

## **Do Budget Deficits Raise Interest Rates? A Survey of the Empirical Literature\***

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### **Abstract**

Do government budget deficits raise interest rates and thus “crowd out” private investment? This question has been the topic of a multitude of empirical studies, which proposed to evaluate the impact of financing government activity. We survey the theory and some empirical results. Traditional theories either support deficits having a positive or a neutral effect on interest rates. Various tests of these propositions yield diverse results, and one can find all conclusions - that deficits raise, decrease or do not effect interest rates. Also, there is little attempt to ground their assumption that rising interest rates result in a crowding out of private borrowing and investment. The problem with many of the empirical studies begins with their narrow theoretical underpinnings which are driven by assumptions of resource constraints, exogenous money supply, or government budget constraints. Alternatively, models that derive their economics from the demand side determining supply, have a transmission mechanisms missing from traditional models that may explain econometric testing incongruities. Such models take account of multi-asset markets, investment accelerators and consider the alternative causality - interest rates to budget deficits. They emphasize financial market instruments, investor behavior, and the relationship between the treasury and the central bank in determining fiscal and monetary policy. As a result, such models provide a richer understanding to the interaction between deficits and interest rates in their institutional setting.

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## Introduction

A frequent theme in policy discussions is the perils of government deficits and debt. Rising government deficits to GNP over the past few decades have been blamed for high interest rates, recessions, unemployment, inflation, trade deficits, exchange rate volatility, and almost any other decline in economic performance. This has led to virtually all political parties in the United States and much of the world to feature deficit reduction and balanced budgets as the centerpiece of their economic policy.

Despite this popular consensus, these alleged effects of government debt and deficits on an economy are not obvious from empirical evidence, nor is there any agreement among economic theories on what the effects should be.<sup>1</sup> This paper will attempt to summarise the main theoretical arguments regarding the relationship between budget deficits and interest rates, which leads to what is known as "crowding out" of private investment. It is considered by some schools of thought that it is this side of government activity that creates a burden on society either now or in the future.

Our purpose is to concentrate on the "pure" effect of deficits on interest rates.

As deficits can increase from an increase in government spending or a decrease in taxation, we shall abstract from the effects these other two independent channels have on interest rates.

Under traditional Keynesian theory, *government spending* stimulates the economy, reduces unemployment and makes households feel wealthier. As a result, money demand rises and interest rates will increase - and thus investment declines. We may term this "spending crowding out". If this is tax-financed, then this rise in interest is smaller as output is smaller. If money-financed, there is no rise because money supply rises concurrently with money demand. If it is deficit-financed, the associated rise in public debt and a constant money supply implies that in order for agents to hold this new, more illiquid composition of money and bonds, interest rates must rise. If there is a wealth effect where agents now feel "wealthier" as a result of holding government bonds, then there may also be an increase in consumption, which will again increase output and money demand, creating an additional interest rate rise. This bond-financing channel

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<sup>1</sup> For alternative reviews on this literature see Yellen (1989), Haliassos and Tobin (1990), or Seater (1993).

is what we shall call the "pure deficit" effect on interest rate rise from private spending. If these higher interest rates lead to a decline in private investment, then we shall say that we have "deficit crowding out".

The ascendancy of macroeconomics with rational optimizing agents and money neutrality, strongly counters these Keynesian propositions. Financing issues, such as the size of the deficit, debt, or the debt/tax mix, it claims, have no effect at all on economic activity or real interest rates. According to this theory, first outlined by Barro (1974) and commonly known as the Ricardian Equivalence Hypothesis (REH), it is only government spending and marginal tax rates that should affect the real economy.<sup>2</sup> As a consequence, these authors emphasize the aspects of fiscal policies regarding the size, time profile and composition of government spending and marginal taxation on private spending - as only these will affect the traditional Neoclassical data of endowments, technology and preferences. Thus the financing side of government activity is irrelevant.

Thus, in both the Keynesian and REH theories, government spending "crowds out" private sector activity to some extent. However, in the Keynesian model, we have the additional channel of deficits (i.e. government borrowing) crowding out investment - a channel deemed to be inoperative by REH.

In the next section, we shall present a brief taxonomy of the theory of "crowding out" arising from government budget deficits. Following that, we shall present a selective survey of representative empirical evidence on the deficit-interest rate link, and consider the validity of interest rate crowding out, debt neutrality and crowding in, from rising budget deficits.

### **A Taxonomy of "Crowding Out" Theory**

The intuition behind the "crowding out" of private investment spending is based on the implicit or explicit assumption of scarcity of resources which government and private sectors compete for. In looking at the impact of pure budget deficit effects, we will derive "crowding out" from

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<sup>2</sup> Under REH temporary government spending raises interest rates while permanent government spending will have no effect on interest rates, but will still reduce private consumption (Barro 1981).

two sources, "real" and "financial," coming from either supply constraints or monetary constraints respectively.

I - "Real" Crowding Out: increased government borrowing relative to taxation leads to reductions in private investment due to constraints in aggregate supply.

II - "Financial" Crowding Out: increased government borrowing relative to taxes leads to reductions in private investment due to constraints in the financial markets.

Traditional neoclassical economics has real crowding out underlying the theory of "loanable funds" - even though the latter is often stated in financial terms. Increased government borrowing increases the demand for loanable funds (i.e. increases the supply of bonds) and thus leads to greater competition for available domestic savings thereby bidding up interest rates and reducing private investment, holding all else constant. However, savings are determined by the household consumption-savings decision at full employment income thus it is aggregate supply which places a constraint on the supply of loanable funds.

In Keynesian theory, there are (at least) two financial assets, bonds and money, and crowding out is dependent on the financial constraint of fixed money supply, as opposed to a real constraint. The interest rate is determined by the portfolio allocation decision between stocks of bonds and money. As deficit is a flow, then a constant or increasing government deficit will lead to a rising stock of bonds. As the stock of money is fixed, the economy-wide composition of assets is relatively more illiquid. Thus, by the theory of liquidity preference, agents will demand a higher interest rate in order to hold this more illiquid portfolio. The rise in interest rates reduces investment and consequently output.

If the deficit is rising, whether by increased government spending or falling taxes, there will be an additional effect (in the case of unemployment): the income multiplier arising from these expansionary fiscal activities will increase income and savings and thus demand for financial assets. As bond demand rises, the interest rise that results from greater government bond supply should be mitigated. However, the transaction motive implies that money demand will also rise and, as money supply is fixed, a further rise in interest rate is required. Furthermore, if there is a "wealth effect", the rise in the stock of bonds will lead to an increase in consumption and thus a further multiplier effect on income which will raise interest rates further.

Note that although the net effect on output can be ambiguous in some of these scenarios, there is always a rising proportion of consumption to investment in aggregate demand. The main point is that the crowding out of investment arises from the financial constraint imposed by a constant money supply. Endogenous money theories would not exhibit these constraints. There would be "real" crowding out in this Keynesian model if we are at full employment. Discussion of the impact of deficits in a Keynesian model is outlined in Blinder and Solow (1973, 1976) and Tobin and Buiter (1976).

In both the loanable funds and Keynesian models, interest rates will not rise from a government debt issue if the demand for government bonds is infinitely elastic or there is an exogenous rise in bond demand by the same amount of the increase in bond supply. In an open economy model with perfect capital mobility, and where government bonds are close substitutes for other international financial assets, demand for bonds is infinitely sensitive to interest and thus domestic deficits cannot raise interest rates above world interest rates. In this case exchange rates rise and local exporters are crowded out by the government borrowing. In contrast, an exogenous shift in bond demand from the monetary authorities buying bonds and monetizing government debt, will stop the interest rate or exchange rate from rising and thus relieve the crowding out pressure.

Another exogenous increase in bond demand can arise from the tax-fearing consumer as in the Ricardian Equivalence Hypothesis of Barro (1974). In its most simplistic form, the REH considers that all government spending must be financed by taxation either now or sometime in the future. In other words, a government deficit is simply deferred taxation. Households know this, and if there is a bond-financed tax reduction, agents will increase savings and buy the government bonds in order to hedge their future tax payment (i.e the taxes raised to pay back the bonds). This exogenous increase in bond demand perfectly matches the exogenous increase in bond supply by the government and neither interest rates nor the consumption path of individuals will change.

Technically, the Ricardian Equivalence Hypothesis is a supposedly straightforward "generalization" of the permanent income/life cycle hypothesis - although it actually imposes stronger assumptions - specifically, perfect capital markets, intergenerationally altruistic agents with perfect foresight and homogeneous preferences, etc. (Barro, 1989b; Haliassos and Tobin,

1990; Seater, 1993). The environment is usually one with no portfolio allocation decision, a government which only raises revenue via lump-sum taxation, and a limitless increase of government debt is ruled out via a government budget constraint. The economy is either static or, if growing, the imposition of the government budget constraint implies that the interest rate is assumed to be greater than economic growth - otherwise it would be possible for governments to grow out of their debt without imposing future tax hikes (see Haliassos and Tobin 1990: p.914). All these assumptions reduce the model to the determination of consumption and savings paths via an infinitely-lived representative agent with perfect foresight and no liquidity constraints, who maximizes her intertemporal utility given a known permanent income constraint.

As a result, consumers regard government spending as the true measure of the government's claim on private resources, and do not respond to changes in the taxation/borrowing mix. Even in circumstances of unemployment, the multiplier is killed off, and no deficit crowding out occurs.

New Keynesian economists maintain the basic structure of the REH model, but disable the actual debt-neutrality hypothesis by allowing for imperfections such as liquidity constraints (Hubbard and Judd, 1986), finite lives (Blanchard, 1985), uncertainty of future income and taxation (Chan, 1983; Barsky, Mankiw and Zeldes, 1986), etc. This brings back the real crowding out of deficits - i.e. increases in deficits relative to taxes reduce national savings and hence interest rates rise and investment falls.

The New Keynesians are particularly interested in the long-run effects of crowding out on growth. "Burden of debt" arguments are usually couched in these terms: namely, as government deficits "crowd out" investment, then, in the longer run, deficits lead to will lead to reductions in the steady state growth path of output per capita in the future (e.g. Modigliani, 1961; Blanchard and Fischer, 1989). However, these growth models tend to not have independent investment functions and very poor asset menus. In contrast, Keynes-Wicksell growth models (e.g. Stein, 1971), which allow for independent investment functions and multiple assets, allow a richer set of possibilities. Similarly, Lerner (1973) and others have suggested that rising government debt can actually crowd in growth by enhancing productivity.

In more complex theories, the opposite phenomenon, that investment may be "crowded in" by

government activity, is considered. We can again distinguish between "crowding in" effects of deficits and government spending. In the Keynesian theory of the multiplier, consumption spending is induced by expansionary fiscal policy, but the issue is whether investment spending can also be induced to rise. Both the Neoclassical and Keynesian theories can accommodate an investment "accelerator" mechanism in which rising (expected) demand from an exogenous increase in government spending induces firms to increase investment spending. The accelerator, thus, is a form of "spending crowding in". Productivity of government capital can also have clear "crowding in" effects in a Neoclassical framework (e.g. Aschauer, 1989a, 1989b, 1990).

In contrast, some observers argue that there can also be "deficit crowding in" both in "real" and "financial" terms. In the former, rising government debt can lead to real productivity gains, benefits in being able to price other bonds, completing markets, adding risk-free assets that enable diversification and higher risk tolerance, etc. (e.g. Lerner, 1973; Ball, Elmendorf and Mankiw, 1995). Financial crowding in occurs in multi-asset models, where there are more than two asset markets, e.g. short and long term bonds, corporate bonds, equity, money, etc. The extent and form of financial crowding in depends on the substitutability between these assets and money. For example, if government debt is a relatively close substitute for money, then increases in government bonds increase the relative demand for equity and not money. This leads to rising equity prices - that is, required rates of return on equity go down - which leads to higher capital investment. (Tobin 1961, 1969; Friedman, 1978; Roley, 1979).<sup>3</sup> Thus it is important in multi-asset models to determine what instrument private investors use when borrowing - bank loans, equity, promissory notes, or corporate bonds - and how this is priced relative to treasury reserves, bills and bonds.

If we were to expand our asset menus to include short-term bonds, long-term bonds and equity, then we could also obtain a story of the impact of fiscal policy on the term structure of interest rates. Short-term bonds are closer substitutes with money, and long-term bonds have more in common with equity. If a bond-financed fiscal expansion is expected, we have expectations of higher interest rates as a whole - this would lead to people moving out of long-term bonds and

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<sup>3</sup> For a more complete analysis of the long-run implications of bond-financed deficits in multi-asset models, see Buiter (1977), Friedman (1980), Tobin (1982) and Tobin and Buiter (1976, 1980).

into short-term bonds which would depress the prices of long-term and increase the prices of short-term bonds - or, in terms of rates of return, it would steepen the yield curve. Thus bond-financed fiscal policy expansions could lead to lower short-term rates and higher long-term rates temporarily. This is indeed the expected result laid out by Blanchard (1981), Turnovsky and Miller (1984), Turnovsky (1989) and Fisher and Turnovsky (1992). It should be noted that interest rate volatility should also impact term structure by increasing the risk premium and therefore interest rate on long-term bonds (Friedman, 1982; Evans, 1984).

Ultimately the conclusions from these crowding in models are ambiguous. They allow for certain types of interest rates to rise in certain circumstances and fall in others. Therefore, such effects have often been ignored by many economists as having too many degrees of freedom - thereby they tend to work with one or two-asset models to derive their conclusions.

### **The Deficit-Interest Rate Link: Empirical Studies**

There have been a plethora of empirical studies testing the effects of budget deficits and debt crowding out - usually geared to verifying the validity of the debt-neutrality thesis of REH. These studies have looked at the effect deficits have on savings, consumption, output, inflation, exchange rates and interest rates. We limit our survey to those studies which examine whether there is a positive relationship between interest rates and budget deficits, as this usually considered the leading indicator of the existence of "crowding out". However, we should remind ourselves that a rise in interest rates does not necessarily mean that investment will decline, especially when there is an investment accelerator or financial crowding in effects.

To recapitulate, the REH would argue that increasing government debt (given a government spending path), should not affect real interest rates. In contrast, most of the opponents of REH would argue that either real or financial crowding out effects would emerge and thus we should see deficits leading to rises in real interest rates. Crowding in theories would say that own rates of return fall on other borrowing instruments used for investment by the private sector.

Using a variety of data on interest rates (real, nominal, short-term, long-term, etc.) and different measurements of the deficit and debt, numerous empirical studies have been dedicated to the deficit-interest rate relationship. Many of these studies focus solely on the financial impact of

deficits, and attempt to control for the effects of government spending<sup>4</sup>, in order to isolate "pure deficit" effects.

In Appendix I, we categorize many of the empirical results from the various studies. While these models are not directly comparable, the distribution of results gives some indication of the balance as well as the range of disagreement among economists on this issue. In Appendix II, we provide a more detailed summaries of a representative selection of these studies.

Although there are numerous different econometric models, the principal equation that is tested is some form of the following:

$$R = f(D, G, M)$$

where R is some rate of return (usually ex ante real rate on some bond or average of several bonds), D is some measure of the real deficit, G is some real measure of government spending, and M the real money supply. In principle, according to conventional Keynesian theory, one would expect  $f_G > 0$ ,  $f_D > 0$ , and  $f_M < 0$ . In contrast, Ricardian Equivalence would expect that at least  $f_D = 0$ .

Naturally, the deficit (D) component is a contentious one for it combines an "endogenous" element (cyclical deficits) and an "exogenous" one (structural deficits). This implies several things: notably, as tax receipts increase with income, then deficits are normally countercyclical while interest rates, in turn, are normally procyclical. The implication is that unless this is corrected for or adjusted by some procedure, regression coefficients attached to D will generally be downwardly biased and possibly even negative (Makin, 1983). The inclusion of government spending (G) in this equation mitigates this somewhat.

Some commentators insist that a better measure than deficits is the change in the stock of debt outstanding, priced at some market value. This measure can be quite different from the actual government deficit (De Leeuw and Holloway, 1985). The actual measurement of government

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<sup>4</sup> REH argues that unanticipated permanent government spending has no effect on interest, but unanticipated temporary government spending will raise interest rates (Barro, 1981). Barro (1987, 1989a), Evans (1987a, 1987b), Plosser (1987) and others found a desirable positive relationship between temporary government spending on interest. Hoelscher (1986) did not.

deficits and debt, as Eisner and Pieper (1984) have shown, is a tricky issue.<sup>5</sup> Also Boskin (1982) stresses that the different components of government net worth affect economic activity and interest rates in different ways.

The other components are straightforward: government spending (G) is included to control for the "spending" effect on interest rates, whereas real money supply (M) is included to control for the monetization of debt and portfolio reallocations. Some economists try to split the real money supply component by including nominal money supply and inflationary expectations separately.

Other variables that are occasionally accounted for include distinguishing publicly-held versus central bank holdings of government debt (to capture debt monetization), the stock of debt (to control for the Keynesian "portfolio" effect), exchange rates (twin deficit issues), interest rate volatility (to capture changes in risk structure), unutilized capacity/unemployment (to attempt to separate the cyclical from structural deficits), import price deflators (to capture supply shocks, e.g. oil prices), and commonly a proxy for expected inflation. Also, variables are commonly divided by GDP because many researchers (e.g. Evans, 1985, 1987a; Hoelscher, 1983, 1986; Cebula, 1990) argue that the deficit, money supply, etc. should be judged relative to the size of the economy. Alternatively (e.g. Zahid, 1988) adjustments are made by first differencing.

An adjustment less often undertaken is to divide anticipated (perceived) from unanticipated (unperceived) components of the equations (D,G,M). Barth and Bradley (1989) which found that interest rates in cases of unanticipated budget deficits. Another component can be expected deficit increases (Evans 1987a), which would lead to a temporary decline in interest rates. Kim and Lombra (1989) found that only unexpected deficits had positive interest rate effects. However, as Barro (1981, 1987) noted, the implications on REH on interest rates primarily divide themselves between permanent and temporary changes in government spending (and, by correlation, deficits, if taxes are unchanged) that temporary changes in G raises interest rates whereas permanent changes would not.

Needless to say, the estimations that test the relationship between deficits and interest rates are very sensitive to the specification of the model, the choice of variables, choice of time period, the measurement of the variables, the treatment of simultaneity or causality and the stationarity

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<sup>5</sup> See also Eisner (1985) and Blejer and Cheasty (1991).

of the data - all of which is evident in the mixed results reported in Appendices I and II. While some early studies did find a positive relationship between deficits and the long-run interest rate (e.g. Feldstein and Eckstein 1970), most studies during the early 1980s (esp. Plosser (1982, 1987) and Evans (1985, 1987a, 1987b, 1989), and the summary in U.S. Treasury Department (1984)), find that government bond-financed deficits are insignificantly related to interest rates and, when a relationship exists, it generally turns out to be negative rather than positive. Only very recently, as models become more sophisticated, extending the study to looking at the slope of the yield curve, as well as individual interest rates, do we begin to obtain evidence of a possible positive relation - albeit, again limited to long-term interest rates (esp. Hoelscher, 1986; Cebula, 1988, 1990, 1991).

On the whole, reports with insignificant results between deficits and real or nominal interest rates seem to predominate. Researchers have taken this to conclude that the loanable funds/Keynesian arguments of "crowding out" are dubious, while the Ricardian Equivalence Hypothesis is supported. This is despite some repeated findings of significantly negative relationships between deficits and interest. To explain this latter phenomenon consistently with REH, some economists have appealed to the separation between cyclical and structural components of deficits (Makin, 1983; Kolluri and Giannaros, 1987; Zahid, 1988) - but after adjustments are made, results are not always different.

In contrast, many commentators have argued that these results do not necessarily vindicate the REH debt-neutrality thesis. Two prominent explanations given for the tenuous relationship between interest rates and deficits include the proposition that a imminent rise in interest rates is countered by the purchases of government debt by the central bank or the capital inflow from foreign savings.

The monetization of debt thesis is an obvious one - particularly since Sargent and Wallace (1981) infer that, at least theoretically, complete monetization of government debt is inevitable. Monetization is usually accounted for in these regressions by either considering government debt as publicly-held debt only (thus excluding Central Bank-held debt - as done by, e.g. Plosser, 1982), or simply by including high-powered money supply in the regression. However, Dwyer (1985) reviews the monetization of debt arguments and finds little evidence to suggest any positive correlation between money supply growth and the issuance of government debt. In contrast, Huang (1986) finds a super neutral result: that if one increases the "monetization" of the

debt, returns on real assets tend to remain unchanged - implying that agents reshuffle their portfolios to account for increased money supply without lowering interest rates.

Contrary to expectations, Blinder (1983) found a rather interesting relationship for the US 1960s and 1970s: that at higher rates of inflation, higher deficits actually lead to slower, not faster, growth of bank reserves. However, this result may not be very surprising as they suggest that when inflationary pressures are great, any expansionary fiscal policy calls forth more restrictive monetary policy. No doubt in today's climate, when the Fed's reaction function is even more sensitive to inflation or expectations of inflation, deficits are increasingly less likely to be monetized, and instead may be "demonetized." This means that deficits may induce contractionary policy by the monetary authorities and thereby leads to higher interest rates. This would lead to a spurious positive result between deficits and interest rates.

In an open economy model, interest rates are also affected by capital inflows. The few direct studies on deficits and exchange rates provide mixed results. Most studies testing the twin deficit scenario are fairly ad hoc and depend on the time period in which they are studied (Dwyer 1985:p.675; Feldstein 1984; Sachs 1985). Hakkio (1996) does a cross country study which emphasized the direct and indirect relationships between deficits and exchange rates. While his results are mixed, he concludes that the a positive deficit - interest relationship is one reason for a positive relationship between deficits and exchange rates. In another, more rigorous, cross country study, Evans (1986) finds that exchange rates actually fall during rising deficits.

In an attempt to conflate the interest rate and exchange rate channels, Barro and Sala-i-Martin (1990) examine one big closed economy: they examine the relationship between "world" budget deficits and "world" interest rates. They find that world budget deficits and the stock of world government debt have no effect on the determination of world real interest rates. However, Hutchinson and Pyle (1994) regress short-term interest rates on "world" deficits and find a significantly positive association.

However much the monetization and open economy arguments may explain why interest rates and budget deficits are unrelated, they provide little or no *a priori* reason for why there ought be a tendency for a negative association between deficits and interests which is *not* expected in REH. Although this is often looked over in the enthusiastic REH jubilee, some more careful observers (e.g. Barro, 1989b; Seater, 1993) appeal to Chan's (1983), "precautionary savings"

idea (i.e. future taxation makes future income uncertain and thus leads to greater-than-necessary savings and thus a collapse in interest rates)<sup>6</sup> and/or Mankiw's (1987) idea of interest rates as a form of tax rate.

Another reason for the negative result may come from financial crowding in. Friedman (1978, 1980) finds empirical support that debt accumulation crowds in private capital formation. Darrat (1988) finds a relationship between past fiscal policy action and stock returns - which may imply a positive bond supply-stock return relationship. Roley (1982) and Frankel (1985) find that government securities are a better substitute for money than equity or long-term corporate bonds - and thus bond-financed deficits lower required rates of return on these instruments, thereby suggesting the existence of "financial crowding in".

Another scenario that has very little investigation, but seems promising is that of reversing the causality of deficits and interest rates (Canto and Rapp 1982; Smithin 1994; Cebula 1997). Any positive association between interest rates and deficits may actually come from rising interest rates causing increases in the government deficit. This would be consistent with the idea that most of the tests which have *not* found positive relationships between interest rates and deficits tended to be contemporaneous tests rather than Granger-causal ones.

The argument that high interest rates lead to high deficits and not vice-versa is an old one (e.g. Domar, 1944). The reasoning can be derived from three sources:

- i higher interest rates imply higher debt-service payments and thus increase the deficit<sup>7</sup>. A short debt maturity will mean greater sensitivity to such interest rate costs due to the frequency of re-financing government debt.

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<sup>6</sup> Surprisingly, Chan (1983) contradicts the arguments of standard "precautionary savings" types (e.g. Carroll, 1992; Barsky, Mankiw and Zeldes, 1986) who had argued that deficits *decrease* future income uncertainty because the government is now taking on the income risk previously faced by private agents.

<sup>7</sup> In 1996 the net interest on national debt approximated 15% of the total budget of the federal Government of the United States (Cebula 1997:326)

- ii by Keynesian theory, higher interest rates leads to a collapse in investment and hence output - which will reduce tax revenues (and increase unemployment benefits, etc.) and thus increase the cyclical deficit.
- iii increases in interest and thus falls in investment and output can *induce* the government to undertake expansionary fiscal policies (public projects, etc.) to combat the political/social/economic fallout of recessionary times. This would increase the structural deficit.

Earlier, Canto and Rapp (1982) had found that short term interest rates Granger-caused nominal deficits. Darret (1990) found that deficits did not Granger-cause interest rates, but that interest also does not Granger-cause *structural* deficits (although they might cause cyclical deficits). More recently, Cebula (1997) finds a lack of Granger-causality from deficits to long-term interest rates but finds causality running from interest rates to total, cyclical and structural deficits. Furthermore, Cebula finds that unemployment Granger-causes deficits (but not vice versa) and that long-term interest rates Granger-cause unemployment (but unemployment does *not* Granger-cause interest rates). Thus, Cebula (1997) concludes that high interest rates cause unemployment which, in turn, leads to rising cyclical and structural deficits.

## **Conclusion**

Most economists, will admit that it is highly implausible that the REH would hold exactly in the real world. The theoretical foundations for the neutrality effect of debt depend on subtleties like the intensity of intergenerational altruism, the possibility of strategic behavior by individuals in their family relations, the nature and extent of liquidity constraints, and the effects of various kinds of uncertainty on the household maximization decision, the degree of homogeneity of agents, the form of taxation, the government's respect for its borrowing constraint and sidestepping the fact that interest rates may be greater or lower than growth rates depending on the span of time considered. Yet despite its nearly certain invalidity of the literal description of the role that public debt plays in the economy, economists are more than ready to accept this simplifying representative agent model and its claims of debt neutrality based on the empirical studies that find results of an "insignificant" relationship between deficits and interest rates.

The particular reduced form for testing REH is itself debatable. Rather than testing the positive elements of their own theory, e.g. that individual consumers buy government bonds when government deficits rise due to anticipation of future equivalent tax burdens, their theories are accepted based on the failure to find a positive significant relationship between deficits and interest rates. But this does not necessarily falsify traditional Keynesian and loanable funds theories because this failure can be accommodated in these theories when one considers models of multi-asset, productivity gains, investment accelerators and other crowding-in effects allowed in complex Keynesian models. Thus, even if we allow for insignificance to falsify the simplistic traditional models, the alternative hypothesis that is accepted need not necessarily be the REH. Furthermore, most reduced-form equations usually exclude important theoretical components of a real Keynesian model. For instance, the "portfolio effect" implied in the Keynesian model requires that the stock of debt be considered as a determinant of interest rates, yet most studies only consider deficits as representative of bond issuance.

Furthermore, the finding of a *negative* relationship between deficits and interest rates could be construed as a contradiction of *both* simple Keynesian and REH models. It is ironic that REH partisans appeal to precautionary savings and other imperfections which they eschewed in their theories in order to accommodate this negative result. In order to evaluate the "validity" of REH, there needs to be a respecification of the empirical test - perhaps by concentrating more on examining individual incentives. Undoubtedly such a test may be hard to develop because of the lack of availability of appropriate micro-level data.

Promising results come from multi-asset models based a more realistic description of the financial markets institutions and how private investors actually raise funds. These models suggest that government bonds are close substitutes for money rather than corporate securities (Frankel 1985). Thus government bond issues do not entail a crowding out of *private* borrowing. Naturally, if both crowding in and out effects exist, then it is hard to disentangle them from each other in the simplified reduced form equations that are tested - and implies that it should be quite reasonable to find paradoxical empirical results. Also, by incorporating accelerator or multi-asset markets (especially with endogenous money) can rid the financial and output scarcity constraints.

An area for future research is to concentrate on the direction of causality between deficits and interest rates. The limited number of ventures into this area have shown promising results for

rejecting the hypothesis that budget deficits lead to higher interest rates and accepting rather that higher interest rates lead to higher budget deficits. This has an important implication for effective demand component of the traditional Keynesian theory and a respecification of the empirical model may contribute to a more interesting dialogue about the meaning of these empirical findings.

Although further exploration into causality needs to be undertaken, the implications of such results provide two interesting points. Firstly, if rising interest rates cause rising deficits then there may be no crowding out from government deficits. Secondly, if rising interest rates cause deficits, then this has important implications for the interaction between fiscal and monetary policy. As a result Keynesian expansionary policy is perhaps less of a problem than monetary authorities imply when justifying austere antinflationary programs. If the Fed does follow a hawk-like reaction function, and increases interest rates in times of rising budget deficits to fend off rising inflation or rising inflationary expectations, this could have the repercussion of increasing the deficit even further. Such a reinforcing strategy could mean escalating debt and deficit - not due to fiscal irresponsibility as such but rather due to misguided monetary "responsibility".

It might be interesting to look at the historical relationship between Treasury and the Central Bank. If the Treasury, as Tabelini and La Via (1989) suggests, has traditionally thought itself as responsible for the public debt, then we should expect them to focus more on the causality of interest rates to debt and their rising debt costs. However, the current regime in the United States and several other countries, suggest that the Central Bank adopted responsibility for public debt and thus concern has focused how debt affects interest rates. Given the findings on reverse causality, this change of responsibility and focus may actually be detrimental.

In summary, the theories and empirical evidence on the relationship between government deficits, debt and interest rates are varied and conflicting. Ultimately, perhaps what needs to occur is a reassessment of the theory, and an appropriate specification that would lead to coherently-specified models, that are comparable with falsifiable hypotheses.

## APPENDIX I: SURVEY OF STUDY RESULTS

These tables of results come from empirical studies regarding the relationships between budget deficits and interest rates. Nominal rates are represented with an asterisks (\*) while all others, when known, are real rates. Our survey is not meant to be complete, and summarizes are sometimes awkwardly categorized. However, we consider that the ratio of results could be taken as indicative of the profession as a whole, although our review is not really comprehensive enough to come to any firm conclusions on this.

### **A - Deficit Interest Rate Relation**

#### Impact of Deficits on Short-Term Interest Rates:

*Positive*                      Hutchison and Pyle, 1994;  
                                            Quigley and Porter-Hudak, 1994

#### *Positive (using non-cyclical component)*

                                            Barth, Iden and Russek, 1985;  
                                            DeLeuw and Holloway, 1985;  
                                            Zahid, 1988

*Insignificant*                      Canto and Rapp, 1982\*;  
                                            Dwyer, 1982a\*;  
                                            Plosser, 1982\*, 1987;  
                                            Dewald, 1983;  
                                            Mascaro and Meltzer, 1983\*;  
                                            Makin, 1983;  
                                            Motley, 1983;  
                                            Hoelscher, 1983, 1986;  
                                            U.S. Treasury Department, 1984  
                                            Evans, 1985, 1987a, 1987b\*;  
                                            McMillin, 1986;  
                                            Dua and Arora, 1989;  
                                            Cebula, 1990;  
                                            Ostrovsky, 1990;  
                                            Barro and Sala-i-Martin, 1990;  
                                            Beard and McMillan, 1991.

*Negative* Evans, 1985, 1987a, 1987b\*;  
Plosser, 1987;  
Kolluri and Giannaros, 1987;  
Zahid, 1988\*;  
Raynold, 1994.

Impact of Deficits on Long-Term Interest Rates:

*Positive* Hoelscher, 1986;  
Feldstein, 1986;  
Wachtel and Young, 1987;  
Bovenberg, 1988;  
Cebula, 1988, 1990;  
Black and Gilmore, 1990\*;  
Cebula and Belton, 1992.

*Insignificant* Dewald, 1983;  
Mascaro and Meltzer, 1983\*;  
Evans, 1985, 1987b\*;  
Barro, 1987;  
Plosser, 1982\*, 1987;  
Heim and Mirowski, 1987\*;  
Darrat, 1990.

*Negative* Evans, 1985, 1987b\*;  
Plosser, 1987; Raynold, 1994.

Impact of Debt on Short Term Rates:

Debt studies include flows and stocks of outstanding treasury debt.

*Insignificant* Mascaro and Meltzer, 1983\*;  
Barro and Sala-i-Martin, 1990

*Negative* Plosser 1982\*, 1987

Impact of Debt on Long Term Rates:

*Positive* De Leeuw & Holloway 1985\*

*Insignificant* Mascaro and Meltzer, 1983\*  
McMillin, 1986  
Barro, 1987

*Negative* Plosser, 1982\*, 1987  
Evans, 1987b\*, 1989  
Boothe and Reid, 1989

Impact on Yield Curve

*Steepening* Cebula, 1988, 1990, 1991;  
Hoelscher 1986.

*Insignificant* Lee, 1991\*

Interest Rates Granger-Cause Deficits (Structural and/or Cyclical):

*Significant* Canto and Rapp, 1982.  
Dwyer, 1982.  
Darrat, 1990.  
Cebula, 1997.

**B - Deficits and Monetization**

*Positive* Hamburger and Zwick, 1981  
Levy, 1981  
Dewald, 1983

*Insignificant* Barro, 1978  
Niskanen, 1978  
Blinder, 1983  
Dwyer, 1982a, 1982b,  
Makin, 1983

*Negative* Blinder, 1983

**C- Impact of Deficit on Exchange Rates**

*Positive*                   Blinder, 19??  
                                  Hakkio, 1996  
                                  Helkie and Hooper 1988

*Insignificant*            Evans, 1986  
                                  Blecker 1991

**D - Impact of Deficit on Consumption:<sup>8</sup>**

*No effect*                   Kormendi, 1983  
                                  Aschauer, 1985  
                                  Seater and Mariano, 1985  
                                  Evans, 1988  
                                  Leiderman and Razin, 1988

*Positive effect:*         Feldstein, 1982  
                                  Reid, 1985  
                                  Modigliani and Sterling, 1986  
                                  Poterba and Summers, 1987  
                                  Bernheim, 1987  
                                  Feldstein and Elmendorf, 1990.

*Negative effect:*        Becker, 1997.

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<sup>8</sup> See Barro (1989a) and Seater (1993) for more extensive reviews.

**APPENDIX II:  
SELECTED EMPIRICAL NOTES**

This appendix provides a little more information for a sample of the studies listed in Appendix I.

This gives some idea on the type of data sets, and the types of models that have been tested, in the search for the deficit-interest rate connection. This survey is only representative of the econometric activity that has been carried out, it is by far complete or comprehensive.

**Budget Deficit and Interest Rates**

*U.S. Treasury Department (1984)* provide a summary of empirical studies and their own results show that deficits do *not* impact either short-term rates or long-term rates, i.e. "Deficits have at most a negligible effect on raising real interest rates" (Treasury, 1984: p.82)

*Plosser (1982)* - quarterly US data (1954 to 1978). Takes securities of various maturities (6, 9 12 month and 20 year Treasury bonds) and regresses excess nominal returns on individual rates, on unexpected changes in monetary base, government purchases and privately-held federal debt. Result is that unexpected movements in privately-held federal debt does not raise the nominal yield of government securities of various maturities. In fact, there is a weak tendency for yields to decline.

*Dewald (1983)* uses quarterly postwar data on short and long-term real interest rates. Also finds "marginally significant" positive result.

*Motley (1983)* uses real yields on three-month T-bills and finds no significant impact from Federal deficit.

*Mascaro and Meltzer (1983)* determine 3-month and ten-year rates from 1969 to 1981 using a plethora of determinants (very rich specification). They found that deficits are not determinants of either short or long-term rates.

*DeLeeuw and Holloway* (1985) use new data on cyclically adjusted Federal debt at market prices (taking par values to allow for impact of changing interest rates on debt and allowing federal lending figures in). They try to find out if there is a relationship between structural debt and short-term interest rates (3-month T-bill). They include both stock of debt and change in debt. They find that interest rates are significantly positively related to non-cyclical debt. However, the impact of changes in debt (i.e. deficits) do not seem to be significant. They also include money stock and capital stock and find that money stock has a much stronger correlation with interest rates than debt, and that debt hints to have crowding in forces for capital stock.

*Evans* (1985) tries to overcome cyclical problem by using 2SLS. He also adjusts for real deficits. However, he still obtains insignificant or negative relationship between interest and deficits.

*McMillin* (1986) uses four different measures of the deficit and verifies if they "Granger-cause" the short-term rate on 3-month T-bills 1957-1984. His conclusion: deficits do not Granger-cause interest.

*Hoelscher* (1986) uses loanable funds model, annual 1953-1984 data and real one-year and ten-year T-bond rates. Regressed these on (three versions of) the government deficit, expected inflation premium, output and the other interest rate (long on short; short on long). The last was significant. Hoelscher's main finding is that while deficits do not impact short-term rates, they do have a positive impact on long-term rates. Attempts to include foreign variables and government spending, but these are insignificant. Summary: the increased slope in the yield curve means that deficits push private borrowers into shorter term markets for funds. "By implication, long-term capital spending projects are reduced and the rate of economic growth suffers."

*Plosser* (1987) similar conclusions to Plosser (1982) for nominal and expected real yields with expanded data set.

*Evans* (1987a) - quarterly data (1974-1985) for six countries (Canada, France, Germany, Japan, UK and US) and finds similar results to Plosser (1987) and Evans (1987b).

*Evans* (1987b) - massive annual data (1908-1984) for US. Regresses long term and short-term

rates (Moody's AAa bond, commercial paper and ex post real commercial paper) on current and past government spending, budget deficits and real money supplies. Also assesses for future deficits. Finds out that current and past real federal deficits have no significant association with nominal rates on commercial paper or corporate bonds or with realized real interest rates on commercial paper. Also, rates do not rise when tax cuts announced (and do not fall when tax increases announced). All insignificant. A few cases when significantly negative.

*Barro* (1987) finds an impact on long-term rates, but recognized that he did not overcome "endogeneity" problems. In the "pure exogenous" cases, Barro found that indeed the interest rate did not move.

*Kolluri and Giannaros* (1987) use a ex ante and ex post forecasting method to examine the effect of deficits on short-term (3-month T-bill) real rates of interest. They conclude that there might have been a structural break in real interest rate behavior around 1980. However, they argue that, in any case, the real interest rate is negatively related to deficits.

*Heim and Mirowski* (1987) find that there was no crowding out during the 1790s-1813 wars in Britain. Compare with Black and Gilmore (1990).

*Wachtel and Young* (1987) attempt to control for the endogeneity of deficits by using "announcements" of projected government deficits. By REH, these should have no effect on interest; by other theories, announcements should lead to increases in interest rates. They take their announcement data from published Congressional Budget Office (CBO) projections of federal deficits. Interest rates are on short and long-term Treasury securities. They control for monetary policy announcements. Wachtel and Young finds a significant positive relationship between unanticipated announcements of projected government deficits and interest rates. Long-term rates react more than short-term rates: yield curve steepens.

*Dua and Arora* (1988) find that expectations of fiscal deficits have no effect on interest rates (they show that expected interest rates are dependent on money growth, expected unemployment, interest rate volatility and inflation uncertainty only).

*Zahid* (1988) regresses 3 month T-bill rate on alternative measures of the deficit (notably its

"gross excess demand for funds") and includes a GDP trend value and money supply. Using nominal interest and using a simple deficit, Zahid finds that the relationship between deficit and interest is significantly negative. However, when he uses a real interest rate and the non-cyclical component of deficits (namely, he adjusts using a cyclical indicator - the ratio of real GDP to trend value), Zahid finds there is a significant positive relationship between deficits and interest.

*Cebula* (1988) tests for relationship between deficits and nominal yield on average Moody's Aaa bond. Uses 2SLS estimation and GDP trend to rid deficit of cyclical components. Finds deficit has significantly positive association with long-term rates.

*Kim and Lombra* (1989) argues that models have generally ignored role of "efficient information" ideas. Theory argues that *current* interest rates should be related to *future* expected deficits which have nothing to do with concurrent actual changes in deficit and interest rates. Thus, one should focus on the "unanticipated" component of deficits. In agreeing with what REH would predict, they find a positive relationship between this component and the 10-year Treasury yield. However, also show that when there are dramatic shifts in fiscal policy (e.g. early Reagan era), the effect is more confusing.

*Ostrovsky* (1990) - apparently missing *Cebula's* (1988) point - shows that once again that deficits do not affect short-term rates. *Cebula* replies in the same issue that he agreed that deficits did not impact short-term rates (and shows it), but maintains that they impact long-term rates.

*Cebula* (1990) tests for the relationship between deficits and a variety of real long-term rates (average yields on Moody's Aaa & Baa bonds, 10 year T-bond & high grade municipal bonds). Adjusts for expected inflation to obtain ex ante real rate. Uses 2SLS estimation to rid deficit of cyclical components. Finds deficit has significantly positive association with long-term rates.

*Black and Gilmore* (1990) use constructed historical data for 1793 to 1813 to argue that British borrowing during the Napoleonic wars led to increased interest rates (nominal India Rate and Consol yields) and thus crowding out. Very poor study, with only real control being inflationary expectations and arbitrary off-the-cuff remarks everywhere.

*Barro and Sala-i-Martin* (1990) regress world average expected short-term interest rates on world stock returns, oil prices, world monetary growth and fiscal variables (world deficits and

debt). Found out that while all the others are significant, deficits and debt are insignificant. Also, regressed investment on these terms and found that deficits/debts do not change investment by much. However, they do find indications that one should be using cross country data to evaluate interest rate determination.

*Beard and McMillan* (1991) use interwar (1922-1938) data to verify the proposition in a standard VAR manner. The test standard deficits in this period against 4-6 month prime commercial paper rates. He finds that the relationship between deficits and interest rates are small and insignificant. He finds one exception: when we exclude government expenditures from the equation, then deficits are positively related to interest - suggesting therefore the importance of including G in regressions. The point of using interwar data was to exclude war-related expenditures which have high Gs and thus may twist results on D-r relationship in a positive direction.

*Raynold* (1994) argues that the reason why we have had poor relationships between deficits and interest rates is because tests have ignored liquidity constraints. Thus, he runs a VAR using the same old variables on short-term and long-term corporate rates - but adds two variables (real value of liabilities of failed firms and real value of deposits of failed banks) as proxies for liquidity constraints. He finds that if he excludes these, deficits have no significant effect on interest rates; but when these variables are included, deficits have significant *negative* effects on interest rates.

*Quigley and Porter-Hudak* (1994) use a different methodology as Wachtel and Young (1987) and confirm their results. But they found that markets only respond to interest rates 40% of the time and when they respond it is temporary (1-6 days) and depends on the size of the announced change in deficits. Nonetheless, announcements of greater deficits have a positive effect on short-term interest rates.

*Hutchison and Pyle* (1994) evaluate short-term rates on "pooled" deficits of cross-country series of data. Regress these rates on money growth and unemployment rate and country-specific data. Find out that pooled government deficits cause the real short-term rates to rise.

## **Causality of Interest Rates and Budget Deficits**

*Canto and Rapp* (1982) use causality tests to test impact of Federal deficit on one-year T-bill rates for 1929-80 period. Fed deficits do not significantly cause rise in interest rate.

*Dwyer* (1982a) verifies whether deficits Granger-cause interest rates; he finds out that they do not. (nor do they Granger-cause money supply growth or inflation)

*Darrat* (1990) asks whether that conventional tests have rarely tested for direction of causality between interest and deficit. Using Cebula's (1988) data and structure, Darratt uses Granger/FPE procedure on long-term Moody's AAa-bond interest rates and structural deficits. Finds that deficits do *not* Granger-cause interest rates. Also finds that interest rates do *not* Granger-cause deficits. Asks whether they might be cointegrated and finds out that they are not - thus structural deficits and long rates don't have a long-term relationship. Thus, supports REH.

*Cebula* (1997) using real twenty-year Treasury bond rate from 1973-1996 and finds Granger-causality from long-term interest rates to total, structural and cyclical deficits but not vice-versa. Also finds interest rates Granger-cause unemployment (but not vice-versa) and that unemployment Granger-causes structural and cyclical deficits (but not vice-versa).

### **Budget Deficits and Crowding In**

*Darrat* (1988) finds a significant relationship between the growth of stock market prices and an increase in budget deficits (change in real high-employment budget deficits relative to GNP). In their most detailed study, they found mostly positive relationships for anticipated and unanticipated lagged government spending. This confirms Tobin's (1969) crowding in multi markets model.

*Friedman B. M.* (1980) simulates the MPS model as used by the Fed Board (1978). 1967-69, he finds that the MPS has a 0.87 multiplier in the short run, some investment rises, but more than full crowding out in the long run (after 10 qtrs). In a similar model adding corporate bonds, Friedman finds that the multiplier is 1.27 in short run and has stronger investment, short term rates rise more, still full crowding out in long run. (Neither model has an outlet for increasing demand for government bonds). This shows that portfolio crowding in and accelerator effects are evident.

*Frankel (1985)* uses a portfolio theory-based equation to estimate the impact of budget deficits on different expected real rates of return in a Tobin-style multi-asset model. Using a wide menu of assets (tangible assets, short-term bills and deposits, treasury bonds, state and local bonds, corporate bonds and equity), Frankel finds that an (i) increase in the supply of equity raises the return on equity, (ii) increase in supply of deposits lowers the return on equity (iii) increase in the supply of government bonds lowers the return on equity ("crowding in"), (iv) increases in supply of government bonds increases the rate on government bonds, (v) increases in supply of government bonds insignificantly increases the rate on corporate bonds. Thus it is evident that Treasury bonds and money tend to be good substitutes for each other, but much poorer substitutes for corporate bonds and equity. Frankel concludes that (ii) implies equity is obviously a poor substitute for money, (iii) implies clearly the phenomenon of "crowding in", (iv) implies the invalidity of REH and (v) implies a mild "crowding out" effect but as it is insignificant, it reinforces the earlier "crowding in" possibility.

### **Budget Deficits and Monetization**

*Barro (1978)* finds no support for the proposition that the growth rate of nominal money increases when deficits increase, rather he finds a negative relationship, once total government spending is controlled for. The data set is 1946-76 USA.

*Hamburger and Zwick (1981)*, using a modified model and Barro's data find that government spending is positively related to increasing money growth, and so are deficits positively related when the time period is shortened to 1961-75. However these results are questioned by *McMillin and Beard (1982)*.

*Blinder (1983)* finds that depending on the inflation rate and the growth of government purchases, a larger deficit can either increase or decrease the change in central bank's holdings of reserves.

*Dewald (19??)* uses quarterly data 1949-1980 and finds a positive association between budget deficits and the growth of fiat money. His assumption is that Governments increase money growth to stop rising interest rates from the growing government deficits

*Dwyer (1985)* survey of the literature, starts with the assumption that interest rates are not

effected by government debt issues, then determines if it is due to monetization or exchange rate appreciation. He finds no evidence for either of these and concludes REH is the best explanation.

*Makin* (1983) finds that 3-month T-bill rate is well-explained by money surprises, expected inflation and inflation uncertainty (1959-1981). The deficit is positive but of marginally significant importance.

*Huang* (1986) estimates relationship between the degree of monetization of government debt versus bond issue, and if these two financing options make a difference to real asset returns on a wide variety of assets (common stocks, corporate bonds, T-bonds and T-bills). Huang finds no significant effect of the monetization or bond financing of deficits on the real returns of these assets. Supports Modigliani-Miller and Barro (doesn't matter if bond or money finance)

### **Budget Deficits and Trade Deficits**

*Evans* (1986) tests for "crowding out" out foreign investment and finds that deficits do not appreciate currency.

### **Budget Deficits and Capital Stock**

*Barth, Russek, Wang* (1986) counter the de Leeuw and Holloways (1985) results that there is a strong and significant negative effect of budget deficits on nonfederal net capital stock (aggregate of consumer durables, nonresidential fixed capital, state and local govt equipment, residential structures). They find their tests were based on spurious regressions, and when accounting for this there is no significant relationship.

### **Budget Deficits and Consumption**

*Kormendi* (1983) consumption is negatively related to government spending but independent of financing mix.

*Modigliani & Sterling* (1986) use the Life Cycle Hypothesis to show that consumption depends

on both net taxes and government expenditure.

*Aschauer* (1985) found that government deficits effect consumption only in as much they are used to forecast future deficits. As a result he accepts the rational expectations and Ricardian equivalence joint hypothesis.

## References

- Allen, S.D. and Chant, J.F. (1983) "Government Borrowing and Monetary Accomodation", *Journal of Monetary Economics*, Vol. 12, p.605-16.
- Aschauer, D.A. (1985) "Fiscal Policy and Aggregate Demand", *American Economic Review*, Vol. 75 (1), p.117-27.
- Aschauer, D.A. (1988) "The Equilibrium Approach to Fiscal Policy", *Journal of Money Credit and Banking*, Vol. 20 (1), p.41-62.
- Aschauer, D.A. (1989a) "Is Public Expenditure Productive?", *Journal of Monetary Economics*, Vol. 23(2), p.177-200.
- Aschauer, D.A. (1989b) "Does Public Capital Crowd Out Private Capital?", *Journal of Monetary Economics*, Vol. 24 (20), p.169-
- Aschauer, D.A. (1990) "Public Investment and Productivity Growth in the Group of Seven", *Federal Reserve Bank of Chicago Economic Perspectives*, Vol. 13, p.17-25.
- Ball, L., Elmendorf, D.W. and Mankiw, N.G. (1995) "The Deficit Gamble", *NBER Working Paper* 5015.
- Barro, R.J. (1974) "Are Government Bonds Net Wealth?", *Journal of Political Economy*. Vol. 82 (6), p.1095-1117.
- Barro, R.J. (1978) "Comment from an Unreconstructed Ricardian", *Journal of Monetary Economics*, Vol. 11, p.569-81.
- Barro, R.J. (1979) "On the Determination of the Public Debt", *Journal of Political Economy*, Vol. 87, p.940-71.
- Barro, R.J. (1980) "Federal Deficit Policy and the Effects of Public Debt Shocks", *Journal of Money, Credit and Banking*, Vol. 12 (4), p.747-62.
- Barro, R.J. (1981) "Output Effects of Government Purchases", *Journal of Political Economy*, Vol. 89, p.1086-1121.
- Barro, R.J. (1987) "Government Spending, Interest Rates, Prices and Budget Deficits in the United Kingdom, 1701-1918", *Journal of Monetary Economics*, Vol. 20 (2), p.221-47.
- Barro, R.J. (1989a) "The Neoclassical Approach to Fiscal Policy", in Barro, editor, *Modern*

*Business Cycle Theory*. Cambridge, Mass: Harvard University Press.

Barro, R.J. (1989b) "The Ricardian Approach to Budget Deficits", *Journal of Economic Perspectives*, Vol. 3 (2), p.37-54.

Barro, R.J. and Sala-i-Martin, X. (1990) "World Real Interest Rates", *NBER Macroeconomics Annual*. Cambridge, MA: M.I.T. Press.

Barsky, R.B., Mankiw, N.G. and Zeldes, S.P. (1986) "Ricardian Consumers with Keynesian Prpensities", *American Economic Review*, Vol. 76, p.676-91.

Barth, J.R. and Bradley, M.D. (1989) "Evidence on the Real Interest Effects of Money, Debt and Government Spending", *Quarterly Journal of Economics and Business*, Vol. 29 (1), p.49-57.

Barth, J.R., Iden, G.R. and Russek, F.S. (1985) "Federal Borrowing and Short-Term Interest Rates: comment", *Southern Economic Journal*, Vol. 52 (2), p.554-9.

Barth, J.R., Russek, F.S. and Wang, H.K. (1986) "Time Series Analysis of the Relationship between the Capital Stock and Federal Debt", *Journal of Money, Credit, and Banking* Vol. 18 (4), p.527-538.

Beard, T.R. and McMillan, W.D. (1991) "The Impact of Budget Deficits in the Interwar Period", *Journal of Macroeconomics*, Vol. 13 (2), p.239-66.

Becker, T. (1997) "An Investigation of Ricardian Equivalence in a Common Trends Model", *Journal of Monetary Economics*, Vol. 39, p.405-31.

Bernheim, B.D. (1987) "Ricardian Equivalence:an evaluation of theory and evidence", *NBER Macroeconomics Annual*, Vol. 2, p.263-303.

Bernheim, B.D. (1989) "The Neoclassical Perspective on Budget Deficits", *Journal of Economic Perspectives*, Vol. 3 (2), p.55-72.

Black, R.A. and Gilmore, C.G. (1990) "Crowding Out During Britain's Industrial Revolution", *Journal of Economic History*, Vol. 50 (1), p.109-31.

Blanchard, O.J. (1981) "Output, the Stock Market, and Interest Rates" *American Economic Review*, Vol. 71 (1), p.132-43.

Blanchard, O.J. (1985) "Debts, Deficits and Finite Horizons", *Journal of Political Economy*, Vol. 93 (2), p.223-47.

Blanchard, O.J. and Fischer, S. (1989) *Lectures on Macroeconomics*. Cambridge, Mass: M.I.T. Press.

- Blejer, M.I. and Cheasty, A. (1991) "The Measurement of Fiscal Deficits: Analytical and methodological issues", *Journal of Economic Literature*, Vol. 29 (4), p.1644-78.
- Blinder, A.S. (1983) "On the Monetization of Deficits", in Meyer, editor, *Economic Consequences of Government Deficits*. Boston: Kluwer-Nijhoff.
- Blinder, A.S. and Solow, R.M. (1973) "Does Fiscal Policy Matter?", *Journal of Public Economics*, Vol. 2, p.318-37.
- Blinder, A.S. and Solow, R.M. (1974) "Analytical Foundations of Fiscal Policy", in Blinder et al., *The Economics of Public Finance*, Washington, DC: Brookings Institution.
- Blinder, A.S. and Solow, R.M. (1976) "Does Fiscal Policy Still Matter?", *Journal of Public Economics*, Vol. 5, p.501-10.
- Boothe, and Reid, B.G. (1989) "Asset Returns and Government Budgets in a Small Open Economy: Empirical evidence for Canada", *Journal of Monetary Economics*, Vol. 23 (1), p.65-77.
- Boskin, M.J. (1982) "Federal Government Deficits: Some Myths and Realities." *American Economic Review*, Vol 72, May, pp296-303.
- Bovenberg, A. (1988) "Long-Term Interest Rates", *International Monetary Review*, Vol. ??, p.382-90.
- Brainard, W.S. and Tobin, J. (1968) "Pitfalls in Financial Model Building", *American Economic Review*, Vol. 58 (2), p.99-122.
- Buiter, W.H. (1977) "Crowding Out and the Effectiveness of Fiscal Policy", *Journal of Public Economics*, Vol. 7, p.309-28.
- Buiter, W.H. (1991) "Debt Neutrality, Redistribution and Consumer Heterogeneity: a survey and some extensions", in Brainard, Nordhaus and Watts, editors, *Money, Macroeconomics and Economic Policy: Essays in honor of James Tobin*. Cambridge, Mass: M.I.T. Press.
- Canto, V.A. and Rapp, D. (1982) "The Crowding Out Controversy: Arguments and evidence", *Federal Reserve Bank of Atlanta Quarterly Review*, Vol. 67, p.33-37.
- Carroll, C.D. (1992) "The Buffer-Stock Theory of Saving: Some macroeconomic evidence", *Brookings Papers on Economic Activity*, p.61-156.
- Cebula, R.J. (1988) "Federal Government Budget Deficits and Interest Rates: A brief note", *Southern Economic Journal*, Vol. 54, p.206-10.

- Cebula, R.J. (1990) "A Note on Budget Deficits and Ex Ante Real Long Term Interest Rates in the United States", *Southern Economic Journal*, Vol. 56 (3), p.797-801; 804-6.
- Cebula, R.J. (1991) "A Note on Federal Budget Deficits and the Term Structure of Interest Rates", *Southern Economic Journal*, Vol. 57, p.1170-73.
- Cebula, R.J. and Belton, W. (1992) "Deficits and Real Interest Rates in the United States: A note on the Barro Theory versus the Cukierman-Meltzer Theory of government debt and deficits in a neo-Ricardian framework", *Economia Internazionale*, Vol. 45 (3-4), p.289-95.
- Cebula, R.J. (1997) "Government Deficits, *ex post* Real Long-Term Interest Rates and Causality", *Banca Nazionale de Lavoro Quarterly Review*, Vol. 202, p.325-36.
- Chan, L.K.C. (1983) "Uncertainty and the Neutrality of Government Financing Policy", *Journal of Monetary Economics*, Vol. 11, p.351-72.
- Christ, C. (1968) "A Simple Macroeconomic Model with a Government Budget Restraint", *Journal of Political Economy*, Vol. 76 (1), p.53-67.
- Christ, C. (1979) "On Fiscal and Monetary Policies and the Government Budget Restraint", *American Economic Review*, Vol. 69, p.526-38.
- Darrat, A.F. (1988) "On Fiscal Policy and the Stock Market", *Journal of Money, Credit and Banking*, Vol. 20 (3), p.353-63.
- Darrat, A.F. (1990) "Structural Federal Deficits and Interest Rates: Some causality and co-integration tests", *Southern Economic Journal*, Vol. 56 (3), p.752-9.
- De Leeuw, F. and Holloway, T. (1985) "The Measurement and Significance of Cyclically Adjusted Federal Budget and Debt", *Journal of Money, Credit and Banking*, Vol.17 (2), p.323-42.
- Dewald, W.G. (1983) "Federal Deficits and Real Interest Rates: Theory and evidence", *Federal Reserve Bank of Atlanta Quarterly Review*, Vol. 68, p.20-9.
- Dewald, W.G. (19??) "Disentangling Monetary and Fiscal Policy" ????
- Domar, E. (1944) "The 'Burden of the Debt' and the National Income", *American Economic Review*, Vol. 34, p.798-827.
- Dua, P. and Arora, H.K. (1989) "Do Expected Budget Deficits Affect Household Expectations of Interest Rates?", *Journal of Macroeconomics*, Vol. 11 (4), p.551-62.

Dwyer, G.P. (1982a) "Inflation and Government Deficits", *Economic Inquiry*, Vol. 20, p.59-84.

Dwyer, G.P. (1982b) "Is Inflation a Consequence of Government Deficits?", *Federal Reserve Bank of Atlanta Economic Review*, August, 25-32.

Dwyer, G.P. (1985) "Federal Deficits, Interest Rates and Monetary Policy", *Journal of Money, Credit and Banking*, Vol. 17 (4), p.655-81.

Eisner, R. (1985) *How Real is the Deficit?* New York: Free Press.

Eisner, R. and Pieper, P.J. (1984) "A New View of the Federal Debt and Budget Deficits", *American Economic Review*, Vol. 74, p.11-29.

Evans, P. (1984) "The Effects on Output of Money Growth and Interest Rate Volatility in the United States", *Journal of Political Economy*, Vol. 74, p.11-29.

Evans, P. (1985) "Do Large Deficits Product High Interest Rates?", *American Economic Review*, Vol. 75, p.68-87.

Evans, P. (1986) "Is the Dollar High Because of Large Public Deficits?", *Journal of Monetary Economics*, Vol. 18, p.227-50.

Evans, P. (1987a) "Interest Rates and Expected Future Budget Deficits in the United States", *Journal of Political Economy*, Vol. 95, p.34-58.

Evans, P. (1987b) "Do Budget Deficits Raise Nominal Interest Rates? Evidence from six industrial countries", *Journal of Monetary Economics*, Vol. 20, p.281-300.

Evans, P. (1988) "Are Consumers Ricardian? Evidence for nineteen countries", *Journal of Political Economy*, Vol. 96 (5), p.983-1004.

Evans, P. (1989) "A Test of Steady-State Government-Debt Neutrality", *Economic Inquiry*, Vol. 27(1), p.39-55.

Evans, P. and Karras, G. (1994a) "Is Government Capital Productive? Evidence from a panel of seven countries", *Journal of Macroeconomics*, Vol. 16 (2), p.271-9.

Evans, P. and Karras, G. (1994b) "Are Government Activities Productive? Evidence from a panel of U.S. states", *Review of Economics and Statistics*, Vol. 16 (2), p.271-9.

Feldstein, M. (1974) "Social Security, Induced Retirement and Aggregate Capital Accumulation", *Journal of Political Economy*, Vol. 82, p.905-26.

Feldstein, M. (1982) "Government Deficits and Aggregate Demand", *Journal of Monetary*

*Economics*, Vol. 9 (1), p.1-21.

Feldstein, M. (1986) "", *Journal of Monetary Economics*, Vol. 9 (1), p.1-21.

Feldstein, M. and Elmendorf, D.W. (1990) "Government Debt, Government Spending and Private Sector Behavior Revisited: Comment", *American Economic Review*, Vol. 80 (3), p.589-99.

Fisher, W.H. and Turnovsky, S.J. (1992) "Fiscal Policy and the Term Structure of Interest Rates: An intertemporal optimizing analysis", *Journal of Money, Credit and Banking*, Vol. 24 (1), p.1-26.

Frankel, J.A. (1985) "Portfolio Crowding-Out: Empirically estimated", *Quarterly Journal of Economics*, Vol. 100, p.1041-65.

Friedman, B.M. (1978) "Crowding Out or Crowding In? Economic Consequences of Financing Government Deficits", *Brookings Papers on Economic Activity*, Vol. 3, p.593-642.

Friedman, B.M. (1980) "The Determination of Long-Term Interest Rates: Implications for fiscal and monetary policies", 1980, *Journal of Money, Credit and Banking*, Vol. 12, p.331-52.

Friedman, B.M. (1982) "Federal Reserve Policy, Interest Rate Volatility and the U.S. Capital-Raising Mechanism", *Journal of Money, Credit and Banking*, Vol. 14, p.721-45.

Friedman, B.M. (1988) *Day of Reckoning: the consequences of American economic policy*. New York: Vintage.

Hakkio C.S. (1996) "The Effects of Budget Deficit Reduction on the Exchange Rate" Federal Reserve Bank of Kansas City, Working Paper ?

Haliassos, M. and Tobin, J. (1990) "The Macroeconomics of Government Finance", in Friedman and Hahn, editors, *Handbook of Monetary Economics, Volume II*. Amsterdam: North-Holland.

Hamburger, M.J. and Zwick, B. (1981) "Deficits, Money and Inflation", *Journal of Monetary Economics*, Vol. 9, p.141-150.

Hamburger, M.J. and Zwick, B. (1982) "Deficits, Money and Inflation: Reply", *Journal of Monetary Economics*, Vol. 10, p.279-83.

Hayashi, F. (1987) "Tests for Liquidity Constraints: a critical survey and some new observations", in Bewley, editor, *Advances in Econometrics, Fifth World Congress*. Cambridge, UK: Cambridge University Press.

Heilbroner, R.L. and Bernstein, P.L. (1990) *The Debt and the Deficit: False alarms/real*

*possibilities*. New York: Norton.

Heim, C.E. and Mirowski, P. (1987) "Interest Rates and Crowding Out During Britain's Industrial Revolution", *Journal of Economic History*, Vol. 47 (1), p.117-39.

Hoelscher, G. (1983) "Federal Borrowing and Short-Term Interest Rates", *Southern Economic Journal*, Vol. 50 (2), p.319-33.

Hoelscher, G. (1986) "New Evidence on Deficits and Interest Rates", *Journal of Money, Credit and Banking*, Vol. 18 (1), p.1-17.

Holcombe R.G (1982) "Deficits, Savings, and Capital Formation." Federal Reserve Bank of Atlanta *Economic Review*, Vol. 67, p.38-44.

Huang, R.D. (1986) "Does Monetization of the Federal Debt Matter? Evidence from financial markets", *Journal of Money, Credit and Banking*, Vol. 18 (3), p.275-289.

Hubbard, R.G. and Judd, K.L. (1986) "Liquidity Constraints, Fiscal Policy and Consumption", *Brookings Papers on Economic Activity*, 1, p.1-50.

Hutchison, M.M. and Pyle, D.H. (1994) "The Real Interest Rate/Budget Deficit Link: International evidence, 1973-82", *Federal Reserve Bank of San Francisco Economic Review*, 4, p.26-33.

Keynes, J.M. (1936) *The General Theory of Employment, Interest and Money*. 1964 Edition, New York: Harcourt, Brace and World.

Kim, S.Y. and Lombra, R.E. (1989) "Why the Empirical Relationship Between Deficits and Interest Rates Appears so Fragile", *Journal of Economics and Business*, Vol. 41, p.241-51.

Kimball, M.S. and Mankiw, N.G. (1989) "Precautionary Savings and the Timing of Taxes", *Journal of Political Economy*, Vol. 97, p.863-79.

King, R.G. and Plosser, C.I. (1985) "Money, Deficits and Inflation", *Carnegie-Rochester Conference Series*, Vol. 22, Amsterdam: North-Holland.

Kolluri, B.R. and Giannaros, D.S. (1987) "Budget Deficits and Short-Term Real Interest Rate Forecasting", *Journal of Macroeconomics*, Vol. 9 (1), p.109-25.

Kormendi, R.C. (1983) "Government Debt, Government Spending, and Private Sector Behavior", *American Economic Review*, Vol. 73 (5), p.994-1010.

Lee, B.S. (1991) "Government Deficits and the Term Structure of Interest Rates", *Journal of Monetary Economics*, Vol. 27, p.425-43.

- Leiderman, L. and Razin, A. (1988) "Testing Ricardian Neutrality with an Intertemporal Stochastic Model", *Journal of Money, Credit and Banking*, Vol. 20 (1), p.1-21.
- Lerner, A.P. (1973) "Money, Debt and Wealth", in W. Sellekaerts, editor, *Econometrics and Economic Theory: Essays in honor of Jan Tinbergen*. International Arts and Sciences.
- Levy, M.D. (1981) "Factors Affecting Monetary Policy in an Era of Inflation", *Journal of Monetary Economics*, Vol. 8, p.351-73.
- McCallum, B.T. (1984) "Are Bond-Financed Deficits Inflationary? A Ricardian analysis", *Journal of Political Economy*, Vol. 92, p.123-35.
- McCallum, B.T. (1988) "Inflation: Theory and evidence", in Friedman and Hahn, editors, *Handbook of Monetary Economics*. Amsterdam: North-Holland.
- McMillin, W.D. (1981) "A Dynamic Analysis of the Impact of Fiscal Policy on the Money Supply", *Journal of Money, Credit and Banking*, Vol. 13, p.221-6.
- McMillin, W.D. (1986) "Federal Deficits and Short-Term Interest Rates", *Journal of Macroeconomics*, Vol. 8 (4), p.403-22.
- McMillin, W.D. and Beard, T.R. (1982) "Deficits, Money and Inflation: Comment", *Journal of Monetary Economics*, Vol. 10, p.273-77.
- Makin, J.H. (1983) "Real Interest, Money Surprises, Anticipated Inflation and Fiscal Deficits", *Review of Economics and Statistics*, Vol. 65 (3), p.374-84.
- Mankiw, N.G. (1987) "The Optimal Collection of Seignorage: theory and evidence", *Journal of Monetary Economics*, Vol. 20, p.327-41.
- Mascaro, A. and Meltzer, A.H. (1983) "The Long- and Short-Term Interest Rates in a Risky World", *Journal of Monetary Economics*, Vol. 12, p.485-518.
- Mayer, T. (1984) "The Government Budget Constraint and Standard Macrotheory", *Journal of Monetary Economics*, Vol. 13, p.371-9.
- Modigliani, F. (1961) "Long-Run Implications of Alternative Fiscal Policies and the Burden of the National Debt", *Economic Journal*, Vol. 71, p.730-55.
- Modigliani, F. and Sterling, A. (1986) "Government Debt, Government Spending and Private Sector Behavior", *American Economic Review*., Vol. 76 (5), p.1168-79.
- Motley, B. (1983) "Real Interest Rates, Money and Government Deficits", *Federal Reserve Bank of San Francisco Quarterly Review*, Vol.??, p.31-45.

- Niskanen, W.A. (1978) "Deficits, Government Spending and Inflation: What is the evidence?", *Journal of Monetary Economics*, Vol. 4, p.591-602.
- Ostrovsky, A.L. (1990) "Federal Government Budget Deficits and Interest Rates: Comment", *Southern Economic Journal*, Vol. 56 (3), p.802-3.
- Plosser, C.I. (1982) "Government Financing Decisions and Asset Returns", *Journal of Monetary Economics*, Vol. 9, p.325-52.
- Plosser, C.I. (1987) "Further Evidence on the Relation between Fiscal Policy and the Term Structure", *Journal of Monetary Economics*, Vol. 20, p.343-67.
- Poterba, J.M. and Summers, L.H. (1987) "Finite Lifetimes and the Effects of Budget Deficits on National Savings", *Journal of Monetary Economics*, Vol. 20 (2), p.369-91.
- Quigley, M.R. and Porter-Hudak, S. (1994) "A New Approach in Analyzing the Effect of Deficit Announcements on Interest Rates", *Journal of Money Credit and Banking*, Vol. 26 (4), p.894-902.
- Raynold, P. (1994) "The Impact of Government Deficits when Credit Markets are Imperfect: Evidence from the interwar period", *Journal of Macroeconomics*, Vol. 16 (1), p.55-76.
- Reid, B.G. (1985) "Aggregate Consumption and Deficit Financing: an attempt to separate permanent from transitory effects", *Economic Inquiry*, Vol. 23, p.475-86.
- Roley, V.V. (1979) "A Theory of Federal Debt Management", *American Economic Review*, Vol. 69, p.915-26.
- Sargent, T.J. and Wallace, N. (1981) "Some Unpleasant Monetarist Arithmetic", *Federal Reserve Bank of Minneapolis Quarterly Review*, Fall, p.1-17.
- Seater, J.J. (1985) "Does Government Debt Matter? A review", *Journal of Monetary Economics*, Vol. 16, p.121-31.
- Seater, J.J. (1993) "Ricardian Equivalence", *Journal of Economic Literature*, Vol. 31 (1), p.142-90.
- Seater, J.J. and Mariano, R.S. (1985) "New Tests of Life Cycle and Tax Discounting Hypothesis", *Journal of Monetary Economics*, Vol. 18, p.195-215.
- Smithin, J. (1994) "Cause and effect in the relationship between budget deficits and the rate of interest", *Economies et Societies*, vol 28, (1-2), January-February, p151-69.

- Tabellini, G. and La Via, V. (1989) "Money, Deficit and Public Debt in the United States", *Review of Economics and Statistics*, Vol. 71 (1), p.15-25.
- Tobin, J. (1961) "Money, Capital and Other Stores of Value", *American Economic Review*, Vol. 51 (2), p.26-37.
- Tobin, J. (1969) "A General Equilibrium Approach to Monetary Theory", *Journal of Money, Credit and Banking*, Vol. 1 (1), p.15-29.
- Tobin, J. (1980) *Asset Accumulation and Economic Activity: Reflections on contemporary macroeconomic activity*. Chicago: University of Chicago Press.
- Tobin, J. (1982) "Money and Finance in the Macroeconomic Process", *Journal of Money, Credit and Banking*, Vol. 14 (2), p.171-204.
- Tobin, J. and Buiter, W.H. (1976) "Long-Run Effects of Fiscal and Monetary Policy", in Stein, editor, *Monetarism*, Amsterdam: North Holland.
- Tobin, J. and Buiter, W.H. (1980) "Fiscal and Monetary Policies, Capital Formation and Economic Activity", in Fustenberg, editor, *The Government and Capital Formation*, Cambridge, MA: Ballinger.
- Turnovsky, S.J. (1989) "The Effects of Government Expenditure on the Term Structure of Interest Rates", *Journal of Money, Credit and Banking*, Vol. 21 (3), p.321-47.
- Turnovsky, S.J. and Miller, M.H. (1984) "The Effects of Government Expenditure on the Term Structure of Interest Rates", *Journal of Money, Credit and Banking*, Vol. 16, p.16-33.
- U.S. Treasury Department (1984) *The Effect of Deficits on Prices of Financial Assets: Theory and evidence*. Washington, DC: U.S. Government Printing Office.
- Wachtel, P. and Young, J. (1987) "Deficit Announcements and Interest Rates", *American Economic Review*, Vol. 77 (5), p.1007-12.
- Yellen, J.L. (1989) "Symposium on the Budget Deficit", *Journal of Economic Perspectives*, Vol. 3 (2), p.17-21.
- Yotsuzuka, T. (1987) "Ricardian Equivalence in the Presence of Capital Market Imperfections", *Journal of Monetary Economics*, Vol. 20, p.411-36.
- Zahid, K.H. (1988) "Government Budget Deficits and Interest Rates: The evidence since 1971 using alternative deficit measures", *Southern Economic Journal*, Vol. 54 (3), p.725-31.