RICARDIAN EQUIVALENCE AND NON EQUIVALENCE: AN OVERVIEW.

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1. INTRODUCTION.

Few issues in economic theory are more controversial than the macroeconomic theory of public debt and, in particular, the differential incidence of debt and tax financing. This time-honoured controversy has recently been restated as "Are government bonds net wealth?", "Do government deficits absorb private saving?", "Can the burden of current government expenditure be shifted to future generations?".[1]

The "new classical macroeconomics" gives negative answers to these questions. Even though government spending is financed by issuing bonds instead of levying taxes, the burden of current government expenditure cannot be shifted to future generations; this is due to the fact that the present generation completely discounts the taxes that will be levied to pay the interest and increases its bequests so as to meet that future liability.

This theoretical view, summarized under the term of "debt neutrality", is generally labelled as Ricardian since it was Ricardo (1817, 1820) who first pointed out the case of equivalence between the two alternative methods of financing.[2] Since that classical contribution, the debate on the

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[1] For a comprehensive survey of the large body of the literature, see Bernheim (1987).

[2] His position is actually more complex than the one merely summarized under the label of Ricardian equivalence. Steve (1957), Shoup (1960, 1962) and Neisser (1961), for example, stressed Ricardo's attention to the case of fiscal illusion which implies the shifting of debt burden to the future. A more extreme position, according to which "Ricardo was not a Ricardian", has been supported by O'Driscoll (1977), Buiter and Tobin (1979) and Musgrave (1985). On the relation between Ricardo's analytical scheme and his policy approach to the public debt issue see also Asso and Barucci (1988).

differential incidence of tax financing and borrowing has resurfaced a number of times.[3]

Besides representing one of the oldest areas of theoretical inquiry, the public debt controversy is also relevant for economic policy analysis, since it deals with the effectiveness of a debt-financed tax cut as a stabilization policy in the short run, and with its effects on capital accumulation in the long run. The wealth effect of public debt is in fact a crucial element in the debate: according to conventional keynesian theory[4] a shift from tax to debt financing, for a given level of government spending, raises perceived wealth and thereby causes an expansion of aggregate consumption. Higher interest rates, induced by the change in households' portfolios and by higher desired consumption relative to saving, also reduce the fraction of output which goes to private capital formation. On the contrary, by denying that government bonds are perceived as net wealth, the "new classical macroeconomists" postulate both the short run ineffectiveness of fiscal policy and its irrelevance for the lung run growth of the private capital stock. The effect of fiscal policy is merely measured by the size of real public expenditure, regardless of how it is financed. In terms of theoretical respectability, the debt neutrality thesis represents, indeed, "a much more serious challenge to keynesian fiscal activism than previous discussions that

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[3] See Ferguson (1964) and Tobin (1965) for a survey of the debate in the 1960s. The most recent revival of the controversy, restated as whether government bonds are considered as net wealth, is due to Barro (1974).

[4] See for example Modigliani (1961), Blinder and Solow (1973) and Buiter (1977).

focused on slopes of IS and LM curves" (Barro 1978:571). Unlike the modern re-discoverers of the Ricardian equivalence theorem, its opponents have argued that the required conditions "are so special and so unrealistic that it would be foolish and foolhardy to base policy upon them" (Tobin and Buiter 1980:112,113). The effects of removing the basic assumptions of the theorem have been accordingly analyzed.

This paper surveys some of recent theoretical developments in the Ricardian equivalence debate. Rather than using an overlapping generations model, we shall tackle the issue with a slightly different analytical framework: a two-period model that consolidates the intertemporal budget constraint of the public and the private sector.[5] Such a model provides, on the one hand, the basic analytics to present the Ricardian equivalence theorem and, on the other, a unified framework to study the effects of removing its crucial assumptions (infinite horizons, perfect capital markets, lump-sum taxation).

The outline of the paper is as follows. In the next section we shall present the Ricardian equivalence theorem, as reformulated in the recent revival of the controversy. The two-period model of section 2 also provides the analytical framework to review the main criticism on that theorem. Section 3 deals with the three main factors leading to deviations from Ricardian equivalence: uncertain lifetime with no bequest motive, imperfections in capital markets and distortionary taxation. Section 4 contains a brief account of

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[5] See Leiderman and Blejer (1988).

the empirical literature. In the last section we shall draw some conclusions.

2. THE RICARDIAN EQUIVALENCE THEOREM: A TWO-PERIOD MODEL.

The restatement of Ricardian equivalence by Barro (1974) is based on an overlapping generations model in which each generation is linked to the subsequent one by a series of intergenerational transfers.

We shall here present Barro's result in a slightly different framework, that is in the context of a simple two-period model of the economy that consolidates the intertemporal budget constraints of the public and private sectors. The choice of a two-period model to analyze such an issue may appear quite strange: an overlapping generations model would be a more natural vehicle to handle the "entry" and the "exit" of subsequent generations. However, our analytical scheme is in fact no less appropriate than Barro's: on the one hand, it will allow us a comprehensive consideration of the role of the basic assumptions of Ricardian equivalence, on the other hand, it provides a unified framework to study the effects of removing them.

In our intertemporal model, periods 1 and 2 represent, respectively, the "present" and the "future", while time 0 accounts for initial conditions. Economic agents have a zero probability of death at the end of the first period and a 100% probability of death at the end of the second one. The intertemporal solvency condition for the government requires that the present discounted value of government expenditure

plus initial financial liabilities must equal the present discounted value of tax revenue.

Let's assume that:

1) the economy is in a full employment stationary equilibrium (constant population with zero productivity growth),

2) the level and the nature of government expenditure is exogenously given,

3) the private and the public sector have the same planning horizons,

4) perfect competition prevails in capital markets,

5) lump-sum (i.e. non distortionary) taxes are available and there is no uncertainty about future expected income and wealth.

These assumptions describe a very specific fiscal regime. Firstly, they imply that government debt is fully backed by taxation, i.e. an increase in government bonds held by the private sector brings about an increase in future tax collections, whose present value exactly matches the value of existing government bonds. Secondly, the time path of government spending is assumed as given. Such a fiscal regime is in fact very peculiar. We could for example refer to an alternative scenario where bonds are backed by implicit inflationary taxation in the form of money creation.[6] Furthermore, changes in taxes and debt may cause changes in future government spending, which in turn may induce some kind of reaction in the private sector.[7]

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[6] See for example Sargent and Wallace (1981).

[7] The issue of the signalling role of fiscal behaviour has not yet received particular attention; some exceptions are

The government budget constraint for the two periods, in nominal terms, is the following:

$$G_1 - T_1 + i_0 D_0 = D_1 - D_0 \qquad (1)$$

$$G_2 - T_2 + i_1 D_1 = -D_1 \qquad (2)$$

where G is government expenditure, T is the lump-sum tax revenue, D is the public debt and i is the nominal interest rate. Equation (2) implies that all the debt is paid off, i.e. $D_2 = 0$.

Equations (1) and (2) can be expressed in real terms[8] and consolidated in a single intertemporal government budget constraint. Denoting by P and r, respectively, the price level and the real rate of interest, we obtain the following equation:

$$g_1 + g_2(1+r_1)^{-1} + (1+r_0)d_0 = \tau_1 + \tau_2(1+r_1)^{-1} \qquad (3)$$

where g, d and τ indicate the real value of the corresponding nominal variables G, D, T and

$$(1+r_1) = (1+i_1)(P_1/P_2),$$

$$(1+r_0) = (1+i_0)(P_0/P_1).$$

Feldstein (1982), Hirschhorn (1984) and Leiderman and Blejer (1988).

[8] Any problem of inflation adjustment is left out in the particular fiscal regime depicted by Ricardian equivalence.

Equation (3) simply makes explicit the intertemporal solvency requirement for the government.

If, for the sake of simplicity, we assume a closed economy without physical capital, the private sector budget constraint in periods 1 and 2 can be expressed in nominal terms as follows:

$$C_1 = Y_1 - D_1 + (1+i_0)D_0 - T_1 \qquad (4)$$

$$C_2 = Y_2 + (1 + i_1)D_1 - T_2 \qquad (5)$$

where Y is the income from human capital and D is private wealth.

Equations (4) and (5) can be expressed in real terms and consolidated in the intertemporal private sector budget constraint:

$$c_1 + c_2(1+r_1)^{-1} = y_1 + y_2(1+r_1)^{-1} - \tau_1 - \tau_2(1+r_1)^{-1} + (1+r_0)d_0, \qquad (6)$$

where y and d indicate the corresponding real values for Y and D.

Equation (6) shows that the present discounted value of private consumption must be equal to the present discounted value of disposable income, plus initial wealth. Private sector's optimal consumption plans are obtained by solving the intertemporal utility maximization problem subject to the budget constraint represented by equation (6).

Given our assumptions, the private sector internalizes the intertemporal budget constraint of the public sector in order to fully evaluate the consequences of government activities for its welfare. In fact, modelling private consumption without taking into account the above aspect would involve a rather asymmetric behaviour with regard to fiscal policy. The private sector would be forward-looking in its assessment of income and taxes, but government bonds would still be included as part of private wealth. This myopia regarding the extra taxes required to pay off the principal and the interest appears rather inconsistent with an approach that embodies perfect foresight. In our model therefore, private sector behaviour is assumed to depend on total resources available to the economy, i.e. on national income net of government absorption, rather than on disposable income.

Ricardian equivalence emerges by substituting equation (3), the intertemporal government constraint, into the private sector budget constraint, equation (6). The substitution yields:

$$c_1 + c_2(1+r_1)^{-1} = y_1 - g_1 + (y_2-g_2)(1+r_1)^{-1}. \qquad (7)$$

Equation (7) shows that any debt-tax pattern (d_t,τ_t) that satisfies the intertemporal government budget constraint does not affect the consumption-saving choice of the private sector. Ultimately, debt neutrality implies that the only policy variable that matters for the private sector is the present discounted value of government expenditure,

$g_1+g_2(1+r_1)^{-1}$. Any government's attempt to redistribute resources across generations by means of a 'tax-to-debt' swap is frustrated by rational economic agents.

Such striking result depends on three key assumptions: identical planning horizons for the private and the public sector, perfect capital markets, and lump-sum taxation. We now consider the main criticism of these assumptions in the modern literature.

3. RICARDIAN EQUIVALENCE FAILURES.

3.1. Different Planning horizons for the private and the public sector: uncertain lifetime with no bequest motive.

Three main deviations from the basic hypotheses of the equivalence theorem have been considered in the recent revival of the debate: different planning horizons for the private and the public sector, imperfections in capital markets, distortionary taxation along with uncertainty about future income and wealth. Let us consider each of them separately.

Ricardian equivalence requires that both the private and the public sector have the same planning horizon and the same rate of time preference. In an overlapping generations model, where each individual has a finite lifetime of two periods, this assumption requires agents to act as if they had infinite horizons. In this respect, Barro (1974) assumes that each finitely lived generation is linked to the subsequent one by a series of voluntary intergenerational transfers (bequests, gifts, etc.). In this intergenerational altruism model, the process of bequests makes finitely lived individuals act like infinitely lived ones. Therefore, as long as no change in the

budget constraint of the current generation occurs, there is no reason to change intertemporal consumption plans. The equivalence of tax and debt financing is thus established.

Since the appearance of Barro's paper, the question of Ricardian equivalence has largely focused on the role of, and motivation for, voluntary private intergenerational transfers. The reason for this can be traced to Diamond's (1965) seminal paper with finitely lived agents who do not leave bequests. Diamond's overlapping generations model provided a coherent general equilibrium framework in which lump-sum changes in the government's budget policies have real effects. On the contrary, in Barro's view, the irrelevance of lump-sum changes in government financial policy comes from an operative bequest motive: intergenerational transfers are both ubiquitous and motivated solely by altruism. Both components of this assumption have been treated as theoretically suspect.

With regard to the first component, Drazen (1978), Laitner (1979) and Weil (1987) have argued that, under plausible assumptions about preferences, many parents will bequeath nothing to their children. Models which allow for both gifts (from children to parents) and bequests (from parents to children) show that there is a range of parameter values where transfers flow in neither direction.

With respect to the second component (bequests motivated only by intergenerational altruism), some authors have suggested that bequests can rather be the outcome of a taste for generosity (Tobin 1980), the effect of lifetime uncertainty (Abel 1985) or, still, the result of future earnings uncertainty (Feldstein 1988).

On a priori ground, Tobin (1980) argues, on the one hand, that Barro's dynastic model, which views families as perfectly harmonious units, is extremely restrictive; and, on the other, that the preferences of distinct generations may conflict.

Abel (1985) presents an overlapping-generations model with precautionary saving and accidental (i.e. involuntary) bequests caused by lifetime uncertainty.[9] The key assumptions are: consumers live for either 1 or 2 periods, no bequest motive, no private markets for annuities.[10] In Abel's model, a precautionary demand for saving arises since each individual never knows ex-ante the date of his death. Therefore, when that time occurs, the individual is still likely to hold some wealth that will be passed on to his heir in the form of accidental bequests. In such a framework, a tax-to-debt switch does not imply that future generations inherit a monetary amount just equal to the future taxes for the debt service.

Feldstein (1988) obtains the same result in a similar framework where the crucial hypothesis is that the current generation, in the first half of its lifetime, is uncertain about second-period income, y_2. The focus is on the effect induced by that uncertainty on the desired bequest. Because of the stochastic nature of second-period earnings, individuals choose their current consumption, c_1, without knowing whether they will be able to make a bequest in period 2. Furthermore, due to precautionary saving, c_1 may be substantially less than

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[9] The effect of lifetime uncertainty on individual consumption were first examined formally in a seminal paper by Yaari (1965). His model represented the common framework for most subsequent works.

[10] The existence of such markets would exclude accidental bequests.

it would be under conditions of full certainty. In such a context, the ultimate effect of uncertainty about future earnings is to "shorten" the present generation's horizon, which implies that a shift from tax to debt financing will raise current consumption.

Let us consider now the implication of lifetime uncertainty for Ricardian equivalence in our two-period model. Let us assume that, contrary to the case of equal planning horizons for the private and the public sector, each economic agent has the same (constant) probability of dying, p, before the start of the second period ($0 \leq p \leq 1$). All the other hypotheses of the model are the same.[11]

Because of uncertainty of survival, individuals discount the future more heavily. The effective interest rate facing the consumers-taxpayers is therefore
$R_1 = (1+r_1)/(1-p) - 1$, where r_1 is the real interest rate if probability of death is nil.

Whereas the government budget constraint is the same as before, the new private sector budget constraint is the following:

$$c_1 + c_2(1+R_1)^{-1} = y_1 + y_2(1+R_1)^{-1} - \tau_1 - \tau_2(1+R_1)^{-1} + (1+R_0)d_0, \qquad (8)$$

where $(1+r_1)/(1-p) - 1 = [(1+i_1)/(1-p) - 1](P_1/P_2)$.

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[11] Macroeconomic models incorporating agents with uncertain lifetime and no bequest motive were first studied by Blanchard (1984, 1985). Other crucial assumptions are full employment with constant population, perfect capital markets and lump-sum taxation.

Since the private sector internalizes the intertemporal government budget constraint, substituting (3) into (8) yields:

$$c_1 + c_2(1+R_1)^{-1} = y_1 + y_2(1+R_1)^{-1} - g_1 - g_2(1+r_1)^{-1}$$

$$+ (R_0-r_0)d_0 + p\tau_2[(1-p)(1+R_1)]^{-1}. \quad (9)$$

Equation (9) shows that a current tax cut ($d\tau_1<0$) that is matched by an increase in future taxes ($d\tau_2>0$) raises consumers' perceived wealth and thus consumption. To the extent that individuals have a strictly positive probability of death before the start of period 2 ($p>0$), the departure from the equivalence theorem occurs since the current tax cut involves a less than one-to-one increase in the present value of future taxes. In fact, it is as if a tax-to-debt swap at period 1 presents individuals with the opportunity to extract funds from the "future" (period 2).

The Yaari-Blanchard approach, in which the horizon of agents is a parameter that can be chosen arbitrarily, is extremely flexible. If p goes to zero equations (9) and (7) coincide: Barro's model is obtained as a special case.[12]

Two considerations are required at this stage in order to avoid misleading conclusions. Firstly, the wealth effect of

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[12] The Yaari-Blanchard model allows for radically divergent implications: a role for short run stabilization policy when agents have finite horizons ($p>0$), debt neutrality when they display infinite horizons ($p=0$). Since Blanchard (1984, 1985), the hypothesis of finite horizons' agents has been the standard approach to build a role for deficit-spending policies.

public debt in the Yaari-Blanchard model does not depend on the randomness of lifetime in itself, but on the fact that lifetime uncertainty "shortens" the horizon of risk-averse agents. Such a consideration may look trivial: in our two-period model uncertain lifetimes imply necessarily a shorter horizon. Generally speaking, however, it cannot be excluded that a random lifetime causes an agent's horizon to be longer than that of an agent with certain lifetime. In this case, as argued by Levhari and Mirman (1977), two elements act in opposite directions: the desire of a risk-averter to provide for a longer life together with the desire for more certainty. While current consumption is decreased by the former element, it is increased by the latter one. The final effect cannot be established a priori.

The second remark, due to Buiter (1988a,b), is that, in the case of lifetime uncertainty, debt non-neutrality hinges on the implicit assumption of a positive birth rate. In other words, as long as there is a zero birth rate, uncertain lifetime (represented by a positive constant probability of death) does not destroy debt neutrality. The intuition behind the result is that, with a zero birth rate, postponing lump-sum taxes fails to redistribute income or wealth over time: while the probability to survive to pay future taxes declines, the per capita tax burden of the survivors increases.[13] This remark is consistent with our two-period model: given the hypothesis of constant population, to assume a constant

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[13] Buiter (1988b) has shown that these two effects cancel each other out exactly.

probability of death before the start of period 2, necessarily implies a positive birth rate.

3.2. Imperfections in capital markets.

Another important channel leading to deviations from Ricardian equivalence are imperfections in capital markets.

It has recently been contended that the issue of agents' horizon along with the bequest motive is not likely to be empirically relevant. Hubbard and Judd (1986) and Poterba and Summers (1987) for example point out that under a variety of plausible deficit scenarios, a substantial fraction of the deferred tax burden is not shifted upon future generations. These authors conclude that factors such as liquidity constraints may have a much larger bearing on the controversy.

Indeed, the belief that imperfections in capital markets are empirically relevant also explains the large body of recent work designed to identify liquidity constraints from consumption data.[14]

Given all the other assumptions of Ricardian equivalence, let us consider the case of imperfect capital markets in our simple two-period model.

Let us suppose that the private sector faces higher borrowing rates than the government. The higher private borrowing rate could reflect government superiority in the intermediation process as long as the costs of verifying credit-worthiness, of monitoring the borrower, and the expected costs of default are lower for the public than for

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[14] See for example Flavin (1984), Zeldes (1985) and Jappelli (1986).

the private sector. In particular, let us assume that the interest rate facing private sector is $(1+\Phi)i$, where i is the nominal rate of interest that applies to government borrowing and Φ is a premium reflecting the relative inefficiency of the private sector in arranging loans.

The government budget constraint [equation (3)] is not affected by the new assumption. On the contrary, the intertemporal budget constraint of the private sector has to be reformulated as follows:

$$c_1 + c_2 [1+(1+\Phi_1)r_1]^{-1} = y_1 - \tau_1 + (y_2-\tau_2)[1+(1+\Phi_1)r_1]^{-1} + [1+(1+\Phi_0)r_0]d_0, \qquad (10)$$

where $1 + (1+\Phi_1)r_1 = [1 + (1+\Phi_1)i_1](P_1/P_2)$.

Since the private sector internalizes the government budget constraint, equation (10) can be rewritten as:

$$c_1 + c_2[1+r_1(1+\Phi_1)]^{-1} = y_1 + y_2[1+(1+\Phi_1)r_1]^{-1} - g_1 - g_2(1+r_1)^{-1} + \Phi_0 r_0 d_0 + \alpha\Phi_1 r_1 \tau_2 \qquad (11)$$

where $\alpha = (1+r_1)^{-1}[1+(1+\Phi_1)r_1]^{-1}$.

Equation (11) shows that, as long as $\Phi_1>0$, a current shift from tax to debt finance (that is matched by an increase

in future taxes, $d\tau_2>0$) increases private sector consumption. Economic agents are no longer indifferent to the opportunity of postponing tax payments: "Even if they themselves must pay the taxes later, they will increase their consumption now. In effect the government lends to them at its borrowing rate of interest, an option not otherwise available in the credit market" (Tobin 1980:57). The result crucially depends on the assumed government superiority in the intermediation process. If its ability to enforce tax payments is as great as private lending institutions' ability to enforce debt repayment, any rate differential disappears ($\Phi_0=\Phi_1=0$), and equations (11) and (7) coincide. The equivalence theorem is thus restated. Imperfections in capital markets can also take the form of credit rationing. For those individuals whose borrowing constraints are binding, a tax-cut represents a slack in the constraint itself. They may consequently choose to revise their portfolio decisions and increase present consumption. In fact, a tax-to-debt swap can be thought of "as the public sector borrowing from low borrowing cost individuals (those whose borrowing constraints are not binding) and lending to high cost individuals (those with binding constraints)" (Chan 1983:370).

Unfortunately, the basic premise that the government is more efficient than the private market in arranging loans seems quite weak on theoretical grounds. Furthermore, liquidity constraints are assumed as exogenously given.

A different approach, where liquidity constraints are endogenous in the equilibrium, explains credit rationing as a consequence of asymmetric information between lenders and

borrowers. Webb (1981), Hayashi (1987) and Yotsuzuka (1987) have for example analyzed the implications of "adverse selection" in private financial markets. As regards the public debt controversy, the question arises as to whether models of informationally imperfect markets provide a sound theoretical basis for debt non-neutrality.

In this respect, neither Hayashi (1987) nor Yotsuzuka (1987) offer clear-cut answers: unless the exact nature of market imperfections and the extent to which information is shared among lenders are clearly specified, adverse selection in capital markets does not seem to violate Ricardian equivalence. Apart from these preliminary results, which do not imply, as Yotsuzuka himself states, "that capital market imperfections do not matter", the microfoundations of imperfect capital markets remain an issue on which future theoretical work should concentrate.

3.3. Distortionary taxation.

A third important source of debt non-neutrality is the non lump-sum nature of the tax system: by inducing intertemporal substitution effects, non lump-sum taxes affect the decisions of private sector. Under these circumstances, debt financing is no longer perceived as a mere "tax postponement".

Most of the current debate has not paid attention to the crucial role played by the assumption of lump-sum taxation. Since Barro (1974), as previously argued, the main focus has been by far on the role of voluntary private intergenerational transfer (bequest motive).

Some recent exceptions are Abel (1986) and Barsky et al. (1986). Abel has shown that, with increasing marginal estate tax rates, postponing lump-sum taxes boosts consumption. The failure of Ricardian equivalence emerges also in the study by Barsky et al. (1986), whose crucial assumptions are that taxes are an increasing function of income and that uncertainty on future incomes prevails. They show that a shift from tax to debt finance acts as an insurance mechanism, by reducing the variance of future after-tax income. As precautionary saving decreases, the marginal propensity to consume out of a current tax cut turns to be positive. It has to be noticed that these authors' finding holds only as far as private insurance markets do not exist. However, the absence of such markets is not explained by the authors. As the analysis of imperfect capital markets has pointed out, it can be misleading to discuss the effect of government financial policies in the presence of market failures without modelling the failure explicitly.

The case of distortionary taxation can also be easily illustrated in our two-period model. Let us consider, for example, an open economy with perfect capital mobility, such that the domestic real interest rate, r, is equal to the international rate, r*, which applies to borrowing from abroad. All borrowing, both by public and private sector, is vis-a'-vis foreign lenders. While lump-sum taxes are not available, taxes on interest payments are levied. All the other assumptions of Ricardian equivalence are satisfied.

The hypothesis of distortionary taxation modifies the original intertemporal government budget constraint [equation (3)] as follows:

$$g_1 + g_2(1+r_1)^{-1} + (1+r_0)d_0 = r_0\epsilon_0 b_0 + r_1\epsilon_1 b_1(1+r_1)^{-1} \quad (12)$$

where d and b are, respectively, the public and the private sector debt in real terms and ϵ is the tax rate applied to private sector interest payment for the external debt. The private sector intertemporal budget constraint is the following:

$$c_1 + c_2[1+(1+\epsilon_1)r_1]^{-1} = y_1 + y_2[1+r_1(1+\epsilon_1)]^{-1} - [1+r_0(1+\epsilon_0)]b_0. \quad (13)$$

Substituting (12) in (13) gives the intertemporal budget constraint facing rational economic agents:

$$c_1 + c_2[1+r_1(1+\epsilon_1)]^{-1} = y_1 + y_2[1+(1+\epsilon_1)r_1]^{-1} - g_1 - g_2(1+r_1)^{-1} - (1+r_0)(b_0+d_0) + r_1\epsilon_1 b_1(1+r_1)^{-1}. \quad (14)$$

The first four terms on the RHS are the present value of the real resources available to the private sector, while the other two represent the initial value of the economy's external debt commitment. The higher the value of the external

debt commitment, the lower the level of wealth and of private consumption will be.

Equation (14) shows that when $\epsilon_1=0$ (no tax on interest payments for the external debt) Ricardian equivalence holds again. The government's subsequent foreign borrowing has no effect on private consumption. This is affected only by the amount of public expenditure, $g_1 + g_2(1+r_1)^{-1}$, and not by the form in which it is financed. On the contrary, when $\epsilon_1 \neq 0$, a current tax cut ($d\epsilon_0<0$) followed by a future increase ($d\epsilon_1>0$) implies both substitution and wealth effects. A current tax cut can alter the relative price of present consumption in such a way that consumers-taxpayers will be induced to substitute away from future towards current consumption.

Along with the debate on Ricardian equivalence, the implications of assuming distortionary taxes have also been analyzed by the "optimum debt" theory.[15] The starting point is that, even though taxpayers display infinite horizons and capital markets are perfect, tax-to-debt swaps are not irrelevant whenever welfare costs are associated with collecting distortionary taxes.

Given the intertemporal government budget constraint, the problem is to derive the time pattern of taxes which minimizes the excess burden induced by non lump-sum taxation. This is a dynamic application of the theory of optimal taxation to the study of fiscal policy. In this respect the theory of optimal taxation becomes a theory of optimal public debt since borrowing is viewed as a device to redistribute tax

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[15] See in particular Barro (1979, 1980), Buiter (1983), Lucas and Stokey (1983).

distorsions over time. The basic result is that it is optimal to smooth planned tax rates relative to planned government spending. This implies that debt financing should be used either in the case of exceptionally high expenditures (such as during wars) or when tax receipts are temporarily low (such as during recessions).[16]

4. EMPIRICAL EVIDENCE: A BRIEF NOTE.

A survey of the main criticism on the equivalence theorem has shown the extremely restrictive conditions on which the irrelevance of alternative government financing rules can be maintained. Far from providing policy implications, the essential objection is that "the possible neutrality of public debt and deficits is little more than a theoretical curiosum" (Buiter 1985:42). Nevertheless, this objection does not fault the logic inherent in the theorem. Therefore it seems that the controversy can be settled only on empirical grounds.

Two basic approaches have been followed in the literature testing the Ricardian equivalence hypothesis. The first one is an extension of traditional time-series aggregate consumption function estimations, which allow for fiscal variables. This approach has tried to expand the traditional set of factors thought to affect aggregate consumption and to derive "better"

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[16] As far as the current policy maker can commit its successors to follow his optimal plan, the application of the optimal taxation theory to a dynamic framework does not originate any time-consistency problem. However, since it is more sensible to think of tax rates as being set over time by a government with limited ability to bind future tax decisions, an incentive to deviate from previously announced policy may arise. On the issue of time-consistency of optimal fiscal policy see Lucas and Stokey (1983), Lucas (1986), Persson, Persson and Svensson (1987).

measures of the relevant variables such as permanent income, wealth, government deficit, or other fiscal and monetary variables. The second, more recent, approach derives the estimated relations from an explicit intertemporal optimization framework. This approach estimates the Euler equation obtained from the first order conditions for optimal consumption behaviour under uncertainty, which suggests that consumption follows a random walk. The basic question is whether an "excess sensitivity" of consumption to income arises.

Rather than solving the controversy, the bulk of existing empirical work looks rather inconclusive. With respect to the first approach, the results are quite sensitive to the time period examined, the choice of dependent and independent variables, and the measurement of fiscal variables.[17] Direct examinations of wealth effect of public debt in the second approach have not been as many as in the traditional time-series consumption function approach.[18] Also in this case any clear-cut answer has not been provided.

Ultimately, despite the frequent remark that the dispute has to be settled on empirical grounds, it seems that "the evidence at this stage is insufficient to change the prior views of most economists by very much" (Fischer 1988:328).

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[17] A support to Ricardian equivalence theorem can be found in Kochin (1974), Tanner (1979), Carmichael (1982), Kormendi (1983), Seater and Mariano (1985), and Evans (1988). On the contrary, the theorem is rejected by Yawitz and Meyer (1976), Buiter and Tobin (1979), Holcombe, Jackson and Zardkoohi (1981, 1982), Feldstein (1982), Barth, Iden and Russek (1985), and Modigliani and Sterling (1986).

[18] See, for example, Aschauer (1985), and Leiderman and Razin (1988).

5. CONCLUSIONS.

The purpose of this paper has been to provide an overview of recent theoretical developments in the macroeconomic theory of public debt. The protracted controversy can be traced to Ricardo's (1817, 1820) classical contribution, according to whom debt and taxes are perfectly equivalent as alternative government financing rules. Substitution of debt for taxes has no impact on private sector wealth and consumption. Since Ricardo the dispute has resurfaced a number of times, the last stage of it being the question of whether government bonds are net wealth (Barro 1974).

Our review of the Ricardian equivalence debate has been carried out, rather than by the standard device of an overlapping generations model, by a two-period model that consolidates the intertemporal budget constraint of the public and the private sector. Such a framework, besides clearly displaying the crucial assumptions of the equivalence theorem (infinite horizons, perfect capital markets and lump-sum taxation), also provides a unified scheme to study the effects of removing them.

The most recent revival of the debate has pointed out that the central issue is an empirical one, since the Ricardian equivalence theorem is perfectly consistent within the framework of its assumptions. Therefore, the inquiry should focus on the nature of the main deviations from it (lifetime uncertainty with no bequest motive, imperfections in capital markets and distortionary taxation) and their empirical relevance.

The present resurgence of the controversy, however, offers a further reason of interest, namely the possibility of a retrospective reading of the current debate. In fact, a striking theoretical clearness in tackling the issue was shown by the Italian Tradition of Public Finance, at the turn of this century. Spelling out the key assumptions of the equivalence theorem, which remained implicit in Ricardo's exposition, the Italian School of Public Finance made evident the logic inherent in the theorem. Such remarkable contribution has been substantially neglected by the subsequent literature. Not only did the controversy resurface a number of times, but even the most recent views appeared substantially anticipated by those classical studies. In this respect, quite apart from any historical interest, a comparison between modern and classical strands of thought in the Ricardian equivalence debate could be an interesting topic of further research.

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