM functions.
Nor is the real balance effect crucial for a positive
response of output to changes in money or the monetary base; the
dominant wealth effect induced by monetary (and some fiscal)
policies is a change in the price of output (the price level).
A constant, maintained budget deficit financed by issuing debt
raises market interest rates and the price of real capital.

LOANABLE FUNDS (FLOW-OF-FUNDS) ANALYSIS

Frequently the effects of deficits are analyzed in terms of
loanable funds, especially when the analysis is concerned with
very short-term impacts of deficits on financial markets. The
issuance of bonds by the government for the purpose of financing
an increase in the deficit is said to increase the demand for
loanable funds, and if the supply of loanable funds does not
increase by the same amount, interest rates will rise. Whether
or not the supply of loanable funds will increase by the same
amount as the demand depends on the extent to which the future
liabilities implied by the new bonds are taken into account and
whether the bonds are regarded as wealth. If the future liabilities
completely offset the current wealth in the bonds, in most sit-
uations (aside from incentive effects) saving and the supply of
loanable funds should rise by the same amount as the demand, and
interest rates should not have to change to bring supply and
demand into balance. This subject is discussed in Tsiang (1956)
and in the references to the Ricardo/Barro "equivalence theorem."

CROWDING-OUT

Benjamin Friedman (1978) analyzes the financial market
aspects of the question whether Federal Government deficits crowd-
out private investment spending. His model assumes that: monetary
policy does not accommodate the increase in the deficit; the
economy is operating at less than full capacity (at full employ-
ment, additional debt financed government spending induces infla-
tion and thus displaces some private spending); and that higher
utilization rates induced by government spending do not have an
"accelerator effect" which would result in an increase in the
desired capital stock. Friedman examines two financial market
phenomena: transactions crowding-out and portfolio crowding-out.

To the extent that an increase in the fiscal deficit stimu-
lates aggregate demand, it increases the demand for money to
finance the larger volume of transactions, which raises interest
rates, thus discouraging some private spending. This result is
moderated to the extent that the demand for money decreases (the
velocity of money increases) in response to the rise in the

interest rate -- so interest rates rise less -- and the extent
to which the demand for investment goods is insensitive to the
rise in interest rates. Friedman's statistical estimates indicate
that, in the short run, transactions crowding-out is minor, and
although it increases in the longer run it discourages less than
half of the potential fiscal impact of the deficit.

Portfolio adjustments can occur as a result of an increase
in the deficit financed by government bonds sold to the public.
Friedman's analysis, building on the work of Tobin, examines a
model with 3 assets: money, government bonds and private capital
ownership. This model is sufficiently general to yield ambiguous
results of the portfolio adjustment effect of a deficit increase
on private investment.

The public may respond to the increased volume of bonds in
their portfolios by seeking to increase its desired holdings of
cash or real capital. Increased demand for real capital tends to
reduce the required return on investment, thus promoting real
capital accumulation. In contrast, increased demand for more
cash holdings tends to raise interest rates on government debt,
making investment in real capital less attractive. The outcome
depends on whether money or private capital ownership is the
closer substitute for government debt. Portfolio crowding-out of
private capital formation necessarily follows if investors view
government securities and capital as perfect substitutes. Some
Keynesian models, such as Blinder and Solow (1973), assume this
is the case, but this assumption is shown to be neither theoret-
ically nor empirically valid. On the other hand, portfolio
crowding-in of private capital formation necessarily follows if
an increase in wealth does not increase the demand for cash.
But Friedman presents empirical evidence that wealth does influ-
ence money demand. Friedman emphasizes that there are no conclu-
sive findings as to whether actual behavior results in portfolio
crowding-out or portfolio crowding-in.

However, Friedman suggests that short- and long-term govern-
ment securities may have different relative substitutabilities
with cash and capital -- short-term Treasury bills are perhaps
more like money, while very long-term Treasury bonds are more
likely to provide investors with substitutes for long lived
capital goods. To the extent this is the case, debt management
practices that finance a deficit with very short-term rather
than long-term securities would be less likely to crowd-out
private capital investment.

Other references on the subject of portfolio crowding-out
are Roley (1979, 1981, and 1982). These papers also provide
useful references to empirical and theoretical research in this
area.

IMPLICATIONS OF GROWTH IN THE FEDERAL DEBT

Prolonged large Federal deficits create the risk that the
Federal debt will account for a large and growing share of the
total credit market indebtedness of U.S. nonfinancial borrowers.
Benjamin Friedman (1983) notes that the economy's total debt-
to-GNP ratio has remained relatively constant (displaying no trend
and little cyclical fluctuation) since the end of World War II.
However, despite the relative stability of the total, the compo-
nents -- the private sector debt-to-GNP ratio and the Federal
debt-to-GNP ratio -- fluctuate. Neither component shows a stable
relationship to GNP, but their movements have been offsetting, so
the total has remained a rather constant 1.45 percent of GNP.

Friedman traces the Federal debt-to-GNP ratio, noting a
decline from 103 percent in 1946, to 63 percent in 1953, to the
24-29 percent range in the 1970s through 1982 -- which he compares
to the 27 percent rate in 1918. However, he points out that the
declining trend stopped in the mid 1970s, has turned up in FY 1983,
and is projected to rise further through FY 1988. The rising
Federal debt-to-GNP ratio reflects a path of deficits that is
relatively large compared to nominal GNP growth resulting from
either real output growth or inflation. Given the rather constant
total debt-to-GNP ratio, the rise in the Federal debt ratio
implies a falling private debt-to-GNP ratio.

He puts the projected decline in the private debt ratio in
the perspective of the 1956-1980 period during which the noncor-
porate business sector (which accounts for about three-quarters
of U.S. plant and equipment investment) used borrowing to fund
about 64 percent of its net financial requirements. Thus, Friedman concludes
that in the absence of a major change in financing
patterns, the build-up of the Federal debt-to-GNP ratio implies
less debt available to finance the private capital accumulation
necessary to increase the nation's capital intensity (the capital
stock-to-total output ratio). By focusing on the debt-to-GNP
ratio Friedman adjusts for actual inflation rather than properly
accounting for expected inflation, and it is not clear whether he
makes a par to market value adjustment, but nevertheless his main
conclusions deserve consideration.

Frank de Leeuw and Thomas Holloway (1983) also explore the
buildup of Federal debt resulting from sustained deficits. Based
on the level of real GNP at its mid-expansion point in the cycle,
they estimate a "mid-expansion trend GNP path," which removes
cyclical fluctuations, but preserves the average level of real
GNP growth over the period 1953-80. Based on this trend real
GNP path, they estimate a time series of the cyclically adjusted
Federal deficit and the cyclically adjusted Federal debt.

To analyze the long-run "crowding-out" of private investment, de Leeuw and Holloway prefer to represent the role of the Federal budget by an estimate of the market value of the stock of publicly held Federal debt rather than the current deficit flow. This analytical preference stems from the fact that the stock of government securities, not the current deficit, is a substitute for capital stock in the public's asset portfolio (as noted above in Friedman's analysis of crowding-out). The choice is important because the Federal deficit-to-GNP ratio need not move in the same direction as the Federal debt-to-GNP ratio.

Rather than use actual data, they use cyclically adjusted data because the growth of the trend (cyclically adjusted) debt relative to trend GNP is important for the analysis of the impact of the budget on productivity and growth. And, focusing on changes in the cyclically adjusted debt-to-trend GNP ratio is similar to analyzing the effect of the real (rather than the nominal) deficit by including real (rather than nominal) interest payments to account for changes in the real value of outstanding Federal debt.

Of course, the cyclically adjusted Federal debt is the cumulation of annual cyclically adjusted Federal deficits. So it is important to note that the de Leeuw and Holloway estimate of the cyclically adjusted Federal deficit tends to be higher than alternative measures such as the BEA's published high employment budget (measured at a 4.9 percent unemployment rate) or even a high employment budget based on a 6 percent unemployment rate. For example, for 1983, when the actual deficit was 5.6 percent of actual GNP, the de Leeuw and Holloway cyclically adjusted deficit was 4 percent of "mid-expansion trend" GNP, whereas the BEA high employment deficit was 1.5 percent of high employment GNP, and the high employment budget at 6 percent unemployment was 2.5 percent of the corresponding high employment GNP.

The de Leeuw and Holloway estimates indicate that increases in the cyclically adjusted Federal debt-to-trend GNP ratio during 1981-83 were due, about equally, to the differential between the interest rate on Federal debt and the GNP growth rate, and to explicit policy decisions about Federal receipts and expenditures. The major policy decisions were cuts in personal and corporate taxes, and increases in defense spending. de Leeuw and Holloway project that, under a wide range of assumptions about interest rates, GNP growth rates, and budget decisions, the cyclically adjusted Federal debt-to-trend GNP ratio will increase during the period 1983 to 1988.

POTENTIAL INSTABILITY

Sargent and Wallace (1981) have pointed out that persistent deficits cause an increase in the Federal debt-to-GNP ratio that can be unstable. If Federal expenditures other than interest

payments on the Federal debt are a larger share of GNP than are
Federal tax receipts (that is, there is a so-called "primary
deficit"), and if the interest rate on the Federal debt exceeds
the growth rate of GNP, interest payments on the Federal debt
become a progressively larger share of GNP. The Federal debt-to-
GNP ratio rises because of the need to finance the persistent
primary deficit and the ever growing interest bill. Sargent and
Wallace suggest that as this process continues, so does the
pressure to monetize the debt. Monetization would bring inflation,
which would reduce the real value of the debt and thereby reduce
the real value of interest payments on the debt. But inflation
could accelerate unless expenditure reductions and/or tax increases
reduced the primary deficit and allowed the monetization process
to stop.

James Tobin (Conference Board, 1983) analyzes the dynamics
of Federal deficits and debt using a model similar to the one
examined by Sargent and Wallace. He focuses attention on an
equation that describes the growth of the Federal debt-to-GNP
ratio. This equation shows the crucial relationship between the
real interest rate on Federal debt and the growth rate of real
GNP. The assumption of reasonable values for the parameters in
the equation permits the calculation of a "steady state" or
"stationary" value of the debt-to-GNP ratio, the level at which
the ratio would stop rising, as long as the growth rate of real
GNP exceeds the real interest rate.

Tobin also uses the model to estimate the path of the Federal
debt-to-GNP ratio for various periods from 1952 to the present.
For example, for the 1980-81 period, he calculates the actual
debt-to-GNP ratio to be 26.5 percent. Using parameter values from
that period he estimates that after 5 years the ratio would rise
to 29.1 percent and to 31.6 percent after 10 years, and that the
hypothetical "stationary" level of the ratio is 80 percent.
While rather imprecise, these estimates are commensurate with
those of de Leeuw and Holloway mentioned above.

Tobin also suggests that, rather than allowing the debt-
to-GNP ratio to rise to the maximum level implied by the situation
in 1980-81, policy steps could be taken to stabilize the ratio at
about 30 percent. He says this would require reducing the primary
deficit to 0.6 percent of GNP. But, he says, the key is to reduce
the real (after tax) interest rate to 1 percent, by a one time
monetary injection, which would raise the Fed's monetization of
the debt and future deficits to about 17 percent (a level much
closer to historical practice than is current policy).

MONETIZATION OF THE DEFICIT

Macroeconomic analysis generally concludes that important
consequences depend upon the extent to which the Federal debt is
monetized. The search continues for conclusive evidence on

several related questions. One is the extent to which monetization affects real versus nominal GNP. Another question is what factors determine the extent to which the Fed will monetize the deficit.

As Alan Blinder (1983) puts it, the first question amounts to asking, "do open market operations matter?" That is, for a given budget deficit, will real or nominal GNP behave differently depending on whether the new bonds are bought by the Fed or the public? Blinder presents the traditional analysis and then reviews some recent theoretical literature which indicates that the answer is ambiguous when the dynamics of wealth effects, supply-side effects, and expectational effects are considered. To resolve the ambiguity, he presents time series evidence (see page 12 above) which supports the idea that monetization matters mainly as a predictor of future growth in nominal, but not real, GNP. In addition, Blinder finds only mixed evidence that a monetary base variable helps predict inflation, once growth in government debt is accounted for.

Since the extent of monetization is considered to be an essential consideration in estimating the extent to which deficits might be connected to the process of inflation, Blinder also reviews recent studies of the extent to which deficits are asso-ciated with increased money growth. He finds the evidence mixed -- no firm conclusions about the determinants of monetization. His own estimates, based on data for the period 1961-1981, indi-cate that about 6-1/2 percent of a nominal deficit would be monetized, after accounting for the effects of inflation and the annual growth of government purchases, both of which tend to decrease the fraction of the nominal deficit that is monetized. These estimates are similar to those reported by Mickey Levy (1981). However, when Blinder based his estimates on the inflation adjusted deficit, that variable showed no relationship with money growth. Both the Blinder and the Levy papers provide succinct reviews of and further references to the literature on this topic.

As was mentioned in the section above on "potential insta-bility," the buildup of the Federal debt-to-GNP ratio increases the pressure to monetize the debt. Indeed, Sargent and Wallace (1981) show that under some circumstances, a relatively large Federal debt severely constrains the ability of monetary policy to control inflation. Tight money now will result in future inflation higher than it would be with looser monetary policy now, because tighter money means greater reliance on bond finance. This in turn means that the debt will be larger at some specified date in the future when monetization will, by assumption, begin. The larger the debt, the more monetization will be required, and the greater the inflation that will result. To the extent that this chain of events is anticipated and results in an increase in the monetary base, tighter money now could result in more inflation now. In addition, Preston Miller (1983) argues that even if the Federal Reserve does not formally monetize the debt,

higher interest rates make it profitable to hold interest bearing assets that are as risk-free as money and that can be used essentially as money in transactions. Thus the private sector introduces and trades in such instruments and effectively monetizes the debt.

EFFECT OF WAGE-PRICE BEHAVIOR IN DEFICIT/INTEREST RATE ANALYSIS

The analysis and prediction of wage-price behavior continues to be an area of great controversy. Assumptions about such behavior can be crucial to conclusions about the deficit/interest rate issue. It tends to be true, for example, that neoclassical models assume that wages and prices are much more flexible in the short run than Keynesian models. Consequently, neoclassical macroeconomic models are much more similar to microeconomic general equilibrium models, and they tend to allow more room for incentive effects to operate. As a result, in such models the effects of an increase in the deficit brought about by a tax cut are more supply-side oriented, and the demand-side effects which may raise interest rates are less pronounced. For more on these complicated issues see Barro and Grossman (1971), Clower (1965), and Leijonhufvud (1968). An early article on wages in the Keynesian system is Keynes (1939). An important and controversial strand of the Keynesian tradition is the Phillips curve, which postulates that less unemployment leads to faster wage increases. The basic article for this approach is Phillips (1958). Other very fruitful sources are E. Phelps (1970 and 1972), R. Gordon (1983), M. Baily (1983) and J. Taylor (1983).

RELATIVE PRICE EFFECTS OF TAXES IN DEFICIT/INTEREST RATE ANALYSIS

The effects of taxes on prices and hence resource allocation also can be crucial to conclusions about the deficit/interest rate issue. As pointed out by a number of authors, the subject is treated inadequately at best in Keynesian-type analyses. Dale W. Jorgenson (1962) presented data to show that "the central feature of the neoclassical theory is the response of the demand for capital to changes in relative factor prices." In later work with Robert E. Hall, Jorgenson presented empirical evidence that investment was responsive to tax treatment (Jorgenson and Hall, 1967). Arnold Harberger, (1962, 1964, and 1974) utilizing concepts originating with Marshall and Walras, analyzed the way in which differential taxes contribute to inefficiency, and estimated the loss of efficiency associated with the corporate income tax.

RATIONAL EXPECTATIONS

As was indicated earlier, an important qualification to the standard Keynesian model that serves as a basis for much of the discussion of the deficit/interest rate issue is the growing literature on rational expectations. In a series of articles, Robert E. Lucas and Edmund S. Phelps developed a formal theory of

aggregate supply based on the methods used by economic agents to distinguish relative from absolute price changes. This theory allows for information lags and adjusted costs (see for example Phelps, 1970, and Lucas, 1973).

Thomas Sargent and Neil Wallace (1975) have offered an alternative formulation in which aggregate output varies with the difference between the actual current general price level and the general price level that people expected, in the last production period, to prevail during this production period.

More recent contributions, for example Blinder (1981), indicate that even anticipated money-supply changes can exert real output effects when the rational expectations paradigm is extended to the behavior of inventories.

The empirical studies of Friedman and Schwartz did not decompose the effects of money growth rate changes into their real and nominal components or identify the link between the formulation of people's expectations and the dissipation of real effects. In an effort to fill this gap, Leonall Andersen and Denis Karnosky (1973) examined the relationship between percentage changes in the money supply and percentage changes in prices and in real output. They found that permanent changes in monetary growth tend to be followed by "a sharp and substantial positive response of output growth for five quarters," whereas it takes the rate of price inflation at least 20 quarters to adjust.

In a later study, John Rutledge (1980) examined the effects of changes in the growth of money -- separated into anticipated and unanticipated components -- on prices and real output. He found that the adjustment of real output to an unanticipated change in the growth of money is about the same as the adjustment of prices to an anticipated change in the growth of money. Both take about eleven quarters to work themselves out. Robert Barro has estimated that an unanticipated rise of 1 percent in the growth of money will generate, in the same year, about a .36 percent rise in the price level and almost a 1 percent rise in real output. The price effect and the real output effect take, respectively, five years and two years to work themselves out.

CONCLUSION

Although not an exhaustive survey of the literature, the foregoing bibliographic notes acquaint the reader with a reasonably comprehensive sample of economic research on the relationship between the Federal deficit and interest rates, including references to the issues in macroeconomic theory that form the context of the discussion. The review of this sample indicates that controversy prevails, and the issue is yet to be settled in either the theoretical or empirical literature.

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PART III

INTEREST RATES AND THE FEDERAL DEFICIT:

SOME EMPIRICAL TESTS

INTEREST RATES AND THE FEDERAL DEFICIT:
SOME EMPIRICAL TESTS

INTRODUCTION

This paper presents empirical tests of the hypothesis that
higher Federal deficits raise real interest rates. The tests
make use of a particular type of equation for the determination
of interest rates which is presented in Feldstein and Eckstein
(1970). In the first stage of the analysis, the Feldstein-
Eckstein equation is estimated over the same sample period as in
the original article using the same data concepts, and then
reestimated for the period 1965 Q1 - 1983 QII, the sample used
in this paper. The reestimation indicates that the equation
fits poorly in the latter period, and therefore needs to be
respecified if it is to be used for testing the relationship in
the more recent past. This is done in the second section.
Finally, the tests for the effects of the deficit using this
equation are presented in the last section. The results of the
tests indicate that judging by the econometric techniques employed
in this paper, high deficits have had virtually no relationship
with high interest rates in this time period.

EXTENDING THE FELDSTEIN-ECKSTEIN ANALYSIS

The interest-rate equation used for the tests in this paper
is based upon the type of equation in Feldstein and Eckstein
(1970). This equation has been used with variations by other
authors, including Feldstein and Chamberlain (1973) and Sinai and
Rathjens (1983). Such an equation can be developed from a simple
modified LM curve giving the condition for equality of the supply
of and demand for the monetary base. This LM curve can be written
in implicit form as

$$G(i-p^e,m,x,z)-m=0 \qquad\qquad (1)$$

where i is the nominal interest rate, p^e is the expected inflation
rate so that $i-p^e$ is the real interest rate, m and x are the
logarithms of the real monetary base and real output respectively,
z is a vector of additional variables, and the function G is the
demand for m. Equation (1) can be solved to isolate the real
interest rate on the left-hand side for purposes of estimation:

$$i-p^e=F(m,x,z) \qquad\qquad (2)$$

Several variables are included in z. If the Federal deficit affects interest rates, z should include a measure of the level of debt or the change in debt, that is, the deficit. When the government runs a deficit and issues bonds to finance it, private individuals or institutions can purchase these bonds by reducing either their level of consumption, or their holdings of money balances, or their holdings of assets representing claims on real private capital. If these government bonds are substitutes for real private capital in the portfolios of investors, they will be purchased largely by reducing investment. In such a case investment and capital intensity will decline, and the marginal product of capital and real interest rates will rise.

However, if the bonds are perceived as generating future liabilities, such as a future tax burden, these liabilities may bring about reduced consumption and increased private saving which could be used to purchase the bonds, leaving real interest rates and real private investment unchanged. More on these and related issues can be found in various articles surveyed in the companion survey of literature on the subject.

In addition, z should include p^e. This is because an increase in expected inflation lowers the return to holding money, thereby inducing a shift in portfolios away from real money balances. This reduction in the holding of wealth in the form of money could lead to an increase either in consumption or in investment. Insofar as investment increases, there is an increase in capital intensity and a reduction in real interest rates. Moreover, higher inflation rates tend also to be more highly variable, and in general, periods of high inflation have tended to be more unstable, both because of the volatility of the inflation rate itself, and because of the volatile nature of government policy responses to high inflation. Such volatility increases risk and could result in less innovation and technical change, in which case the productivity of capital and real interest rates would tend to be relatively lower. Hence these arguments lead to the conclusion that higher expected inflation brings about lower real interest rates.

In contrast to this discussion, in an equation such as equation (2) it is possible that higher anticipated inflation leads to higher real interest rates rather than lower ones. This could happen if a proportional tax is applied to interest income in nominal terms and nominal interest payments are deductible.[1/]   The tendency of inflation to raise real interest rates would be stronger insofar as the tax system is progressive, not indexed, and therefore marginal tax rates on interest income increase with inflation through bracket creep. Thus, a priori it cannot be said whether an increase in expected inflation

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[1/] Tax effects of this sort are examined in Darby (1975), Feldstein (1976), Peek (1982), and Tanzi (1980).

raises or lowers real interest rates. In Sections II and III equations will be presented which use both the before-tax and after-tax interest rate.

The vector of variables z should also include a measure of volatility in financial markets. This is because increased volatility raises risk for investors, who therefore insist on higher risk premiums in _real_ interest rates (in addition to higher risk premiums in nominal rates), thus causing real interest rates to rise.

The above discussion suggests that equation (2) be written in linear form as:

$$i-p^e = \beta_0 + \beta_1 m + \beta_2 x + \beta_3 d + \beta_4 p^e + \beta_5 s + u \tag{3a}$$

where d is a measure of Federal debt or the deficit, s is the measure of financial market volatility, and u is a disturbance. It is hypothesized that $\beta_1 < 0$ and $\beta_2, \beta_5 > 0$. If the deficit raises real interest rates, $\beta_3 > 0$. As noted above, the sign on β_4 is ambiguous. Finally, following Feldstein and Eckstein, in this style of equation p^e is measured as a distributed lag on the inflation rate $p^{2/}$, and so after moving p^e to the right-hand side, equation (3a) becomes

$$i = \beta_0 + \beta_1 m + \beta_2 x + \beta_3 d + (1 + \beta_4)\pi(L)p + \beta_5 s + u \tag{3b}$$

where $\pi(L)$ is a polynomial in the lag operator L, with the sum of coefficients equal to unity. It is understood that variables other than p may also enter the equation with lags.

In this equation the coefficient on the lag on inflation, $1 + \beta_4$, may not equal unity. If it does not, the Fisher effect, postulating that changes in inflationary expectations are equally reflected in changes in nominal interest rates, would not hold. On the other hand, over certain periods β_4 may be near 0. This could happen, for example, when inflation is relatively low and stable, and has little effect on investment or on marginal tax rates.

Nevertheless it should be clear that, in general, whatever is the value of β_4 when the interest rate is defined to be before-tax, it should decline and be negative when the same equation is estimated using an after-tax interest rate. This follows from the fact that using an after-tax interest rate

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[2/] Distributed lags on inflation were also used in Yohe and Karnosky (1969).

removes from the equation the effects of inflation through taxes on before-tax interest rates.

On balance, the existing empirical evidence from a number of studies indicates that $ß_4$ tends to be negative in most time periods even when a before-tax interest rate is used.[3/] In many cases $1+ß_4$ is substantially below unity. Therefore, in the equations done here, $1+ß_4$ is expected to be below unity when a before-tax interest rate is used, and to decline even more when an after-tax interest rate is used instead.

Equation (3) is estimated using quarterly data for the sample period 1965 QI - 1983 QII. The first step in this esti-mation is to reproduce as closely as possible Feldstein-Eckstein's specification of this equation (equation (10) in their article) for their original sample 1954 QI - 1969 QII, and test whether that specification is suitable for the later sample period. In reproducing the equation, except as noted below the variables are defined as nearly as possible to be the same as in Feldstein-Eckstein, so far as could be determined from their description in the original article. Of course there have been data revi-sions since their paper was written. The revised data are used here, so some differences from their results can be expected on the basis of these revisions alone. Similarly the estimation technique is as near to theirs as could be determined from their paper.

The following variables are used. For i the variable used is RI, the interest rate on seasoned Moody's AAA corporate bonds. Some of the independent variables are measured in real per capita terms; in each case this is done by dividing by the implicit price deflator for GNP and by the resident population. m is HPNL, the logarithm of the real per capita monetary base, using monetary base data from the Federal Reserve Bank of St. Louis. x is QNL, the logarithm of real GNP minus real GNP produced in the government sector, all on a per capita basis. This is a measure of real output produced in the private sector. d is DPNL, the logarithm of real per capita interest-bearing public debt securities held by private investors plus matured public debt and debt bearing no interest. There were changes in the definition of this series around 1968, and after 1968 QIII these data are spliced with old series embodying the same con-cepts. p is PCG, the percent change from the previous quarter at an annual rate of the implicit price deflator for personal consumption expenditures. This differs from the specification used by Feldstein and Eckstein, since they do not annualize the growth rate.

[3/] See Fisher (1930), Pearce (1979), Summers (1983), and Wood (1981).

Following Feldstein and Eckstein, the variable RID lagged one quarter is included, where RID is the first difference in RI. As discussed by them, such a variable measures expected changes in interest rates. As such it captures some but not all of the instability in financial markets that the variable s represents. No other measure of s is included.

Table 1 contains ordinary least squares estimates of the original Feldstein-Eckstein specification of equation (3) (equation (10) in their paper) using the data described above for their original sample period 1954 QI - 1969 QII, for the period 1965 QI - 1983 QII, and for the entire sample 1954 QI - 1983 QII. In Table 1 these three estimates are numbered equations (4), (5), and (6), and they differ only in that they are for different sample periods. The distributed lag on PCG(-1) is a third-degree polynomial distributed lag with no endpoint constraints. The a_i are the lag coefficients for this distributed lag. In these and all equations in this paper the t-ratios are in parentheses beneath the coefficients.

Equation (4) is, on balance, fairly close to the original equation (10) of Feldstein and Eckstein.[4/] The most striking difference, however, is that the sign on the debt variable has switched to negative, while at the same time this variable is significant. A negative sign, of course, says that more real debt per capita lowers interest rates. This switch in sign suggests that the influence of government debt in this equation over this sample is uncertain at best.

Equation (5) for the sample 1965 QI - 1983 QII differs from equation (4) in several respects. The coefficients on HPNL and QNL are much larger in absolute value. The debt term is still negative, and now it is highly significant. The RID(-1) term is very weak and of the wrong sign. And the coefficients on the price terms sum to a negative number. These results imply that this particular specification of equation (3) is unstable over time, and the equation needs to be respecified if it is to be of use in the later sample period. Moreover, the low Durbin-Watson statistic suggests that the equation needs to be corrected for serial correlation. Equation (6), run for the entire sample 1954 QI - 1983 QII, confirms these conclusions. Here the debt variable switches back to its original sign. However the Durbin-Watson statistic is far too low.

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[4/] As in their original equation, the sum of lag coefficients on PCG indicates that a change in expected inflation changes the interest rate by about the same amount. As noted before, this result is different from most empirical work, which gets a coefficient below unity.

Table 1

Estimates of the Feldstein-Eckstein
Specification of the Interest-Rate Equation

Equation Number	4	5	6
Dependent Variable	RI	RI	RI
Sample	1954QI-1969QII	1965QI-1983QII	1954QI-1983QII
Estimation Method	OLS	OLS	OLS

Independent Variables:

Constant	-46.3140	-699.232	-70.6909
	(-10.78)	(-11.34)	(-2.70)
HPNL	-5.4290	-66.9358	-10.7192
	(-8.36)	(-13.16)	(-5.83)
QNL	4.5801	27.4776	8.4721
	(6.51)	(8.83)	(7.13)
DPNL	-1.6072	-4.7611	3.0435
	(-2.07)	(-4.48)	(3.33)
PCG	0.0425	0.0255	-0.0201
	(3.20)	(0.46)	(-0.36)
RID(-1)	0.6897	-0.0770	0.3997
	(6.34)	(-0.44)	(1.77)

Coefficients of Polynomial Distributed Lag on PCG(-1):

	$a_1 = 0.0604$	$a_1 = -0.0140$	$a_1 = 0.0717$
	$a_2 = 0.0612$	$a_2 = -0.0093$	$a_2 = 0.0737$
	$a_3 = 0.0612$	$a_3 = -0.0058$	$a_3 = 0.0738$
	$a_4 = 0.0607$	$a_4 = -0.0033$	$a_4 = 0.0723$
	$a_5 = 0.0595$	$a_5 = -0.0018$	$a_5 = 0.0695$
	$a_6 = 0.0579$	$a_6 = -0.0012$	$a_6 = 0.0654$
	$a_7 = 0.0559$	$a_7 = -0.0014$	$a_7 = 0.0603$
	$a_8 = 0.0534$	$a_8 = -0.0023$	$a_8 = 0.0543$
	$a_9 = 0.0507$	$a_9 = -0.0038$	$a_9 = 0.0477$
	$a_{10} = 0.0477$	$a_{10} = -0.0058$	$a_{10} = 0.0406$
	$a_{11} = 0.0445$	$a_{11} = -0.0083$	$a_{11} = 0.0331$
	$a_{12} = 0.0413$	$a_{12} = -0.0110$	$a_{12} = 0.0256$
	$a_{13} = 0.0380$	$a_{13} = -0.0141$	$a_{13} = 0.0181$
	$a_{14} = 0.0347$	$a_{14} = -0.0172$	$a_{14} = 0.0109$
	$a_{15} = 0.0314$	$a_{15} = -0.0204$	$a_{15} = 0.0041$
	$a_{16} = 0.0283$	$a_{16} = -0.0235$	$a_{16} = -0.0020$
	$a_{17} = 0.0255$	$a_{17} = -0.0265$	$a_{17} = -0.0073$
	$a_{18} = 0.0229$	$a_{18} = -0.0293$	$a_{18} = -0.0117$
	$a_{19} = 0.0206$	$a_{19} = -0.0317$	$a_{19} = -0.0149$
	$a_{20} = 0.0187$	$a_{20} = -0.0337$	$a_{20} = -0.0167$
	$a_{21} = 0.0173$	$a_{21} = -0.0352$	$a_{21} = -0.0170$
	$a_{22} = 0.0165$	$a_{22} = -0.0361$	$a_{22} = -0.0155$
	$a_{23} = 0.0162$	$a_{23} = -0.0363$	$a_{23} = -0.0122$
Sum	0.9245	-0.3719	0.6238
	(15.45)	(-2.57)	(6.94)
Adjusted R^2	0.987	0.957	0.935
Std. Error	0.1093	0.5519	0.7798
D-W	1.51	1.17	0.26

RESPECIFICATION OF THE DEFICIT-INTEREST RATE MODEL

The results in the previous section indicate that the original Feldstein-Eckstein specification of this interest-rate determination equation needs to be changed for the sample 1965 QI - 1983 QII. This is done in this section, except that variables representing the Federal debt or deficit are omitted. These variables are added in Section III to test for their possible effect on the interest rate.

In respecifying the equation several changes are made. These changes were developed by experimenting with alternative specifications of equation (3). First, QNL is replaced by XNL, the logarithm of real GNP per capita. Since real GNP is a broader measure of output, it should reflect better the total effects of output upon interest rates. This variable comes in the equation as XNLA, which is defined as:

$$XNLA = (\Sigma_{i=0}^{-2}XNL(i))/3 \qquad\qquad (7)$$

Also, RID(-1) is replaced by RIDSL, which is

$$RIDSL = (\Sigma_{i=-2}^{-9}RIDS(i))/8 \qquad\qquad (8)$$

where RIDS is the absolute value of RID.

RIDSL is a distributed lag on the absolute value of changes in the interest rate and is a better measure than RID(-1) of vola-tility in financial markets. The previous section showed that RID(-1) performs poorly and a better variable is needed.

In addition, the distributed lag using the current value of PCG and a polynomial lag on PCG(-1) is replaced by a Pascal lag on the current and lagged values, which captures the lag pattern more concisely. In this paper a Pascal lag of a given order and average lag is computed by calculating the first 21 lag coeffi-cients for that order and average, then normalizing them so they sum to unity and applying them to the current and lagged values of the variable. In the following tables PCG04 and PCG08 are Pascal lags on PCG of second and third orders respectively with average lags of 4 and 8 quarters respectively. In the previous section the average lag in equation (4) in the original sample 1954 QI - 1969 QII was over 8 quarters. However the negative signs on the lags in the 1965 QI - 1983 QII sample suggest that in that sample the average lag should be much shorter. As shown below, the four-quarter average lag works well.

A final change is that HPNL is lagged two quarters. This two-quarter lag is consistent with the lag back two quarters of XNL, and the two-quarter lag of the two-year average of RIDS.

Estimates of the interest-rate equation respecified in this manner are presented in Tables 2 and 3. Included is an equation using the after-tax interest rate RIT defined as RI(1-T), where T is the average marginal tax rate on interest income. Data for T were kindly provided by Vito Tanzi. These data are available only through 1981, so equation (12) stops at that point.

Table 2

Final Specification of the Interest-Rate Equation

Equation Number	9	10	11	12
Dependent Variable	RI	RI	RI	RI
Sample	1965QI–1983QII	1965QI–1983QII	1965QI–1983QII	1965QI–1981QIV
Estimation Method	OLS	ML	Weighted ML	Weighted ML

Independent Variables:

Constant	-164.626	-259.860	-177.408	-93.1944
	(-3.94)	(-3.94)	(-3.06)	(-1.82)
HPNL(-2)	-17.1459	-25.4711	-18.4304	-10.0429
	(-4.96)	(-4.68)	(-3.72)	(-2.26)
XNLA	8.5508	10.1366	9.1457	5.4986
	(8.00)	(5.11)	(5.21)	(3.38)
PCG04	0.4162	0.4493	0.4583	0.3136
	(9.65)	(5.68)	(6.39)	(5.01)
RIDSL	5.0242	3.2855	3.4422	1.2472
	(10.72)	(4.45)	(4.65)	(1.83)
Adjusted R^2	0.974	0.870	0.991	0.977
Std. Error	0.4321	0.3643	0.7494	0.4922
D-W	0.98	1.81	1.77	1.80
ρ	----	0.6379	0.6047	0.7846

Table 3

Alternative Specifications of the Interest-Rate Equation

Equation Number	13	14	15
Dependent Variable	RI	RI	RI
Sample	1965QI-1983QII	1965QI-1983QII	1965QI-1983QII
Estimation Method	Weighted ML	Weighted ML	Weighted ML
Independent Variables:			
Constant	-172.251	-181.040	-77.9902
	(-2.86)	(-3.26)	(-0.91)
HPNL		-12.2172	
		(-1.63)	
HPNL(-1)		10.2937	
		(1.15)	
HPNL(-2)	-17.9934	-16.9534	-10.0458
	(-3.48)	(-2.26)	(-1.29)
XNLA		9.4869	8.2218
		(5.62)	(2.25)
XNL	4.0470		
	(0.98)		
XNL(-1)	0.8672		
	(0.18)		
XNL(-2)	4.1764		
	(1.01)		
PCG04	0.4559	0.4070	
	(5.96)	(5.87)	
PCG08			0.6940
			(4.10)
RIDSL	3.4982	3.9432	0.2344
	(4.58)	(5.96)	(0.17)
Adjusted R^2	0.991	0.994	0.920
Std. Error	0.7594	0.7492	0.8008
D-W	1.76	1.82	1.82
ρ	0.6015	0.5005	0.9030

Equation (9) is the respecified equation estimated using ordinary least squares. The low Durbin-Watson statistic indicates serial correlation, so the equation is reestimated as equation (10) by full maximum likelihood with a first-order serial correlation correction. However in addition to serial correlation, there is reason to believe that the error term in this equation is heteroscedastic. Specifically, when volatility in financial markets as measured by RIDSL is higher, there will probably be more variability in RI for given values of the independent variables. To test for this,[5]/ RIDSL was put in ascending order and the rho-transformed variables from equation (10) were reordered correspondingly. The reordered sample of 74 observations was broken into three subsamples of 28, 18, and 28 observations, and the ratio of the residual sums of squares from the last and first subsamples was computed. The result was 6.43, which when compared with an F distribution with 23 and 23 degrees of freedom leads to rejection of the null hypothesis at the usual levels of significance.

In correcting for this heteroscedasticity, it was assumed that the variance of the disturbance in the equation was proportional to RIDSL. Accordingly, the equation was respecified by dividing all variables by the square root of RIDSL, and the resulting equation was estimated by maximum likelihood with the first-order serial correlation correction. The resulting estimates, termed weighted maximum likelihood estimates, are in equation (11). Using equation (11) and the same procedure as in the previous paragraph, the statistic for testing for heteroscedasticity is reduced to 1.87, which is no longer significant.

On balance the estimates in equations (9), (10), and (11) are relatively similar despite the different estimation techniques, which shows that this particular equation is robust and captures a strong empirical regularity in the data. Equation (11) is the best equation. All the variables are highly significant. The coefficient on PCG04 is significantly different from unity, indicating that changes in inflation do not change RI to the same degree. As discussed before, this result has been found in other work.

Table 3 contains estimates of variants of equation (11). This table shows that the lags on XNL are collinear, and they need to be weighted together. Also, the substitution of PCG08 for PCG04 makes its coefficient not significantly different from unity, but the quality of the other coefficients deteriorates sharply.

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[5]/ This test relies upon the work in Goldfeld and Quandt (1965). See also Theil (1971).

Finally, in equation (12) RIT is substituted for RI. The
result is similar to equation (11), although the absolute values
of the coefficients tend to fall. As hypothesized in Section I,
the coefficient on PCG04 falls between equations (11) and (12).

EMPIRICAL RESULTS

In this section measures of the Federal deficit or debt
are added to equation (11) to test whether they have any
discernible effect on interest rates. The first measure added
is DPNL as defined in the first section. Also tried is FPNL,
which is the first difference in DPNL, that is, DPNL-DPNL(-1).
And finally the variable SPN is added, which is the real per
capita Federal surplus from the National Income and Product
Accounts multiplied by 1,000,000.

Tables 4, 5, and 6 contain estimates of equation (11)
including various lags on these variables. Table 4 contains
the equations with lags on DPNL. Table 5 contains lags on
FPNL, and Table 6 contains lags on SPN. The variables DPNL04,
FPNL04, and SPN04 are second-order Pascal lags on DPNL, FPNL,
and SPN, respectively, with average lag of 4 quarters.

Table 4

Estimates of the Before-Tax Interest-Rate
Equation including DPNL

Equation Number	16	17	18	19
Dependent Variable	RI	RI	RI	RI
Sample	1965QI–	1965QI–	1965QI	1965QI–
	1983QII	1983QII	1983QII	1983QII
Estimation Method	Weighted ML	Weighted ML	Weighted ML	Weighted ML

Independent Variables:

Constant	-231.558	-206.309	-212.768	-147.344
	(-3.34)	(-2.86)	(-2.66)	(-2.04)
HPNL(-2)	-23.4899	-20.8375	-21.3883	-15.9987
	(-3.95)	(-3.18)	(-3.15)	(-2.67)
XLNA	11.1883	9.6731	9.9906	8.5872
	(5.86)	(4.68)	(4.53)	(4.65)
PCG04	0.3737	0.4218	0.4203	0.4773
	(5.50)	(5.33)	(4.83)	(6.00)
RIDSL	4.3550	3.9420	3.3991	3.7550
	(7.16)	(5.55)	(4.46)	(4.95)
DPNL	-3.6217	-1.9624	-0.7205	
	(-1.29)	(-0.97)	(-0.67)	
DPNL(-1)	-0.3550	-0.0027		
	(-0.07)	(-0.00)		
DPNL(-2)	0.7152	1.5626		
	(0.14)	(0.77)		
DPNL(-3)	-1.2164			
	(-0.23)			
DPNL(-4)	4.0273			
	(1.38)			
DPNL04				0.6597
				(0.59)
Adjusted R^2	0.997	0.994	0.992	0.992
Std. Error	0.7399	0.7609	0.7529	0.7536
D-W	1.71	1.73	1.76	1.76
ρ	0.3366	0.4796	0.5823	0.5750

Table 5

Estimates of the Before-Tax Interest-Rate
Equation including FPNL

Equation Number	20	21	22	23
Dependent Variable	RI	RI	RI	RI
Sample	1965QI-	1965QI-	1965QI	1965QI-
	1983QII	1983QII	1983QII	1983QII
Estimation Method	Weighted ML	Weighted ML	Weighted ML	Weighted ML

Independent Variables:

Constant	-204.580	-200.159	-179.147	-215.429
	(-4.66)	(-4.70)	(-3.27)	(-4.70)
HPNL(-2)	-21.1320	-20.5627	-18.5438	-22.7910
	(-5.56)	(-5.61)	(-3.96)	(-5.58)
XNLA	10.3865	9.8875	9.0881	12.2203
	(6.99)	(7.91)	(5.59)	(7.19)
PCG04	0.4005	0.4150	0.4494	0.3633
	(7.19)	(8.57)	(6.80)	(6.51)
RIDSL	4.5331	4.5981	3.7808	3.9136
	(8.51)	(9.11)	(5.52)	(7.18)
FPNL	-3.5331	-5.4870	-1.4385	
	(-1.19)	(-2.42)	(-0.78)	
.FPNL(-1)	-3.8382	-0.8981		
	(-1.27)	(-0.43)		
FPHL(-2)	-2.5341	-5.3350		
	(-0.79)	(-2.28)		
FPNL(-3)	-4.2210			
	(-1.34)			
FPNL(-4)	0.7049			
	(0.22)			
FPNL04				-20.1086
				(-3.15)
Adjusted R^2	0.997	0.997	0.993	0.996
Std. Error	0.7411	0.7404	0.7532	0.7198
D-W	1.71	1.75	1.75	1.71
ρ	0.3409	0.3176	0.5449	0.3884

Table 6

Estimates of the Before-Tax Interest-Rate
Equation including SPN

Equation Number	24	25	26	27
Dependent Variable	RI	RI	RI	RI
Sample	1965QI- 1983QII	1965QI- 1983QII	1965QI 1983QII	1965QI- 1983QII
Estimation Method	Weighted ML	Weighted ML	Weighted ML	Weighted ML

Independent Variables:

Constant	-188.312	-194.676	-190.717	-191.487
	(-4.57)	(-4.44)	(-3.93)	(-4.87)
HPNL(-2)	-20.0534	-20.1671	-19.5289	-20.9441
	(-5.68)	(-5.36)	(-4.70)	(-6.06)
XNLA	10.8848	9.9696	9.2255	12.3592
	(8.16)	(7.58)	(6.56)	(8.35)
PCG04	0.4001	0.4309	0.4557	0.3767
	(7.89)	(8.35)	(7.96)	(7.84)
RIDSL	4.8487	4.7815	4.3831	4.5291
	(9.62)	(8.90)	(7.25)	(9.38)
SPN	0.1007	0.1114	0.1727	
	(1.07)	(1.19)	(2.09)	
SPN(-1)	0.0611	0.0645		
	(0.56)	(0.60)		
SPN(-2)	0.0350	0.1178		
	(0.32)	(1.23)		
SPN(-3)	0.0778			
	(0.76)			
SPN(-4)	0.1136			
	(1.22)			
SPN04				0.5260
				(4.00)
Adjusted R^2	0.997	0.997	0.995	0.997
Std. Error	0.7283	0.7356	0.7397	0.7020
D-W	1.73	1.73	1.74	1.73
ρ	0.3046	0.3518	0.4493	0.3287

In order for the level of the Federal debt or the change
in the debt to raise interest rates, the sign on the debt terms
in the equations in Tables 4 and 5 should be positive. However
all the coefficients either have a negative sign or are positive
and insignificant. In the case of FPNL and FPNL(-2) in equa-
tion (21) and FPNL04 in equation (23), the sign is negative
and significant, indicating that an increase in the debt is
correlated with lower interest rates. In addition, the other
coefficients in the equations remain near to those in equation
(11). Hence the debt variables do not contribute to equation
(11), nor do they suggest that a change in specification is
needed.

The same conclusions hold with regard to lags on SPN in
Table 6. If deficits raise interest rates, the sign on such
lags should be negative. However all the signs are positive,
and SPN04 is significant. Again the other coefficients change
little, so this deficit variable contributes nothing to the
equation.

The equations in Tables 4, 5, and 6 are presented in Tables
7, 8, and 9 with the dependent variable changed to the after-tax
interest rate RIT, and with the sample 1965 QI - 1981 QIV. The
results are similar to those using the before-tax interest
rate. Lags on DPNL and FPNL have negative or positive and
insignificant coefficients. Again FPNL04 is significant nega-
tive. All the signs for SPN are positive. Again SPN04 is
positive and significant.

Table 7

Estimates of the After-Tax Interest-Rate
Equation including DPNL

Equation Number	28	29	30	31
Dependent Variable	RIT	RIT	RIT	RIT
Sample	1965QI- 1981QIV	1965QI- 1981QIV	1965QI 1981QIV	1965QI- 1981QIV
Estimation Method	Weighted ML	Weighted ML	Weighted ML	Weighted ML

Independent Variables:

	28	29	30	31
Constant	-112.530 (-2.10)	-102.994 (-1.73)	-106.143 (-1.80)	-91.6961 (-1.58)
HPNL(-2)	-11.7598 (-2.54)	-10.6430 (-2.10)	-10.9254 (-2.17)	9.9487 (-2.05)
XNLA	6.2653 (4.26)	5.4962 (3.32)	5.6262 (3.38)	5.4978 (3.31)
PCG04	0.2173 (4.24)	0.2639 (3.98)	0.2673 (4.02)	0.3162 (4.50)
RIDSL	2.8275 (6.17)	1.9298 (3.21)	1.7185 (2.82)	1.2451 (1.76)
DPNL	-2.2385 (-1.18)	-0.5956 (-0.45)	-0.6390 (-0.80)	
DPNL(-1)	-0.4737 (-0.14)	-0.5282 (-0.29)		
DPNL(-2)	0.1819 (0.05)	0.5621 (0.42)		
DPNL(-3)	-0.3647 (-0.10)			
DPNL(-4)	2.4121 (1.21)			
DPNL04				0.0796 (0.07)
Adjusted R^2	0.996	0.989	0.987	0.976
Std. Error	0.4979	0.5043	0.4961	0.4961
D-W	1.67	1.74	1.76	1.80
ρ	0.3961	0.6472	0.6874	0.7868

Table 8

Estimates of the After-Tax Interest-Rate
Equation including FPNL

Equation Number	32	33	34	35
Dependent Variable	RIT	RIT	RIT	RIT
Sample	1965QI– 1981QIV	1965QI– 1981QIV	1965QI 1981QIV	1965QI– 1981QIV
Estimation Method	Weighted ML	Weighted ML	Weighted ML	Weighted ML

Independent Variables:

Constant	-83.0189 (-2.35)	-76.8514 (-2.18)	-93.5644 (-1.78)	-94.5330 (-2.66)
HPNL(-2)	-9.2966 (-2.99)	-8.5467 (-2.79)	-10.0835 (-2.21)	-10.7367 (-3.36)
XNLA	5.6640 (4.81)	5.0705 (4.98)	5.5245 (3.31)	6.8686 (5.39)
PCG04	0.2374 (5.57)	0.2564 (6.70)	0.3151 (4.95)	0.2165 (5.28)
RIDSL	2.9492 (7.06)	2.9507 (7.11)	1.2070 (1.74)	2.5639 (6.27)
FPNL	-1.6403 (-0.80)	-2.9270 (-1.83)	0.0875 (0.08)	
FPNL(-1)	-2.1895 (-1.09)	-0.7387 (-0.54-)		
FPNL(-2)	-2.3181 (-1.08)	-3.2890 (-1.97)		
FPHL(-3)	-2.0874 (-0.99)			
FPHL(-4)	-0.6757 (-0.31)			
FPNL04				-14.0588 (-3.09)

Adjusted R^2	0.996	0.996	0.976	0.996
Std. Error	0.4998	0.4973	0.4960	0.4766
D-W	1.68	1.71	1.80	1.69
ρ	0.4036	0.4142	0.7906	0.4344

Table 9

Estimates of the After-Tax Interest-Rate
Equation including SPN

Equation Number	36	37	38	39
Dependent Variable	RIT	RIT	RIT	RIT
Sample	1965QI–	1965QI–	1965QI	1965QI–
	1981QIV	1981QIV	1981QIV	1981QIV
Estimation Method	Weighted ML	Weighted ML	Weighted ML	Weighted ML

Independent Variables:

Constant	-62.1310	-66.6548	-70.5344	-69.4095
	(-1.99)	(-1.89)	(-1.75)	(-2.28)
HPNL(-2)	-7.6418	-7.6734	-7.8693	-8.6371
	(-2.82)	(-2.51)	(-2.25)	(-3.22)
XNLA	5.6932	4.9288	4.6624	6.6492
	(5.71)	(4.74)	(3.94)	(6.09)
PCG04	0.2409	0.2700	0.2880	0.2323
	(6.48)	(6.78)	(6.13)	(6.61)
RIDSL	3.1964	3.0000	2.5197	2.9457
	(8.42)	(6.98)	(4.96)	(7.96)
SPN	0.0601	0.0648	0.0797	
	(0.93)	(1.00)	(1.31)	
SPN(-1)	0.0131	0.0234		
	(0.18)	(0.33)		
SPN(-2)	0.0214	0.0806		
	(0.29)	(1.22)		
SPN(-3)	0.0818			
	(1.20)			
SPN(-4)	0.0749			
	(1.18)			
SPN04				0.3528
				(3.71)
Adjusted R^2	0.997	0.996	0.993	0.997
Std. Error	0.4889	0.4982	0.4963	0.4690
D-W	1.71	1.71	1.73	1.71
ρ	0.3418	0.4282	0.5629	0.3759

CONCLUSIONS

This paper examined the empirical evidence of an association between changes in the Federal debt or deficit and real interest rates. The approach taken was to estimate an interest-rate equation without the debt or deficit measures, and then add them in to test for their statistical significance.

The interest-rate equation was based upon equation (10) in Feldstein and Eckstein (1970). The first step was to replicate this equation as nearly as feasible for the original sample period, and extend it for the sample 1965 QI - 1983 QII. The results indicated that this type of equation could be used for the latter sample, but that it needed respecification. The respecified equation contained more lags than the original.

Measures of debt and the deficit were then added to this equation. Such measures were either of the wrong sign, or of the correct sign but insignificant. Moreover the other coefficients were little affected. On the basis of these tests, it would appear that over the sample examined high Federal deficits have had at most a negligible effect in raising real interest rates.

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