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A Political Theory of Government Debt and Deficits in a Neo-Ricardian Framework

By ALEX CUKIERMAN AND ALLAN H. MELTZER*

Individuals differ in abilities. Some are bequest constrained even in a neo-Ricardian world. They vote taxes to issue bonds to be paid by taxes on future generations, thereby increasing current consumption, crowding-out capital, reducing wage rates, and increasing the interest rate. Therefore even unconstrained individuals are not indifferent to the size of government debt. Conditions conducive to larger debt and deficits are derived when each of the living generations determines current taxes, Social Security benefits and the national debt by majority rule.

Government expenditure is used for two main purposes, the provision of public goods and the redistribution of income. We focus here on the implications of redistribution for the size of the public debt, budgetary deficits, and surpluses. Since the focus is on redistribution, we abstract from the function of government as a provider of public goods and from issues that relate to minimization of the deadweight loss of taxation over time. This paper can be viewed as complementary to the work of Robert Barro (1979) who proposes and tests a theory of public debt based on society's attempt to minimize the excess burden of taxation over time.

The main function of public debt is to redistribute the burden of taxation over time and across generations. In a neo-Ricardian world such activity seems an idle exercise. Barro shows that, in the presence of an operative bequest motive and a perfect capital market, individuals totally undo the

effects of debt-induced redistribution on consumption and welfare by adjusting their bequests appropriately. The existence of government debt in countries with developed capital markets, and the frequently stated belief that debt is a burden, is puzzling. Why do rational individuals complain about a burden that, according to Barro, does not occur?

The puzzle vanishes when individuals differ in abilities and therefore in wage earnings, and perhaps also in their initial nonhuman wealth. The reason is that some do not desire to leave positive bequests, and some would choose to borrow resources from future generations. As Allan Drazen (1978, fn. 1 below) has noted, no one can obligate the future labor income of his descendants within the existing institutional structure of democratic societies. The minimum bequest is constrained to zero; negative bequests are forbidden and, perhaps more importantly, do not have to be discharged. We refer to people who would choose to leave negative bequests as bequest-constrained individuals. These individuals favor any fiscal policy that increases their lifetime income at the expense of future generations even when the present value of the tax change is zero. For example, increased Social Security benefits financed by debt issues shift taxes forward and enable bequest-constrained individuals to achieve a superior allocation of consump-

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tion across generations within the same family.

Whether the bequest-constrained individuals succeed in pushing fiscal policy toward lower current taxes, higher debt, and higher Social Security benefits depends on the characteristics of the political process. Here we adopt the hypothesis that fiscal policy in democratic societies is determined by majority rule.¹ Hence, if the decisive voter is bequest constrained, he will choose lower current taxes financed by additional debt and perhaps also increased Social Security benefits.

If the decisive voter is not bequest constrained, he is indifferent to a reallocation of taxes and Social Security over time that maintains present value. This indifference, which is a direct consequence of the Barro (1974) debt neutrality theorem, holds only if the reallocation does not affect wage rates and the return to capital. If some voters are bequest constrained, a present value preserving substitution of taxes for debt increases the consumption of bequest-constrained individuals. They obtain the additional resources from the nonbequest-constrained individuals who substitute bonds for capital in their portfolios. Although debt and capital are perfect substitutes in portfolios, they are not perfect substitutes in production. Additional debt crowds out some capital² and causes changes in returns to factors of production. Obviously, individuals are not indifferent to such induced general equilibrium effects of a higher debt, even if they are not bequest constrained.

There are two cases in which individuals with an operative bequest motive remain indifferent to the size of the government debt. First, if there are no bequest-constrained individuals in the economy, debt does not crowd out capital. Second, if a change in the

capital-labor ratio does not affect factor returns in the relevant range, nonbequest-constrained individuals behave as in Barro (1974). However, in the latter case voters relax the bequest constraint. The individual with the most severe bequest constraint is decisive; majority rule leads to a choice of debt that frees all bequest-constrained individuals from their constraints (provided the capital stock is sufficiently large).

In the general case, crowding out of capital affects the welfare of all individuals by changing factor returns. The rate of return to capital increases with the debt and, if labor and capital are complements in production, real wages fall. Individuals for whom labor income is the major source of income are adversely affected by the increase in debt. If they are not bequest constrained, they vote against the increase. If they are bequest constrained, their vote depends on a comparison of the gain from intergenerational reallocation of consumption and the loss in welfare from the decrease in wages.

A main purpose of the paper is to identify economic conditions that induce a larger debt and larger current deficits under majority rule. Debt is larger: (1) the larger is the size of the spread of the distribution of wealth (human and nonhuman) across individuals and the smaller the fraction of individuals for whom labor income is the main source of income; (2) the higher is the rate of technical progress; and (3) the less responsive are wages, and the more responsive the return to capital, to a change in the capital-labor ratio.

Majority choice of a large current debt does not necessarily imply a current deficit. Whether the current choice of debt level implies a current deficit or a surplus depends on whether the debt currently chosen is larger or smaller than the debt chosen by majority rule in the previous period. Deficits are likely when the decisive voter experiences a change in economic conditions that induces a larger debt. In particular, the likelihood of deficits increases with an increase in the rate of economic growth, an extension of the franchise to low wealth individuals who are likely to be bequest constrained, and an increase in the proportion of individuals whose main source of income is from returns to capital.

¹In this we follow Tom Romer (1975), Kevin Roberts (1977), and Allan Meltzer and Scott Richard (1981), who all use this paradigm to characterize taxation and redistribution in atemporal frameworks.

²The amount of capital that is crowded out by an additional unit of debt depends on the fraction of bequest-constrained individuals in the economy and on the extent to which they are constrained.

To bring out the reasons why debt and taxes are not equivalent in our model, we retain many of the features that are standard in this literature, including the overlapping generations model, due to Paul Samuelson (1958), lump-sum taxes, and Barro's (1974) intergenerational transfers from parent to child. There is no uncertainty. We differ from this standard framework by introducing, as in Meltzer and Richard (1981) and Alex Cukierman and Allan Meltzer (1988), differences in individual ability and, therefore, in wage rates. In addition, individuals receive different bequests. The position of each individual in the distribution of wealth, his wage rate and the wage rates he expects for future generations in his family determine his attitude toward the size of the debt. Given individual preferences, majority rule determines the debt size and the current taxes chosen by voters. In addition, as in Peter Diamond (1965), the model explicitly recognizes the productive functions of capital and labor.

The paper is organized as follows. The economy and the political institutions are described briefly in Section I. Section II shows the consumption, saving, and bequest decisions of bequest-constrained and nonbequest-constrained individuals for given tax and Social Security structures. It also summarizes conditions on wages, taxes, and bequests received under which an individual is likely to be bequest constrained. Section III describes more fully the institutional structure within which political decisions about debt, taxes, and Social Security benefits are made each period. It also characterizes the factors that determine individual attitudes toward intertemporal reallocations of taxes in the absence of general equilibrium effects. The core section of the paper, Section IV, combines results from previous sections to characterize the determination of public debt by majority rule. An important intermediate step derives individual attitudes toward debt in the presence of general equilibrium effects. Section V uses the results to derive conditions that are conducive to large debts and deficits. This section contains the main, empirically testable, implications of the theory. Concluding remarks follow.

I. Structure of the Economy and of the Political Process—Preliminaries

A. The Private Economy

The economy is represented by an overlapping generations structure with bequests. Generation t is young in period t and old in period $t + 1$. The young of generation t overlap with the old of generation $t - 1$ in period t . Population is stationary. The number of young and old, denoted N , is identical across periods. Individuals work only when young. Each young individual differs in productivity. He supplies inelastically one unit of labor each period, and he receives the wage for his type of labor. Output is produced by means of a constant return to scale aggregate production function

$$(1) \quad F(G^t N, K_t),$$

where K_t is the aggregate quantity of capital in period t , and G is the (gross) rate of labor augmenting technological progress. The capital and labor markets are competitive. The real rate of interest, r_t , is determined by the marginal productivity of capital and is given by

$$(2) \quad r_t = F_K(G^t N, K_t).$$

The average wage rate in period t , \bar{w}_t , is equal to the marginal product of labor

$$(3) \quad \bar{w}_t = G^t F_N(G^t N, K_t).$$

The wage rate of any young individual i differs from the average wage rate.³

$$(4) \quad w_{it} = (1 + v_i) \bar{w}_t \quad i = 1, \dots, N$$

where

$$(5) \quad 1 + v_i \geq 0, \quad i = 1, \dots, N \quad \text{and} \quad \sum_{i=1}^N v_i = 0.$$

³Since the average real wage is equal to the marginal product of labor, the wage bill plus total returns to capital exhaust the product.

Individuals consume both when young and old. When young, they save part of their resources to consume during old age or to pass as a bequest to the next generation. Savings may be held as capital or as government bonds; bonds are perfect substitutes for capital in the portfolios of individuals, so both assets carry the same interest r . When old, individuals may get a bequest in the form of either government bonds or capital from their deceased parents. They use the bequest for consumption or to leave a bequest to their own children. All individuals have the same time-invariant utility function⁴

$$(6) \quad u[c_t^1, c_{t+1}^2] + \beta V^{t+1}, \quad 0 \leq \beta < 1,$$

where c_t^1 and c_{t+1}^2 are, respectively, first- and second-period consumption of a member of generation t ; V^{t+1} is the maximum utility attained by his immediate offspring, and β measures the extent to which parents discount the utility of their children. The utility function is strictly concave with positive and decreasing marginal utility of consumption in each period. Letting subscripts designate partial derivatives with respect to the subscripted variable,

$$(7) \quad u_i > 0, \quad u_{ii} < 0 \quad i=1,2$$

and u is strictly concave.

B. Redistribution Through the Political Process

When old, each individual receives a lump-sum transfer of size S_t which can be thought of as Social Security.⁵ Total current

⁴Consumption and V^{t+1} differ across individuals. We do not incorporate these individual differences in the notation explicitly. The constraint $\beta < 1$ reflects a positive time preference or some degree of selfishness or both on the parts of parents. As pointed out by Willem Buiter and Jeffrey Carmichael (1984) either factor alone is sufficient to deliver the constraint. (See also Carmichael, 1982, and John Burbidge, 1983, 1984).

⁵Since the focus of this paper is on intergenerational redistribution we abstract from the provision of public goods by government.

expenditure, $S_t + (1 + r_{t-1})b_{t-1}$, is financed by a combination of lump-sum taxes on the current young and issuance of one-period government bonds that have to be repaid with interest in the next period. The government's budget constraint for period t is therefore⁶

$$(8) \quad P_t \equiv S_t + (1 + r_{t-1})b_{t-1} = T_t + b_t,$$

where T is the lump-sum tax imposed on a young individual, and b is the average quantity of one-period bonds per young or old individual. Each individual votes for the mix of financing that maximizes his utility. Social decisions about the intertemporal structure of taxation and redistribution are made by majority rule. A detailed description of the political process appears in Section III below.

II. Who Is Likely to be Bequest Constrained?

A. Characterization of Individual Economic Decisions for a Given Structure of Taxation and Redistribution

Each individual takes the structure of taxation and of Social Security benefits as given and chooses his consumption when young and old (c_t^1, c_{t+1}^2), the amount of his bequest, B_{t+1} , and the amount of resources, a_t , to be carried over from the first- to the second period of life.⁷ The first- and second-period budget constraints of a typical individual from generation t are, respectively

$$(9a) \quad w_t^N \equiv w_t - T_t = c_t^1 + a_t,$$

$$(9b) \quad (1 + r_t)(B_t + a_t) + S_{t+1}$$

$$= c_{t+1}^2 + B_{t+1}.$$

⁶The budget constraint is normalized by the number of young (or old) individuals.

⁷ B_{t+1} is the bequest left by generation t to generation $t+1$. It is set aside by generation t at the beginning of period $t+1$ and received with interest by the immediate offspring in period $t+2$ when they are old. It therefore carries interest r_{t+1} and the bequest received by generation $t+1$ is $(1 + r_{t+1})B_{t+1}$.

The choice of c_t^1 , c_{t+1}^2 , a_t , and B_{t+1} is determined by maximizing utility

$$(10) \quad V^t \equiv \text{Max}_{\{c_t^1, c_{t+1}^2, a_t, B_{t+1}\}} \left\{ u[c_t^1, c_{t+1}^2] + \beta V^{t+1} \right\},$$

subject to the two budget constraints in equation (9) and the additional constraint,

$$(11) \quad B_{t+1} \geq 0.$$

The last constraint reflects the fact that there is no legal mechanism by which parents can borrow today against the future labor income of their children. They can leave their children nothing, but they cannot obligate their children's labor income.

Using equations (9a) and (9b) to eliminate a_t and c_{t+1}^2 , substituting the resulting expression into (10), the Lagrangian for the problem in (10) is

$$(12) \quad \text{Max}_{\{c_t^1, B_{t+1}\}} \left\{ u[c_t^1, (1+r_t)w_t^N + S_{t+1} + (1+r_t)(B_t - c_t^1) - B_{t+1}] + \beta V^{t+1} + \lambda' B_{t+1} \right\},$$

where $\lambda' \geq 0$ is the Lagrange multiplier corresponding to the constraint B_{t+1} . Since the constraint qualification implies that either λ' or B_{t+1} or both are equal to zero, the maximized value of the Lagrangian in (12) is equal to V^t from equation (10). Leading (12) by one period, substituting the resulting expression into (12), and continuing *ad infinitum* the problem in (12) may be expressed as a function of the decision variables of the current generation and of all future generations.⁸ Recognizing that the decision variables of generation t directly affect only the utilities of generations t and $t+1$, and using

the envelope theorem, we obtain the familiar first-order conditions for the problem of generation t as

$$(13a) \quad u_1^t[\cdot] - (1+r_t)u_2^t[\cdot] = 0$$

$$(13b) \quad -u_2^t[\cdot] + \beta(1+r_{t+1})u_2^{t+1}[\cdot]$$

$$+ \lambda' = 0$$

$$(13c) \quad \lambda' B_{t+1} = 0, B_{t+1} \geq 0.$$

Here subscripts designate partial derivatives with respect to the subscripted variables and the superscript designates the generation whose utility is being evaluated. For individuals who desire to leave a positive bequest $B_{t+1} > 0$ and $\lambda' = 0$. For these individuals equations (13a) and (13b) determine c_t^1 and B_{t+1} . For individuals who are bequest constrained $B_{t+1} = 0$ and $\lambda' > 0$; equations (13a) and (13b) determine c_t^1 and the shadow price of the bequest constraint, λ' . An intuitive understanding of λ' is obtained by rewriting (13b) as $\lambda' = u_2^t[\cdot] - \beta(1+r_{t+1})u_2^{t+1}[\cdot]$. The first term on the right-hand side is the marginal utility of an additional unit of second-period consumption for generation t . The second term is the marginal contribution of the marginal utility of second-period consumption of the offspring to the parent's utility. When, at a zero bequest, the first term is larger than the second, the parent could have increased his utility by reallocating resources away from his offspring to himself. Since this is not possible under existing institutions, a positive wedge is created between the two marginal utilities. λ' measures the loss of utility per unit of bequest that is created by the wedge resulting from the constraint $B_{t+1} \geq 0$.

An individual who is old in period t takes his first-period consumption as given since it was chosen in the previous period. Hence the only decision left to him is the allocation of his wealth and Social Security receipts between second-period consumption and his bequest. This leads to a first-order condition, as in (13b), and to a constraint qualification, as in (13c), both lagged by one period. Note

⁸We assume that the present discounted value of the bequest at infinity is zero. Hence the individual's maximization problem is bounded. See also Douglas Gale (1983), ch. 1, sec. 8.

that the old individual follows the same plan when old as he had planned for that period of life when he was young.

B. *Who Is Bequest Constrained?*

Individuals differ in their productivity and therefore in their real wage. They differ, also, in the real wage they expect their children, grandchildren, and later progeny to have. Since there is no uncertainty, each living individual knows the sequence of real wages that the future generations will earn. Differences in the real wages of parents also induce differences in their bequests to their children. Hence for given structures of taxation and redistribution, an individual's behavior as well as his welfare is fully determined by the bequest he receives, his wage, and the sequence of wage rates earned by all of his descendants. The purpose of this section is to show the influence of these known attributes on the size of the bequest that the individual desires to leave. This is done by considering an artificial problem in which the bequest constraint is removed (so that B_{t+j} , $j \geq 1$ can be either positive or negative) and by evaluating, using comparative statics, the effects of changes in individual attributes on the size of the desired bequest. The main results are summarized as follows:

PROPOSITION 1: *In the absence of bequest constraints in either the present or the future, and provided the utility function is strictly concave*

$$(i) \quad \frac{dB_{t+1}}{dB_t} = \frac{dB_{t+1}}{dw_t^N} > 0; \quad \frac{dB_{t+1}}{dS_{t+1}} > 0;$$

$$(ii) \quad \frac{dB_{t+1}}{dw_{t+j}^N} < 0; \quad \frac{dB_{t+1}}{dS_{t+j+1}} < 0$$

for all $j \geq 1$.

(iii) *Provided individual wealth, $w_t^N + B_t$, is positive for all t , $(dB_{t+1})/dr_t > 0$ and $(dB_{t+1})/dr_{t+j} < 0$ for all $j \geq 1$.*

$$(iv) \quad \frac{dB_{t+1}}{d\beta} > 0.$$

Some of these results (parts (ii) and (iv) of the proposition) are due to Drazen (1978) and Philippe Weil (1987). All the results are derived, within a unified framework, in Cukierman and Meltzer (1987a).

The proposition has intuitive appeal. Anything that makes the current generation richer—an increase in bequest received, an increase in the real wage rate, a decrease in current taxes, or an increase in Social Security payments—increases their bequest. Anything that makes any future generations richer decreases the bequest left by the current generation. Thus an increase in future wages, a decrease in future taxes, and an increase in future Social Security payments all tend to decrease the bequest chosen by the current generation.

Part (iii) of the proposition has a similar interpretation. Assuming that all individuals have positive wealth, an increase in the current interest rate makes an individual from the current generation richer, so he chooses a larger bequest. Conversely an increase in future interest rates makes the future generation richer, so the current generation reduces the current bequest. These results reflect the fact that the individual wants to spread the increase in consumption, made possible by an increase in r , over all periods. Part (iv) of the proposition states that the less the individual cares about the welfare of his offspring in comparison to his own welfare, the smaller the bequest he chooses to leave.

Taken as a whole, Proposition 1 implies that for a given structure of taxation and redistribution the bequest chosen by an unconstrained individual depends on $w_t^N + B_t$ and on the sequence w_{t+j}^N , $j \geq 1$, of the net wage rates he expects succeeding generations of his family to earn. Let

$$(14) \quad w_t^N + B_t = A[w_{t+1}^N, w_{t+2}^N, \dots]$$

be the value of $w_t^N + B_t$ that induces the current generation to pick $B_{t+1} = 0$, given the vector of future real wage rates. Parts (i) and (ii) of Proposition 1 imply that the partial derivative of A with respect to w_{t+1}^N for $j \geq 1$ is positive. Figure 1 shows this relation. The upward-sloping curve represents the function $A[\cdot]$ for given values of

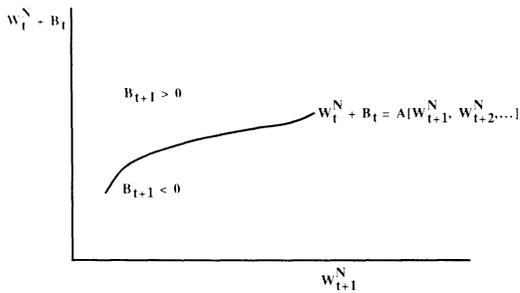


FIGURE 1

w_{t+j}^N , $j \geq 2$. Parts (i) and (ii) of Proposition 1 imply that individuals who are characterized by $\{w_t^N + B_t, w_{t+1}^N\}$ combinations that are above the curve choose a positive bequest. Those whose $\{w_t^N + B_t, w_{t+1}^N\}$ combinations lie below the curve have a negative bequest.

An immediate implication of Figure 1 is that individuals whose wealth is low relative to the expected wage rate of their offspring, w_{t+1}^N , are likely to be bequest constrained since, in the absence of the constraint, they would have chosen a negative bequest. Conversely, individuals with relatively large wealth and relatively small values of w_{t+1}^N are more likely to be nonbequest constrained. An increase in any of the wage rates w_{t+j}^N , $j \geq 2$, shifts, by part (ii) of Proposition 2, the curve in Figure 1 upward so that the proportion of the population that is bequest constrained increases. It follows that the proportion of bequest-constrained individuals in the population is larger, the larger the rate of technological progress. Part (iii) of Proposition 2 implies that an increase in the current rate of interest shifts the curve in Figure 1 downward, implying a decrease in the proportion of bequest-constrained individuals. An increase in any of the future real interest rates, or in the degree by which an individual prefers his own welfare to that of his immediate offspring, shifts the curve upward, increasing the proportion of bequest-constrained individuals in the population.⁹

⁹Recently David Altig and Steve Davis (1987) have shown that when agents live for three periods, get most

III. The Political Process and Individual Preferences with Respect to the Intertemporal Structure of Taxation

Political decisions are made by majority rule. The young of generation t and the old of generation $t - 1$ vote to determine the size of the Social Security benefits to be paid to each member of generation t when he is old. This amount, denoted S_{t+1} (since it is paid out in period $t + 1$), is precommitted by social contract which specifies that the voters' decision in t about S_{t+1} cannot be altered by those living in period $t + 1$. The voters in t also determine the allocation of financing of *current* government expenditure between taxes, T_t , and bonds b_t . When confronted with a choice between two different structures of taxation and Social Security each individual votes for the schedule that maximizes his utility.

Since both S_t and b_{t-1} have been precommitted by the political decisions of the living in $t - 1$, the left-hand side of the government's budget constraint in (8) is predetermined from the point of view of those living in t . They are free to determine the structure of financing of P_t between current taxes and bonds but not the total that has to be financed. Their decisions about S_{t+1} and b_t , however, precommit those living in $t + 1$ to a total government budget of size P_{t+1} .

of their income in the middle period and face borrowing constraints, the incentive of parents to bequeath is stronger than in the absence of such constraints. This structure encourages *inter vivos* transfers during a child's constrained period of life and narrows the set of parameters for which individuals are bequest constrained. But as long as there is a perfect capital market *within* an individual's lifetime (as assumed in the text) the basic thrust of Proposition 1 carries through to a three-period model as well. Moreover as long as there is a perfect capital market within an individual's lifetime, the timing of income, taxes, and bequests within the lifetime is irrelevant for individual welfare provided present values are preserved and only partial equilibrium effects are considered. However, the timing of those variables over the lifetime affects the general equilibrium value of the capital stock, and therefore welfare, through the consequent general equilibrium effects. For example, other things the same, the capital stock is lower with *inter vivos* bequests than with bequests that are transferred at death.

A. Reduction of the Political Choice Set

An individual who is young in period t is indifferent between different combinations of S_{t+1} and of b_t provided the future value, P_{t+1} , of those combinations is the same. The reason is that there is a perfect capital market between the first and second periods of life. An increase in S_{t+1} that is accompanied by a decrease in b_t reduces the disposable income of individuals currently young.¹⁰ Their welfare is unaffected, since they can borrow against their higher Social Security at the market rate of interest to keep the present value of their net wealth (including wages) intact. The same is true of an individual who is old in period t ; the magnitudes S_{t+1} and b_t affect him only through the welfare of his immediate offspring who is young in period t . Hence all the individuals who vote in period t are indifferent between different combinations of S_{t+1} and b_t as long as they all have the same future value, P_{t+1} . It is, therefore, possible to arbitrarily set S_t at some fixed value—say S —and reduce the choice of P_{t+1} to that of choosing b_t for an arbitrarily given S .

Let

$$(15) \quad P_{t+1} = S + (1 + r_t)b_t \quad \text{for all } t.$$

With S fixed, the choice of b_t uniquely determines P_{t+1} and, similarly, the choice of b_{t-1} uniquely determines P_t . In addition, from the government's budget constraint in (8), a choice of b_t also uniquely determines taxes, T_t , since P_t is predetermined by the political decisions of those who were alive in period $t-1$. It follows that, given S , an individual's attitudes toward the triplet S_{t+1} , T_t , and b_t can be, equivalently, characterized by his attitude toward the one-dimensional variable b_t .

¹⁰Since total expenditure in period t , P_t , is predetermined a decrease in b_t implies through the government's budget constraint in (8) that the tax, T_t , on the young has to be increased.

B. Individual Benefits from Intergenerational Reallocation of Taxes Through Debt

Barro (1974) demonstrated that when all generations are linked through an operative bequest motive, a reallocation of taxes across different generations via changes in the proportion of deficit finance does not affect individual welfare. The same is obviously true here for nonbequest-constrained individuals, as long as the present value of taxes is not altered and there is a perfect capital market.¹¹ However individuals who are bequest constrained, or who expect that some future family members will be bequest constrained, benefit from substituting future for current taxes by means of bonds issued to finance the government budget. Since they are bequest constrained, they would like to borrow against the future income of their children but are barred from doing so. Hence government bond financing increases the welfare of the bequest-constrained individuals even if the present value of all taxes is unchanged.

The current generation cannot choose which future generations will pay higher taxes when it votes to decrease current taxes and increase bonds. Taxes are voted on each period. The next generation may decide to pass the tax increase to the following generation by voting to increase bond financing by an appropriate amount. The following generation, in turn, may either vote to postpone or to pay the tax, and so on.

The factors that determine whether there will be a majority for or against deficits or surpluses are discussed in Sections IV and V. Here, it suffices to observe that, since expectations are rational and there is no uncertainty, those currently alive know which generation in the future will pay for a current tax reduction. The consequent change in welfare depends on the severity of the constraint, the number of future offsprings that

¹¹In fact such individuals are even indifferent to the time profile of P_t as long as the present value of this profile is the same.

are also bequest constrained, and on the time interval between the current generation and the generation to which taxes are ultimately shifted.

More formally it can be shown that a reduction in the taxes on generation $t + j$ that is financed by an increase in taxes on generation t , produces the following change in the welfare of generation t :¹²

$$(16) \quad \frac{dV^t}{dT_t} = -(1 + r_t) \times \left[\lambda^t + \sum_{s=1}^{j-1} \beta^s \prod_{i=1}^s (1 + r_{t+i}) \lambda^{t+s} \right].$$

Equation (16) implies that if all individuals in the family between generation t and generation $t + j - 1$ are nonbequest constrained, all $\lambda^{t+s} = 0$ ($0 \leq s \leq j - 1$), and the intertemporal reallocation of taxes via bond financing does not affect the welfare of a young individual in period t . If at least one individual between generation t and generation $t + j - 1$ is bequest constrained, the shifting backward of taxes decreases the welfare of the currently alive individual, since at least one value of λ in equation (16) is positive.¹³ The larger the number of bequest-constrained individuals between generation t and generation $t + j - 1$, and the tighter their constraints as measured by the values of λ , the larger the welfare loss caused by shifting taxes to the current generation.

IV. Crowding Out and the Determination of Government Debt by Majority Rule

The discussion of the previous section suggests that individuals in the economy may be classified into two broad groups. The nonbequest constrained, are indifferent to an inter-

generational reallocation of taxes; the bequest constrained generally prefer to shift taxes to some of their descendants.¹⁴ Each bequest-constrained individual favors an increase in bond financing and a corresponding decrease in current taxes that removes his constraint (and the constraint on all future generations of descendants who are similarly constrained). Once the constraint is relaxed, the individual joins the group of nonbequest-constrained individuals and becomes indifferent to further reductions in taxes that are financed by issuing bonds.

If the political process produces some or all of the decrease in current taxes desired by the bequest constrained, disposable income of all currently alive young individuals increases. The reduction in taxes is matched exactly by an increase in bonds outstanding. The nonbequest-constrained individuals increase their bequest by the amount of the increase in their disposable income, as in Barro (1974). The bequest constrained use the increase in their disposable income to increase consumption. The resources to increase consumption are obtained by using part of the capital stock in the economy. Since bonds and capital are perfect substitutes in portfolios, the additional bonds are absorbed in the portfolios of the nonbequest-constrained individuals who release the physical resources needed to sustain the increased consumption of the bequest constrained.

¹⁴Here we take the term "nonbequest constrained" to mean that not only the currently alive individual but also all future generations of his descendants are nonbequest constrained. The bequest constrained are generally composed of those who are constrained with respect to their immediate offspring (who may or may not be similarly bequest constrained) and those who desire to leave a positive bequest but know that some future generation will be bequest constrained. The bequest constrained like bond financing if it increases the tax burden of generations that come after the bequest-constrained individual. Otherwise they are indifferent to an intertemporal reallocation of taxes. For ease of exposition we focus in the text mostly on those who are immediately bequest constrained, but the same principles apply when one or more individuals in future generations is bequest constrained.

¹²The derivation appears in Section IV, Part B, of Cukierman and Meltzer (1987a).

¹³Note that the individual from generation t does not have to be bequest constrained with respect to his immediate offspring to dislike a backward shift of taxes.

The per capita increase in bonds is equal to the per capita decrease in taxes. A nonbequest-constrained individual increases his holdings of bonds, on average, by more than his proportional share of the increase in bonds, since the bequest-constrained individuals pay taxes but do not buy any bonds. Further, a nonbequest-constrained individual increases his bond portfolio, on average, by more than the increase in his disposable income. His excess purchase of bonds releases capital which is used by the bequest constrained to increase their lifetime consumption. The size of the decrease in the capital stock depends on the proportion of bequest-constrained individuals in the economy and on the degree to which each is bequest constrained. If no one is bequest constrained, capital does not decrease at all as a result of a given unit increase in bond financing; if some people are constrained, capital decreases by a fraction of the increase in bond financing. The proportion of bonds issued to capital displaced is, therefore, bounded between minus one and zero. The ratio is nearer to minus one the larger the proportion of bequest-constrained individuals in the economy. Formally, the crowding-out ratio is

$$(17) \quad -1 < \frac{dk_t}{db_t} \leq 0,$$

where k is the capital-labor ratio. Since the size of the population is fixed the expression in (17) is identical to the crowding-out ratio between the *total* amounts of bonds and of capital.¹⁵

¹⁵The crowding-out ratio exceeds -1 even in the extreme case in which everyone is bequest constrained prior to the shift to bond financing. The reason is that the aggregate value of planned bequests is zero, and the only capital that remains in the economy is held by young individuals who wish to transfer resources from the first to the second period of life. Since the marginal utility in both periods decreases with consumption, young individuals respond to the tax reduction by increasing consumption in both periods. As a result, the increase in the stock of bonds exceeds the decrease in

The crowding out of capital changes the real rate of interest and the wage rates paid to individual workers. This creates two additional channels through which an increase in bond financing affects individual welfare. These general equilibrium effects of debt financing affect the welfare of both bequest-constrained and nonbequest-constrained individuals, since everyone's welfare is affected by changes in the interest rate and his own wage rate.

The combined effect of debt financing on welfare is the sum of the effects operating through three channels. First, an expansion in bond financing permits an intergenerational reallocation of resources within the family. Second, the marginal productivity of capital and, therefore, the interest rate changes. Third, the individual's wage rate changes. It is convenient, for expositional reasons, to examine first the political equilibrium when the last two general equilibrium effects do not operate. Formally this corresponds to the case in which the marginal productivities of capital and of labor do not depend on the capital-labor ratio. In this case a shift to bond financing affects individual welfare only through the intergenerational reallocation of resources that it makes possible.

A. *Determination of the Debt in the Absence of General Equilibrium Effects*

Each individual's decision about an increase in debt financing is, in this case, completely determined by whether or not he is bequest constrained. Each bequest-constrained individual prefers the amount of bond financing that frees him completely from his constraint. Hence those who face the most stringent bequest constraints favor the largest amount of debt. At the other extreme, the nonbequest constrained are indifferent to the way governmental redistribu-

the capital stock, and the crowding-out ratio exceeds -1 even in this limiting case.

tion is financed. We model their indifference by assuming that they split their vote equally between different financing proposals. The bequest constrained always prefer financing proposals that include debt, so proposals to issue debt win in elections involving both groups.

Further, under the restriction that general equilibrium effects can be neglected, the majority favors a level of debt that is sufficiently large to free the bequest constraint of the most severely constrained individual. This choice frees all other bequest-constrained individuals from their constraints. The reasoning leading to this result is straightforward. The size of the government budget, P_t , is given. Suppose voters face two alternatives, one involving a positive quantity of bonds, b_{t0} , the other involving only taxes. Since the nonbequest constrained split equally between the two proposals and all the bequest constrained vote for the proposal involving positive debt, a majority votes for the positive amount of bonds b_{t0} . Let $b_{t1} > b_{t0}$ be the level of debt at which a bequest-constrained voter is freed of his constraint when debt is b_{t0} . At b_{t0} , the nonbequest constrained are indifferent to any level of debt greater than b_{t0} , so they split their votes equally for and against proposals calling for

$$b_{t1} > b_{t0}.$$

Hence there will be a majority in favor of any level of debt at which at least one individual is bequest constrained. Once the most severe bequest constraint is released, everyone is indifferent. Under complete certainty, there will be one vote each period to remove all bequest constraints.

Two qualifications are required. First, all constraints are released only if the capital stock is larger than the amount of additional consumption desired by all those who were bequest constrained.¹⁶ Second, the amount

¹⁶If the desired addition to consumption is larger than the capital stock, the solution is restricted by the existing resources.

of bonds cannot exceed the predetermined government outlays, P_t . If S in equation (15) is not sufficiently large, the constraint $b_t \leq P_t$ may prevent some of the most bequest-constrained individuals from reaching their preferred level of P_{t+1} . They vote to increase S_{t+1} in order to increase P_{t+1} .¹⁷

The main conclusion of this subsection is that in the absence of general equilibrium effects majority rule releases all bequest constraints by issuing debt, provided the existing capital stock is sufficiently large.¹⁸ However, once the general equilibrium effects of a larger debt on factor returns are recognized explicitly, the nonbequest constrained are no longer indifferent to the size of the debt. The following subsections analyze this more general case.

B. Individual Attitudes Toward Debt in the Presence of General Equilibrium Effects

This section characterizes individual attitudes toward the level of the debt in the presence of general equilibrium effects. To find the total effect of an increase in debt financing on the welfare of different individuals in the economy, we first note that by using the recursive structure in (12) the two period's decision problem in this equation may be rewritten as the following infinite

¹⁷All other individuals, being unconstrained, split evenly between any two proposals, so S_{t+1} rises to the point where all individuals become unconstrained. Hence $b_t \leq P_t$ does not change the result that the political process frees all individuals from their constraints. However, when the constraint $b_t \leq P_t$ is binding, part of the solution is found by increasing total outlays, P_{t+1} , for the next period, thereby increasing the likelihood that debt finance is higher next period. If only taxes, T_{t+1} , are raised to finance the increase in P_{t+1} net wages of generation $t+1$ decrease pushing some of these individuals into the group of bequest-constrained individuals by part (i) of Proposition 1. Since in each period the size of the debt is determined by the wishes of the most constrained individuals, the debt voted upon in period $t+1$ is larger.

¹⁸In the absence of general equilibrium effects a social planner would seek to remove the wedge also.

horizon problem;

$$(18) \quad \text{Max}_{\{c_t^1, B_{t+1}\}} \left\{ u \left[c_t^1, (1+r_t)w_t^N \right. \right. \\ \left. \left. + S + (1+r_t)(B_t - c_t^1) - B_{t+1} \right] \right. \\ \left. + \lambda B_{t+1} + \beta \text{Max}_{\{c_{t+1}^1, B_{t+2}\}} \right. \\ \left. \left(u \left[c_{t+1}^1, (1+r_{t+1})w_{t+1}^N + S \right. \right. \right. \\ \left. \left. + (1+r_{t+1})(B_{t+1} - c_{t+1}^1) - B_{t+2} \right] \right. \\ \left. \left. + \lambda^{t+1} B_{t+2} \right) + \dots \right\}.$$

Differentiating (18) totally with respect to b_t , we obtain the total effect of a change in the level of debt on individual welfare. The total effect, shown in equation (19), has three components. The first, $dV^t/db_t|_{IR}$, is the effect on current welfare from the intergenerational reallocation of resources induced by the change in debt. Second is the effect on welfare from present and future changes in interest rates and wage rates. Third, the changes in interest rates and wages induced by the change in debt affect bequests; dB_{t+s+1}/db_t^T is the effect on bequests by current and future generations. Using the first-order condition from equation (13a), $u_1^t - (1+r_t)u_2^t = 0$ for all t , the total derivative is

$$(19) \quad \frac{dV^t}{db_t} = \frac{dV^t}{db_t} \Big|_{IR} + \frac{db_t^T}{db_t} \sum_{s=0}^{\infty} \beta^s u_2^{t+s} \\ \times \left[(w_{t+s}^N + B_{t+s}) \frac{dr_{t+s}}{db_t^T} \right. \\ \left. + (1+r_{t+s}) \frac{dw_{t+s}}{db_t^T} - \lambda^{t+s} \frac{dB_{t+s+1}}{db_t^T} \right],$$

where

$$(20) \quad b_t^T \equiv Nb_t$$

is the total amount of bonds in the economy. From equations (2), (3), (4), and (20) and the fact that the crowding-out ratio measured using aggregates is equal to the ratio in per capita terms

$$(21a) \quad \frac{dr_{t+s}}{db_t^T} = F_{KK}^{t+s} \frac{dK_{t+s}}{dK_t} \frac{dk_t}{db_t} \\ = F_{KK}^{t+s} \frac{dk_t}{db_t},$$

$$(21b) \quad \frac{dw_{t+s}}{db_t^T} = (1+v_{t+s})$$

$$\times G^{t+s} F_{NK}^{t+s} \frac{dK_{t+s}}{dK_t} \frac{dk_t}{db_t}$$

$$= (1+v_{t+s}) G^{t+s} F_{NK}^{t+s} \frac{dk_t}{db_t},$$

$$(21c) \quad \frac{db_t^T}{db_t} = N,$$

where F_{KK}^{t+s} and F_{NK}^{t+s} are respectively the second partial derivatives of the production function with respect to capital and the cross partial derivative of the production function between labor and capital in period $t+s$. We assume decreasing marginal productivity of capital and complementarity between labor and capital, so

$$(22) \quad F_{KK}^t < 0, \quad F_{NK}^t > 0 \quad \text{for all } t.$$

v_{t+s} is a productivity class of generation $t+s$. Since $P_t = T_t + b_t$ and P_t is predetermined,

$$(23) \quad \frac{dT_t}{db_t} = -1.$$

Using equations (16), (21), and (23) in (19)

$$\begin{aligned}
 (24) \quad \frac{dV^t}{db_t} = & (1+r_t) \\
 & \times \left\{ \lambda^t + \sum_{s=1}^{j-1} \beta^s \prod_{i=1}^s (1+r_{t+i}) \lambda^{t+s} \right\}, \\
 & + N \sum_{s=0}^{\infty} \beta^s u_2^{t+s} [(w_{t+s}^N + B_{t+s}) F_{KK}^{t+s} \\
 & + (1+r_{t+s})(1+v_{t+s}) G^{t+s} F_{NK}^{t+s}] \frac{dk_t}{db_t}, \\
 & - N \sum_{s=0}^{\infty} \beta^s u_2^{t+s} \lambda^{t+s} \frac{dB_{t+s+1}}{db_t^T}.
 \end{aligned}$$

Equation (24) is a general expression for the total change in welfare as a result of a one-unit increase in the deficit that is financed by an increase in taxes on generation $t + j$. The first term is the change in welfare due to the intergenerational reallocation of consumption. The second is the direct change in welfare due to the induced changes in factors' returns. The third term is the change in welfare induced by the realignment in bequests due to the change in factor returns.

C. The Effects of Debt on the Welfare of a Nonbequest-Constrained Individual

For a nonbequest-constrained individual $\lambda^{t+s} = 0$ for all s . The only effects of debt issues (or withdrawals) are the induced effects on wages and interest rates arising from the change in the consumption of the bequest constrained. Equation (24) reduces to its second term,

$$\begin{aligned}
 (24a) \quad \frac{dV^t}{db_t} = & N \frac{dk_t}{db_t} \sum_{s=0}^{\infty} \beta^s u_2^{t+s} \\
 & \times [(w_{t+s}^N + B_{t+s}) F_{KK}^{t+s} \\
 & + (1+r_{t+s})(1+v_{t+s}) G^{t+s} F_{NK}^{t+s}].
 \end{aligned}$$

If there are no bequest-constrained individuals in the economy, the crowding-out ratio dk_t/db_t equals zero, and deficits have no impact on welfare. This is not surprising since, in the absence of crowding out, factor returns are not affected by the way government expenditure is financed.

Equation (24a) implies that the increase in the interest rate and the decrease in the wage rate caused by the crowding out of capital have opposing effects on the individual's welfare. Since $w_{t+s}^N + B_{t+s} > 0$ for all $t + s$ and $dk_t/db_t < 0$, the increase in interest rates increases the individual's welfare while the decrease in real wages reduces his welfare. The net effect on welfare depends on the relative sizes of F_{KK} and F_{NK} and on the personal characteristics of the individual.

If the marginal product of capital is relatively sensitive to the quantity of capital (high $|F_{KK}|$) and wage rates are relatively insensitive to the quantity of capital (low F_{NK}) debt issues are more likely to increase than to decrease the individual's welfare. Conversely when F_{NK} is high relative to $|F_{KK}|$ the effect of debt issues and crowding out on welfare, through the decrease in wages, is more likely to dominate. If we assume that, as the capital-labor ratio decreases, F_{NK} increases relative to $|F_{KK}|$, the decrease in real wage rates ultimately dominates the rise in interest rates on the individual's welfare as the capital stock falls. Welfare declines, and a rising fraction of the nonbequest constrained oppose further debt. Votes for surpluses, to increase the capital stock and wages, rise. A falling capital-labor ratio acts as a brake on the tendency to create deficits and assures that deficits will disappear before the entire capital stock is consumed.¹⁹

For a given capital stock, different nonbequest-constrained individuals are affected differently by an increase in debt financing. Nonbequest-constrained individuals with relatively large bequests and relatively low labor productivity have large values of $w^N + B$ and low values of v . The increase in the

¹⁹Obviously this result obtains even if F_{NK} increases relative to $|F_{KK}|$ only after a sufficiently low capital stock.

interest rate dominates the change in their welfare, so they vote for more debt relative to current taxes. Conversely, nonbequest-constrained individuals who receive small (or zero) bequests and have relatively large labor productivity vote against a higher debt. The fall in wages dominates the change in their welfare.

We can summarize the effects of debt finance on the welfare and votes of the nonbequest constrained in the following propositions. Those who have a relatively large fraction of nonhuman to human wealth favor a larger fraction of debt financing. Those who have a relatively large fraction of human wealth prefer a lower fraction of debt.²⁰ As the capital stock falls, some of the individuals who previously favored larger debts oppose further additions because reductions in wages become more important than increases in interest rates. This limits the vote for a larger debt.

D. *The Effects of Debt on the Welfare of a Bequest-Constrained Individual*

All of the welfare effects of changes in interest rates and wages carry over to bequest-constrained individuals. In addition, debt issues permit the bequest constrained to transfer resources from future generations to themselves. This is represented by the first term in equation (24); this term is always positive for bequest-constrained individuals.²¹ The third term in equation (24) is the effect of changes in factor returns on the size of bequests. The marginal increase in

debt and the induced changes in factor prices can remove the constraint from some who were previously bequest constrained. They become unconstrained. Others may find that the constraint remains binding but is less severe. For everyone that remains bequest constrained, $dB_{t+s+1}/db_t^T = 0$; the last term in (24) vanishes. For individuals who originally were near the margin, the product $\lambda^{t+s}dB_{t+s+1}/db_t^T$ may (but does not have to) differ from zero. By definition

$$(25) \quad \frac{dB_{t+s+1}}{db_t^T} = \frac{dB_{t+s+1}}{dw_{t+s}} \frac{dw_{t+s}}{db_t^T} + \frac{dB_{t+s+1}}{dr_{t+s}} \frac{dr_{t+s}}{db_t^T} + \frac{dB_{t+s+1}}{dB_{t+s}} \frac{dB_{t+s}}{db_t^T}.$$

From Proposition 1,

$$dB_{t+s+1}/dw_{t+s}, \quad dB_{t+s+1}/dr_{t+s}$$

and

$$+ \frac{dB_{t+s+1}}{dB_{t+s}} \frac{dB_{t+s}}{db_t^T}.$$

are all positive. But dw_{t+s}/db_t^T and dr_{t+s}/db_t^T have opposite signs, so the sum of the first two expressions on the right-hand side of equation (25) is ambiguous. For a similar reason the sign of dB_{t+s}/db_t^T is ambiguous as well. Moreover, since dB_{t+s+1}/db_t^T is nonzero only for individuals who are very near to being nonbequest constrained, it is multiplied by a value of λ^{t+s} which is close to zero. The expression for dB_{t+s+1}/db_t^T in (25) includes both positive and negative terms that tend to offset each other. It seems reasonable to assume that, even when there are some products in the last sum on the right-hand side of (24) which are nonzero, the terms in (25) do not dominate the sign of the expression for dV^t/db_t . Given this assumption, the change in welfare experienced by a bequest-constrained individual as a result of a one-unit increase in bond financing depends on three compo-

²⁰Note that whether the ultimate effect on an increase in debt on welfare is positive or negative, it is stronger the larger the fraction of constrained individuals in the economy since $|dk_t/db_t|$ is larger in this case. The existence of more bequest-constrained individuals magnifies the differential effects of debt on the welfare of nonbequest-constrained individuals with different structures of wealth.

²¹A full discussion of the factors that determine this term is in part B of Section III and is not reproduced here. Recall, however, that the larger the number of bequest-constrained individuals among current and future generations, the larger are the benefits from intergenerational reallocation of resources.

nents: (1) benefits of intergenerational reallocation of resources, (2) the increase in welfare from a higher return on assets, and (3) the decrease in welfare due to the decrease in wage rates.

E. Characterization of the Voting Equilibrium

We turn now to a more precise characterization of the political equilibrium in the presence of general equilibrium effects. To avoid potential problems of cycling with majority rule we assume that V^t is a concave function of b_t .²² Under this condition, V^t is a single-peaked function of b_t and the level of b_t for which

$$(26) \quad \frac{dV^t}{db_t} [b_t; B_t, \{w_{t+j}, j = 0, 1, 2, \dots\}] = 0$$

is the stock of debt most preferred by the individual under consideration. Since individuals differ in bequests received, in their wage rates, and in the sequence of wage rates they expect for future generations the most preferred value of b_t differs among individuals. Let

$$b_t^* = b^* [B_t, \{w_{t+j}, j = 0, 1, 2, \dots\}]$$

be the value of b_t most preferred by an individual who received a bequest of size B_t ,

²²A more detailed discussion of some underlying conditions for this concavity appears in Appendix C of Cukierman and Meltzer (1987a). We assume, for simplicity, that (although they can perfectly predict future political outcomes) the currently alive voters do not take into consideration the effect of their choice of b_t on the votes of future generations. In other words they do not vote strategically. Instead, as in a regular Nash equilibrium, they take future votes as given. But they do take into consideration, when voting, the general equilibrium effects of current political outcomes on the welfare of all their offspring. Note that having atomistic agents take into account general equilibrium ramifications of their actions is, in this case, rational behavior on their part since they can affect returns to factors in their possession through voting.

has a wage rate w_t , and who expects a sequence of wages $\{w_{t+j}, j \geq 1\}$ for future generations of descendants. The value of b_t is restricted from above by the predetermined value of P_t . We assume government debt cannot be negative,²³ so

$$(27) \quad 0 \leq b_t \leq P_t.$$

Hence

$$(28) \quad b_t^* = b_t \text{ from equation (26) if } 0 \leq b_t \leq P_t;$$

$$b_t^* = 0 \text{ if } \frac{dV^t}{db_t} [0; B_t, \{\cdot\}] < 0;$$

$$b_t^* = P_t \text{ if } \frac{dV^t}{db_t} [P_t; B_t, \{\cdot\}] > 0.$$

Since the utility of each individual is a single-peaked function of b_t , there exists a unique median range for b_t that will defeat any other value of b_t outside this range when voting is by majority rule.²⁴ Let $b_{t,d}$ be a point in the median range. To avoid unnecessary complications, we assume that the

²³When government is allowed to set taxes above the level necessary to finance P_t in order to lend to the public, the outstanding government debt may be negative. In this case the constraint $b_t \geq 0$ in (27) and the second line of (28) are no longer relevant. Instead the first condition in equation (28) holds for the entire range $b_t \leq P_t$. Assuming government lends equally to all young individuals, the nonbequest constrained are indifferent to the existence of this additional option. The higher taxes and loans mean that they have fewer resources in the second period of life and some of their offspring have a lower tax burden. They compensate for that by an appropriate downward adjustment in their bequests. The bequest constrained must reduce their consumption, since the loan is for one period only. As a result the capital stock increases. Such a policy is likely to be favored by nonbequest-constrained individuals with a relatively large ratio of human to nonhuman wealth.

²⁴If the distributions of B_t and of $\{w_{t+j}\}$ across descendants is sufficiently dense this range is quite narrow. In the limit when the distributions of B_t and of $\{w_{t+j}\}$ are continuous the median b_t reduces to a single point.

arbitrary value of S is set at a level at which some taxes are paid; this assures that the maximum value of b_{id} is smaller than P_i . Hence, even if there are individuals who would like to increase the level of S , they never have a majority. Consequently, S does not change over time, as assumed in Section III. The precise location of the median depends on the relative frequencies of the three main types of individuals described in the previous subsection.

V. Economywide Conditions That Are Conducive to Debt and Deficits

A. Who Votes for and Against a Large Debt?

We saw that nonbequest-constrained individuals may oppose debt if a large fraction of their wealth is human wealth. Bequest-constrained individuals may oppose debt also, if their loss from the decrease in wage rates is larger than the sum of their gains from the increase in interest rates and the increase in the availability of current resources. Inspection of equation (24) and Proposition 1 suggests that the latter group is likely to include individuals whose total wealth is modest but who have a relatively large fraction of wealth in human capital. They are bequest constrained, but their welfare loss because of the constraint is relatively small. Anything that makes the shadow prices (λ^{t+s}) of the bequest constraint not too large, such as an expectation that the wages of future generations will be only modestly higher than the wages of the current generation, increases the likelihood that a bequest-constrained individual will vote against a large debt.

Bequest-constrained individuals who are likely to vote for higher debt include individuals with low total values of $w_i^N + B_i$ —small inheritance and low productivity—who expect their offsprings to have productivities and wage rates substantially higher than their own. Such individuals choose to increase their own consumption at the expense of their descendants. They suffer a larger loss from being bequest constrained than from

the induced decrease in their real wage rate when the constraint is relaxed. They are therefore likely to vote for a larger debt.

Paradoxically, individuals with large $w_i^N + B_i$, particularly if it is composed of a large component of inherited wealth, also are likely to vote for large debt. By Proposition 1 such individuals are unlikely to be bequest constrained, so they derive no benefits from an intergenerational reallocation of consumption. However, their attitude toward a larger debt is likely to be dominated by the induced increase in interest rates which increases the major component of their income.

To summarize, the coalition favoring increased debt and deficits includes several different groups. Individuals with high and low inheritance will be in the coalition. If those with large inheritance are “rich” and those with small, or zero, inheritance are “poor,” some rich and some poor favor deficits. Their reasons differ, however. The poor vote for deficits to transfer resources from future generations in their family to themselves. The rich vote for deficits to increase the return on their portfolios, particularly if investment income is a large part of their total income. Many of the voters in between, the middle class, are likely to oppose deficits. This is particularly true of any voter with relatively high productivity. Typically, such voters are not bequest constrained, or the constraint is not severe. The welfare loss from wage reduction is likely to be larger than the welfare gain from intertemporal redistribution and from higher returns to capital.

The coalitions favoring and opposing deficits shift as the numbers in the various groups change. Changes in current and expected wages and interest rates, reflecting changes in current and prospective productivity of labor and capital, induce changes in the direct and indirect effects of debt on the welfare of individual voters.

B. Economywide Conditions Conducive to Larger Debts

The larger the rate of labor augmenting technological progress, the larger is the frac-

tion of individuals who are bequest constrained and the more they stand to benefit from an increase in the amount of debt financing. Hence debt financing increases with the rate of technological progress.

The larger the fraction of individuals with a relatively small total wealth (both human and nonhuman) the larger the fraction of individuals for whom loosening of the bequest constraint is a prime consideration and the larger, therefore, the level of debt preferred by the median voter.²⁵

The smaller the fraction of individuals whose main source of income is from wages, the smaller the fraction of individuals that oppose debt because of its downward effect on wages, and the larger the level of the debt. We saw that the coalition favoring larger debts is composed of individuals with extreme values of wealth and income. Hence larger debts are more likely the more spread out is the distribution of individuals by total wealth or income.

The more sensitive is the return to capital to a change in the capital-labor ratio the stronger the upward effect of an increase in debt on the return to capital and the larger the level of debt preferred by the median voter. The less sensitive the level of wages to a change in the capital-labor ratio the smaller the downward effect of a larger debt on wage rates and the larger the debt level picked by the political process. Higher expected longevity (that results in longer time spent in retirement) is also conducive to higher debt since it increases the utility of the individual's own consumption when old and makes it more likely that he is bequest constrained and that he prefers, therefore, a larger debt. This element can be modeled formally by using the marginal utility of consumption in the second period of life as a proxy for the length of time spent in retirement. A detailed analysis appears in Cukierman (1986).

²⁵Here we assume that the distribution of wage rates and bequests received is sufficiently dense so that the median values of b_i can be approximated by single points.

The discussion of this subsection is summarized in the following proposition

PROPOSITION 2: *Under majority rule a larger debt is more likely*

- a. *the larger the expected rate of growth of the economy;*
- b. *the larger the fraction of individuals below a certain level of income and wealth;*
- c. *the smaller the fraction of individuals whose main source of income is from wages;*
- d. *the more spread out the distribution of individuals by total wealth or income;*
- e. *the more sensitive the return to capital to a change in the capital-labor ratio;*
- f. *the less sensitive the level of wages to a change in the capital-labor ratio; and*
- g. *the higher expected longevity.*

C. *Economywide Conditions Conducive to Deficits*

By definition, deficits are created when the national debt increases. Hence, any of the factors in Proposition 2 that increase debt also increase the deficit for a time. More precisely, a deficit is created when the level of debt preferred by the decisive voter in period t , b_{dt} , is larger than the level of debt preferred by the decisive voter of the previous period, $b_{d,t-1}$. Thus, an increase in the rate of growth between periods t and $t+1$ in comparison to the rate of growth between periods $t-1$ and t is likely to produce a deficit in period t . The reason is that, in comparison with the previous period, more individuals are bequest constrained and the constraints are more severe. The group of individuals who favor a relatively large b_i increases.

Deficits are also more likely when the capital stock increases. With a rising capital stock, the negative effect of higher debt on wages becomes less important for welfare compared to the positive effect of total returns from assets.²⁶ As a result, the ideal

²⁶This follows from the assumption that the ratio $|F_{KK}|/F_{NK}$ increases when the capital-labor ratio increases.

level of debt increases, particularly among the nonbequest constrained. The increase tends to make b_{dt} larger than $b_{d,t-1}$.

The higher the total budget, P_t , that has to be financed, the higher is b_{dt} . If an increase in the budget is financed only by current taxes, net current wages decrease. As shown in part (i) of Proposition (1), more individuals move into the ranks of the bequest constrained, and the ideal values of b_t among bequest-constrained individuals rises. As a consequence b_{dt} increases. If P_t is high mainly because Social Security benefits are high, it is likely that b_{dt} is also larger than b_{t-1} , so there is a deficit.

Given that the deficit equals the first difference of the debt, the implications of Proposition 2 for deficits are summarized in Proposition 3.

PROPOSITION 3: *Budgetary deficits are larger under majority rule in periods in which there has been an increase in:*

- a. *the expected rate of growth of the economy;*
- b. *the fraction of individuals below a certain level of income and wealth;*
- c. *the fraction of individuals whose main source of income is not from wages (rentiers);*
- d. *the spread of the distribution of income;*
- e. *expected longevity.*

Preliminary evidence on changes in the functional and size distribution of income as well as in longevity in the United States between the 1970s and 1980s supports parts c and e of the proposition and does not contradict the other parts (Cukierman and Meltzer, 1987b).

VI. Concluding Remarks

This paper has presented an integrated economic and political theory of public debt determination that is based on redistributional considerations (across and within generations) in the presence of differences in abilities and wealth. A basic implication of the theory is that the existence of a positive national debt is directly traceable to the existence of a sufficient number of individuals who desire to leave negative bequests but

are prohibited from doing so. By voting for deficits, they increase their consumption, crowding out capital, but reducing the severity of the bequest constraint.²⁷

Although our model has many of the features found in Barro (1974), we reach a very different conclusion. Debt issues have macroeconomic effects on interest rates, wages, and the stock of capital even when the present value of future taxes equals the value of the debt. The differences are the result of redistribution, where there are some bequest-constrained individuals, features neglected in Barro's model.²⁸

Deficits are often incurred during wars. Our paper focuses on redistribution and abstracts from wartime defense and other public goods. Some of the results extend, however, to the case of an exogenously given, but possibly fluctuating level, of expenditures on public goods. In particular, the theory implies that an increase in government expenditures (possibly due to war) induces, as in Barro (1979), an increase in the public debt even with non-distortionary lump-sum taxes. The mechanism that produces this result differs from the one suggested by Barro. If all the increase in government expenditures is financed by higher taxes, wages net of taxes fall absolutely and relative to future (postwar) generations. The decline in net wages increases the fraction of individuals who are bequest constrained and who vote for a larger debt. As a result, the level of debt most preferred by the decisive voter increases, inducing the political process to use both taxes and debt to finance the increased level of public good expenditures. More generally, the model implies that deficit financing is more likely when government

²⁷In practice, they would be joined by people without offspring who increase their consumption by taxing the offspring of others.

²⁸It is interesting to note in this context that some types of diversity imply the existence of at least one bequest-constrained individual in general equilibrium. Thus Rao Aiyagari (1989) shows within the context of a pure exchange economy that when individuals have different rates-of-time preference there is at least one bequest-constrained individual in the economy. This is the individual with the highest rate-of-time preference.

expenditures increase, and surpluses are more likely when expenditures decline.

To concentrate on the type of effective redistribution ignored by Barro, we have neglected relevant factors affecting taxes, spending, bequests, and consumption. To separate the implications of redistribution from the effects of tax distortions for the level of the national debt, we have assumed lump-sum taxes. Obviously, tax-induced distortions are important in practice. The principles developed here provide some insights that may be relevant for the analysis of tax-induced distortions. Those who would benefit from transfers financed by distortionary taxes on current and future generations probably include many of the same people who benefit from debt finance. Those with low wages, relative to the wages expected by the next generation, will try to tax future wealth. Those who gain from crowding out capital by issuing debt will be willing to crowd out capital by taxing returns to capital.

Martin Feldstein (1976) suggests that a significant part of the resources transferred by parents to children takes place when both generations are still alive. These transfers include both consumption and investment, particularly the purchase of education and other investments in the human capital of the children. Investments in education affect the productivity of offspring and their expected future wages. The traditional overlapping generations framework, used here, does not incorporate this element explicitly. However, we can interpret the first-period consumption of an individual as including expenditures on education. On this interpretation, consumption in the first period of life yields higher utility and is therefore higher. Reallocation of spending to the first period makes it more likely that the decisive voter is bequest constrained and increases the severity of the constraint. The decisive voter, therefore, prefers a larger national debt.

Our focus has been on individual preference for positive debt induced by bequest constraints. Drazen (1978) points out that if the rate of return on investment in human capital is higher than the return on physical capital, parents prefer to invest at least some

resources in the human capital of their children not only for the sake of their children but also to provide for their own retirement. If the bequest they wish to leave at death is larger than the level of investment in human capital at which the returns on human and physical capital are equal, they are indifferent between taxes and debt. However, if the reverse is true, they prefer some debt financing to capture back at retirement the excess of investment in the human capital of their children over their desired bequest, while still allowing the children to enjoy the higher returns from education. In this case (abstracting from general equilibrium effects), individuals have a strict preference for debt whenever their desired bequest is lower than the level of investment in human capital at which the return on this investment is equal to the return on physical capital. In contrast, such a strict preference develops here at the point at which desired bequests become negative. Obviously incorporation of this additional element raises the level of debt most preferred by the decisive voter and therefore the level of the national debt. Consequently, it implies that deficits are more likely to occur during periods in which the return to human capital rises relative to the return on physical capital.

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