

DEFICITS AND INTEREST RATES AS EVIDENCE OF RICARDIAN EQUIVALENCE

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INTRODUCTION

The current political debate regarding the federal deficit focuses on how much and how fast to cut the deficit. This one-sided debate implicitly accepts the conventional view that fiscal deficits are evil because they crowd out private investment (in a closed economy) or net exports (in a small open economy). There is an alternative, however, to the standard view of the deficit, namely, Ricardian equivalence.

The Ricardian equivalence theorem, the name of which was apparently first coined by Buchanan [1976], is the logical extension of the permanent income/life cycle hypothesis.¹ It argues that lump-sum taxes and government debt are equivalent methods of financing a given level of government expenditures. As will be shown in the next section of this paper, an implication of Ricardian equivalence is that deficits are neutral. That is, deficits fail to affect real variables such as real interest rates.² This is such a startling and politically explosive conclusion that enormous time and energy have been spent to empirically validate or reject Ricardian equivalence.

Reduced-form interest rate studies are one type of empirical study commonly cited as evidence of Ricardian equivalence because they often fail to find a significant relationship between deficits and interest rates. In this paper, we address the shortcomings and misinterpretations of reduced-form interest rate studies. We show that although a finding that deficits fail to affect interest rates significantly is an implication of, or is consistent with, Ricardian equivalence, it falls short of direct evidence of Ricardian equivalence. That is, this evidence is a necessary, but not a sufficient, condition for Ricardian equivalence.

Acknowledgment of the shortcomings of reduced-form interest rate studies is particularly important for the following reason: Although practitioners in the field are likely to be aware of the limitations of these studies, many economists, outside the macro area, learned of the concept of Ricardian equivalence through empirical tests, rather than the theory itself. Thus, they mistakenly equate Ricardian equivalence with the statement "deficits don't affect interest rates." As we will show, Ricardian equivalence requires much more. Moreover, we will show that the effect of this mistake is that we may tend to underestimate the impact of larger future deficits on the economy.

In the next section, we briefly develop both the conventional and the Ricardian view of the deficit followed by a summary of the types of evidence that have been employed to test the validity of Ricardian equivalence. We then employ a simple theoretical model of the loanable funds market to express what is in fact being tested by reduced-form interest rate studies. This exercise reveals the shortcomings of utilizing reduced-form interest rate studies as evidence of Ricardian equivalence. We end with concluding remarks.

THE CONVENTIONAL AND RICARDIAN VIEW OF THE DEFICIT

According to the conventional view, deficits are harmful because they crowd out or displace private spending. Both the type of private spending that is crowded out and the mechanism by which the spending is crowded out depend on the extent to which capital is internationally mobile. For example, a reduction in lump-sum taxes causes the government to borrow additional funds. In a closed economy (no capital mobility) interest rates rise because the government now competes with private investors for the available private saving. The increase in interest rates discourages private investment and lowers the economy's long-run growth path.

If, on the other hand, capital is internationally mobile, the increase in domestic interest rates caused by the increase in government borrowing will induce foreign investors to buy assets denominated in the domestic currency. This action will reduce the rise in domestic interest rates and limit the crowding out of domestic investment. The increased foreign demand for domestic currency, however, will cause the domestic currency to appreciate, which, in turn, causes the balance of trade to deteriorate. Thus, foreign spending on domestic goods is crowded out. Crowding out has been shifted from interest sensitive expenditures to exchange rate sensitive expenditures. Moreover, with the deficit financed externally, future interest payments on the deficit go to economic agents outside the domestic economy, lowering future expenditures on domestic production and lowering future standards of living. Therefore, for either an open or a closed economy, an increase in the fiscal deficit implies a slower growth path and a lower future standard of living [Humpage, 1993].

The alternative to the conventional view could not be more antithetical. According to the Ricardian equivalence theorem, lump-sum taxes and government deficits are equivalent methods of financing a given government spending path. This view is based on the following framework: First, since governments must ultimately pay for their expenditures, the present value of their expected expenditures must equal the present value of their expected stream of tax receipts (i.e. there exists a government budget constraint). Thus, for a given spending path, a cut in today's taxes simply implies an increase in future taxes so that the present value of tax receipts remains constant. Second, consumers maximize the present value of lifetime consumption (in accordance with the permanent income/life cycle hypothesis). In this model, a reduction in current taxes leads to an increase in current private saving so that the consumption path can remain undisturbed. Simply put, a decrease in government saving (an increase in the deficit) induces an increase in private saving so that national saving—the sum of private and public saving—is unchanged [Seater, 1993].³

There are numerous implications of the Ricardian equivalence theorem. If the deficit fails to alter national saving, it has no impact on (1) real interest rates, (2) real exchange rates, or (3) aggregate demand. In other words, the timing of government borrowing is irrelevant because the true measure of the government's absorption of resources is government purchases, not taxes. Although the assumptions necessary to derive Ricardian equivalence are both numerous and restrictive, the theory provides an interesting challenge to the traditional view of deficits.⁴

EMPIRICAL TESTS OF RICARDIAN EQUIVALENCE

The Ricardian equivalence theorem described above has a very clear behavioral implication for households: An increase in the budget deficit should increase household saving. That is, households should respond to an increase in the deficit with a rightward *shift* in the credit supply locus so that future consumption need not be reduced to accommodate future taxes. From this single behavioral response, the Ricardian model makes predictions regarding the response of numerous economic variables to changes in deficits. We can group studies which test these relationships empirically into two broad categories—how certain economic *quantities* respond to deficits (direct evidence), and how certain *prices* respond to deficits (indirect evidence).

With regard to direct quantity evidence, Ricardian equivalence predicts that there should be a positive one-to-one relationship between deficits and saving. Similarly, Ricardian equivalence predicts that there should be no relationship between deficits and consumption.⁵ While the direct approach is theoretically appealing, the evidence is inconclusive, complex, and flawed [Seater, 1993], or as Barro says, "the results are all over the map with some favoring Ricardian equivalence, and others not" [1989, 49].

For this reason, other studies have sought to test the validity of Ricardian equivalence indirectly by measuring the response of interest rates and exchange rates (the price of credit and the price of foreign exchange) to changes in the deficit. With regard to interest rates, in a large economy or a small closed economy, Ricardian equivalence predicts that changes in the deficit will have no impact on real interest rates. Both Seater [1993] and Barro [1989] argue that this type of evidence largely supports the Ricardian view. That is, many reduced-form interest rate studies find no relationship between real interest rates and deficits [Plosser, 1982; Makin, 1983; Hoelscher, 1983; Mascaro and Meltzer, 1983; Evans, 1985; 1987a; 1987b; Barro, 1987; among others]. It is this evidence with which we take issue in the next section.⁶

WHAT DO REDUCED-FORM INTEREST RATE STUDIES ACTUALLY TEST?

Recall, the Ricardian equivalence theorem implies that taxes and government debt are equivalent methods of financing government spending. This is because rational households increase their rates of saving in response to increased deficit spending so their (or their descendants') future consumption will not be adversely affected by future tax increases. Thus, an increase in the deficit which causes a

rightward shift in credit demand also causes an equivalent rightward *shift* in credit supply, leaving the interest rate unchanged.

That Ricardian equivalence requires a *shift* in the credit supply locus, as opposed to a movement along the credit supply locus, has long been recognized by the leaders in the field. For example, Seater states,

Evans [1985] and Plosser [1982] find that interest rates are unrelated to government debt, implying that debt demand *shifts* one-to-one with government debt supply, as required by the [Ricardian] hypothesis. [1985, 125]

More recently, Seater states,

The upshot [of Ricardian equivalence] is that the private demand for savings assets moves one-to-one with changes in the supply of public debt, with no change in interest rates and none of the "crowding out" of private demand so familiar with IS-LM analysis. [1993, 145]

We show below that estimates of the coefficients in reduced-form interest rate equations, which are so often cited as evidence of Ricardian equivalence, cannot econometrically disentangle the effects of shifts in credit supply from movements along credit supply. Moreover, this subtle difference makes reduced-form interest rate studies of limited value in the struggle to either validate or reject Ricardian equivalence. In order to demonstrate the argument, we outline a set of algebraic examples, each of which is followed by a graphical demonstration.

The loanable funds market is comprised of credit demand and credit supply which we characterize by the following linear equations:

$$(1) \quad C^d = \alpha_d + \beta_d i + \gamma_d D + \delta_1 X_1 + \delta_2 X_2 + \dots + \delta_n X_n,$$

$$(2) \quad C^s = \alpha_s + \beta_s i + \gamma_s D + \omega_1 Z_1 + \omega_2 Z_2 + \dots + \omega_m Z_m,$$

where C^d and C^s are dollars of credit demanded and credit supplied, the α 's are constant terms, i is the interest rate, D is some measure of the deficit, and the X 's and Z 's are control variables. The β 's, γ 's, δ 's, and ω 's are slope coefficients measuring the sensitivity of credit demand and credit supply to the interest rate, the deficit, and other control variables, respectively. The crux of the Ricardian equivalence theorem's prediction for household behavior is that an increase in the deficit shifts the credit supply locus rightward. In the context of equation (2) this means that $\gamma_s = 1$. That is, credit supply (saving) responds one-to-one to increases in the deficit.

Setting C^d equal to C^s and solving for i generates the following reduced-form interest rate equation:

$$(3) \quad i = [1/(\beta_s - \beta_d)] \left[(\alpha_d - \alpha_s) + (\gamma_d - \gamma_s) D + \sum_{i=1}^n \delta_i X_i - \sum_{j=1}^m \omega_j Z_j \right]$$

Equation (3) is the general form of all reduced-form interest rate equations cited as evidence of Ricardian equivalence. The coefficient on the deficit variable in this reduced-form equation is equal to $(\gamma_d - \gamma_s)/(\beta_s - \beta_d)$. Researchers estimating reduced-form interest rate equations have argued that an insignificant coefficient on the deficit variable in equation (3) is evidence of Ricardian equivalence. However, in order to draw this conclusion, one must argue that when $(\gamma_d - \gamma_s)/(\beta_s - \beta_d) \approx 0$, it implies that both $\gamma_s = 1$ and $\gamma_s \approx \gamma_d$. That is, the response of credit supply (saving) to a change in the deficit must be both equal to one and equal to the response of credit demand to a change in the deficit. Below we discuss two reasons why an insignificant coefficient on the deficit variable in a reduced-form interest rate equation such as equation (3) does not necessarily imply that $\gamma_s = 1$ and $\gamma_s \approx \gamma_d$.

First, suppose that changes in the deficit in the sample were not of sufficient magnitude to change total credit demand significantly. In this case, even if one were to estimate structural equation (1), the variation in the deficit would be too small to allow for a robust estimate of γ_d , the response of credit demand to changes in the deficit. As a result, γ_d would be insignificantly different from zero. If γ_d were zero, the reduced-form coefficient on the deficit variable, $(\gamma_d - \gamma_s)/(\beta_s - \beta_d)$ in equation (3), would be insignificantly different from zero when γ_s , the response of credit supply to changes in the deficit, were zero. Thus, Ricardian equivalence does not hold ($\gamma_s = 0$), but we fail to reject the Ricardian hypothesis with a reduced-form test.

Although proponents of Ricardian equivalence generally reject the view that deficits might not have been large enough in the past to increase total credit demand significantly, Eisner and Pieper [1984], Eisner [1986], and others have shown that the real burden of federal deficits in recent history may not have been as large as is ordinarily supposed. They suggest that this is because state and local governments have run a surplus in the years in which the federal government has run a deficit. Moreover, they argue that the deficit as a percent of GDP has not been unusually large even during the 1980s. Finally, Hoelscher [1986] has noted that annual short-term federal borrowing is inconsequential compared to the stock of short-term liquid assets.⁷

Figure 1 shows the case presented above. Credit supply (saving) fails to respond to an increase in credit demand (the deficit) and Ricardian equivalence should be rejected. Because the increase in credit demand is so small, however, there is an insignificant increase in the interest rate, and we mistakenly fail to reject Ricardian equivalence with a reduced-form interest rate test of the hypothesis.

The second reason why an insignificant coefficient on the deficit variable does not imply a significant shift in the credit supply locus is that reduced-form coefficient estimates on the deficit variable cannot disentangle the effects of shifts in the credit supply locus from movements along it. Suppose that $\gamma_s \approx 0$ (Ricardian equivalence does not hold) but the credit supply locus is very elastic. Since β_s , the parameter

FIGURE 1
Insignificant Shift in Credit Demand

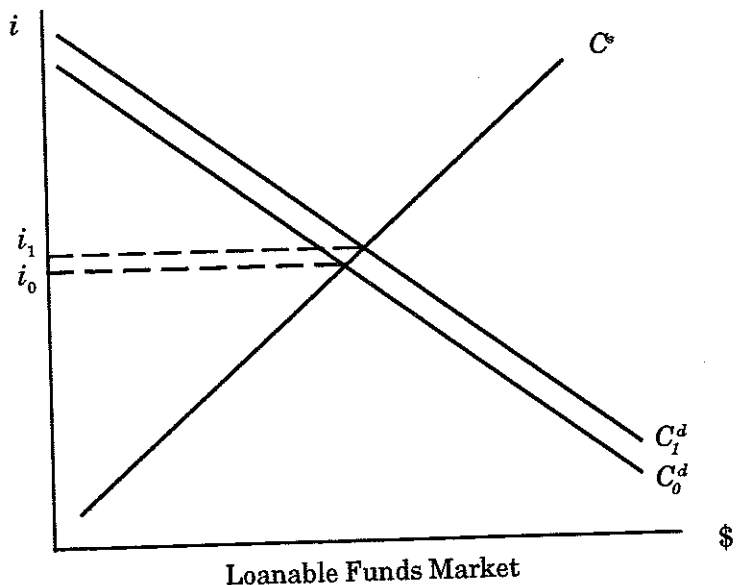
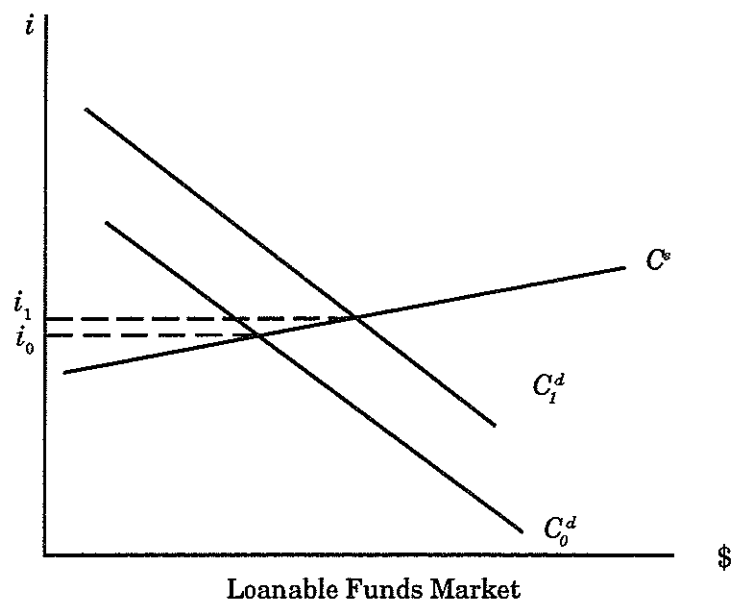


FIGURE 2
Elastic Credit Supply



representing the interest sensitivity of credit supply, is in the denominator of the reduced-form coefficient on the deficit variable, a more elastic credit supply will imply a smaller reduced-form coefficient. Consequently, γ_r , the response of credit supply to changes in the deficit, need not be greater than zero for interest rates to remain unchanged. This means that even if increased deficit spending were to increase total credit demand significantly, the reduced-form coefficient on the deficit variable gives no indication whether the credit supply locus actually *shifts* in response to increases in the deficit. Again, there is an insignificant increase in the interest rate in response to an increase in the deficit, and we mistakenly fail to reject Ricardian equivalence with a reduced-form interest rate test of the hypothesis.⁸

FIGURE 3
Symmetric Shifts in Credit Supply and Credit Demand

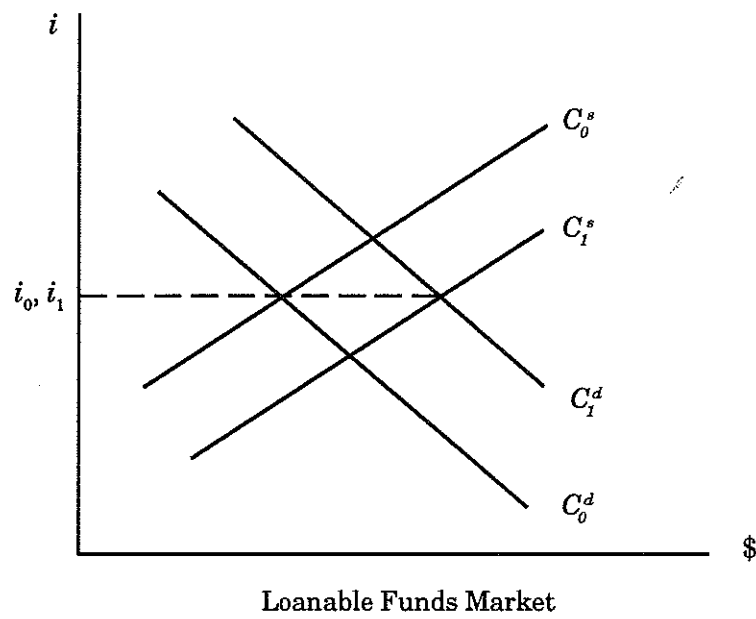


Figure 2 demonstrates the case described above. Credit supply fails to respond to an increase in credit demand and Ricardian equivalence should be rejected. Credit supply is so elastic, however, that even a substantial increase in credit demand fails to increase the interest rate significantly, and we errantly fail to reject Ricardian equivalence.

At this point, the following reasonable questions arise: Why should we care about the analytics behind the empirics? Isn't evidence that interest rates fail to respond to an increase in the deficit good enough for economists to conclude that Ricardian equivalence is a valid operating hypothesis, and thus, to declare that deficits are neutral? That this last question must be answered with a resounding "no" can be demonstrated by comparing Figure 3 with Figures 1 and 2. Figure 3 presents what is truly required by Ricardian equivalence: A rightward shift in credit demand due to an

increase in the deficit is matched by an identical rightward shift in credit supply due to an increase in saving. In short, *all deficits are neutral, regardless of size*. Compare this result to Figures 1 and 2. In Figures 1 and 2, continued increases in the deficit (i.e. continued increases in credit demand) will, at some point, significantly increase interest rates. Moreover, a more realistic Figure 2 would recognize that even if credit supply is locally elastic, there must be some upper bound to credit supply since households have finite incomes. Consequently, beyond some threshold, credit supply must begin to steepen, exacerbating the effect of an increase in the deficit on interest rates. In summary, although reduced-form interest rate studies generally suggest that current deficits have failed to increase interest rates significantly, that same evidence should not make us confident that larger future deficits will also fail to increase interest rates.

CONCLUDING REMARKS

Ricardian equivalence predicts that interest rates will be unaffected by deficits because individuals respond to an increase in government debt with an equivalent increase in saving. Since many reduced-form interest rate studies have found that interest rates are unaffected by increases in the deficit, they have been cited as evidence of the validity of the Ricardian equivalence theorem.

We have shown that a finding that deficits fail to affect interest rates is a necessary but not a sufficient condition for Ricardian equivalence. That is, this finding is consistent with, but not evidence of, Ricardian equivalence. This is because an insignificant coefficient on the deficit variable in a reduced-form interest rate equation is consistent with other saving and borrowing behaviors beyond those specifically required by Ricardian equivalence.

Moreover, there are problems associated with these studies when cited as evidence of Ricardian equivalence beyond those addressed in this paper. As previously mentioned, if international capital flows are unrestricted, increases in government debt may induce an inflow of foreign capital so that interest rates are unaffected by the new government debt. In this case reduced-form interest rate studies will mistakenly fail to reject Ricardian equivalence. Also, there are statistical problems associated with drawing conclusions regarding Ricardian equivalence on the basis of reduced-form interest rate equations [Barth, Iden, and Russek, 1985; Bernheim, 1987; 1989]. The primary problem is that the statistical power of the hypothesis tests are indeterminate since the null hypothesis (that deficits do affect interest rates) is never well-defined. That is, it is the finding of an insignificant relationship that suggests Ricardian equivalence as opposed to a finding of a significant relationship which implies a particular alternative. Further, the finding of an insignificant relationship between deficits and interest rates leaves open the possibility of errors in measurement of the deficit and other control variables. Additional shortcomings are addressed by Seater [1993, 174-7].

If reduced-form interest rate studies say so little about the validity of Ricardian equivalence, why do these studies continue to be cited as evidence of the theorem?⁹

First, the finding of an insignificant relationship between deficits and interest rates is, in fact, consistent with the Ricardian equivalence theorem. Second, more direct evidence of Ricardian equivalence, such as evidence that relates directly to saving and consumption, is, at this time, inconclusive, complex, and flawed. Third, since Ricardian equivalence follows from such an elegant theoretical construct (the permanent income/life-cycle hypothesis) many economists are predisposed to look favorably upon evidence supportive of Ricardian equivalence.

From a public policy standpoint, it is vitally important that we correctly assess the impact of the deficit on interest rates, private investment, and economic growth. Deficits may indeed be neutral, but estimates of reduced-form interest rate equations shed limited light on the issue.

NOTES

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1. Buchanan [1976] attributed the concept of debt neutrality to David Ricardo in his comment on Barro's [1974] now famous paper, "Are Government Bonds Net Wealth?" For a discussion of the exchange between Barro and Buchanan, see O'Driscoll [1977].
2. According to the Ricardian equivalence theorem, the only exception to this statement is that private saving is affected by the deficit.
3. Another way to express Ricardian equivalence is the following: Other things equal, a lump-sum tax rebate is saved, not consumed.
4. For a discussion of the theoretical objections to the Ricardian equivalence theorem, see Barro [1989].
5. There is a deep literature regarding the estimation of consumption functions, many of which predate the recent interest in Ricardian equivalence, yet they are applicable as an empirical test of Ricardian equivalence [Seater, 1993].
6. For an exhaustive review of these studies, see the U.S. Treasury Report [1984] and the Congressional Budget Office Study [1987]. More recent reviews include Barro [1989] and the extremely complete survey article by Seater [1993].
7. It is difficult to imagine, however, that this could be true for periods that span major wars since wars have historically been associated with high levels of deficit spending [Evans, 1988]. During wars, however, private investment spending typically falls, which results in a smaller increase in total credit demand than is generally supposed. It should also be noted that if consumption goods are rationed, consumers may have little choice but to save their earnings. This reduces private investment demand while increasing credit supply at the same time. Indeed, during World War II tremendous political and social pressure was placed on U.S. citizens to use their earnings to buy U.S. War Bonds as a demonstration of their patriotism. Although this may shift the credit supply locus rightward in the face of wartime deficits, it has little to do with Ricardian equivalence and, hence, with peacetime fiscal policy.
8. Boskin [1978] has shown that household saving can be surprisingly sensitive to changes in the after-tax rate of return on saving.
9. Indeed, the two most recent survey articles dedicated to Ricardian equivalence [Barro, 1989; Seater, 1993] both cite reduced-form interest rate studies as evidence of Ricardian equivalence, though Seater [1993] expresses some appropriate caveats when interpreting these studies.

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