



I. Debt and Taxes

A. Paying for services directly produced by Governments normally involves a combination of taxes, borrowing, and other fees.

- i. Taxes are normally the largest source of revenues, followed by debt, and then fees for services of various kinds.
- ii. Governments can also use regulations (and mandates) to indirectly “produce” services by encouraging (or requiring) private organizations and individuals to provide services of interests.
- iii. This lecture analyzes the effects and politics of debt finance.

B. Government borrowing is accomplished by selling promises to pay interest on loans and to repay the amount borrowed.

- i. Because of this, some would argue that borrowing is simply another form of taxation, with the tax revenues coming in the future rather than in the present.

ii. However, there are many differences.

iii. For example, the government debt is rarely fully paid off, which implies that some debt financed services are, in effect, free for taxpayers.

iv. Also, occasionally, a government will default on its debt.

a. They may do so explicitly, by canceling payments to bondholders.

b. Or, they may do so implicitly, through policies that increase inflation and thereby the value of the dollars used to repay the debt.

c. (It can be argued that if governments are free to default, then government services are “free” for taxpayer-voters. Is this true?)

v. For the purposes of this lecture, however, we will assume that the debt is to be repaid--that is to say that there are no “free lunches.”

- C. If all government debt are eventually repaid, then debt and taxes are very similar instruments.
- i. Indeed Ricardo (1820) suggests that taxes and debt are literally equivalent instruments in that the persons who expect to repay the bonds will make their plans based on the assumption of higher taxes.
 - ii. A similar conclusion was reached by Barro (JPE 1974), who was chided by Buchanan (JPE 1976) for neglecting Ricardo.
 - iii. This equivalence is by no means accepted by all economists.
 - iv. (For example, if equivalence in this sense is accepted, then deficit spending cannot stimulate economic activity. Explain why?)
- D. In cases in which debts will eventually be paid off, debt finance is simply a method of altering the timing of taxation.
- i. However, even if future taxes are completely taken into account, the persons paying the taxes and the amounts paid may be affected by the timing of taxes.
 - ii. The timing of taxes may affect both the economics and the politics of tax-debt policies.
 - a. Some persons will die between the issue of the bonds and imposition of the taxes--but get to enjoy the services produced.
 - b. Others will be born and/or become taxpayers and have to pay taxes for services that they many not have benefited from.
 - c. With respect to the latter, Barro (1974) suggests that parents may take account of their children's interest when casting votes.
 - iii. It also bears noting that fiscal illusion with respect to future taxes, may affect both private and public behavior.
 - a. If people systematically underestimate future taxes, then there will be a bias that favors debt over tax finance, even if the voters of interest expect to pay off the debt through taxes.
 - b. Such individuals (and organizations) will not take full account of future tax burdens in their own lives, and save too little to pay for future taxes.
 - c. By reducing the perceived price of government services, this form of fiscal illusion also encourages government expansion beyond that which maximizes the median voter's welfare.

II. Efficiency Arguments for Debt Finance

- A. Political Support for debt finance is not always the result of biased expectations about future taxes or about opportunities to shift tax burdens to the next generation of taxpayers.
- i. There are several arguments that suggest that debt finance can increase social welfare (or generate Pareto superior moves).
 - ii. The most developed of these arguments suggest that borrowing can be used to reduce aggregate dead weight losses and/or to reduce the effects of business cycles.
- B. From a Ramsay taxation perspective, there are normative reasons to **smooth out the path of taxation through time**, because dead weight losses from taxation tend to increase with the square of marginal tax rates.
- i. Borrowing during recessions and paying back loans during booms allows marginal tax rates to fluctuate less.
 - a. A more or less constant tax rate can reduce the (present value of) deadweight loss from a series of high (during recessions) and low tax rates (during booms) that generates the same (present value of) revenues.
 - b. Thus, under a Ramsay tax norm, borrowing increases social welfare by reducing the total burden of taxation.
 - c. The Ramsay approach implies that tax rates should be held fairly constant. Money is borrowed during recessions and paid back during booms. (Note that this is not done for Keynesian reasons, but simply to reduce the long run deadweight loss of taxation.
 - ii. A more or less similar case occurs when a capital good is to be financed. The deadweight loss of taxation can be reduced by spreading the tax payments out through time, rather than paying for it in the first period with relatively high tax rates.
 - a. It may make sense to borrow to pay for school buildings, roads, bridges etc, as a way of keeping marginal tax rates low.
 - b. However, this would not be the case for ordinary expenditures for labor or maintenance.

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- C. A bit of calculus can demonstrate the Ramsay case for public debt fairly easily.
- Suppose that revenue of amount T is required in present value terms over time periods in which income is Y_1 and Y_2 .
 - $T = t_1 Y_1 + t_2 Y_2 / (1+r)$
 - The burden of the tax, however is higher than the revenue generated because of the deadweight loss (excess burden) of the taxes used.
 - The burden can be approximated as:
 - $B = t_1 Y_1 + at_1^2 Y_1 + (t_2 Y_2 + at_2^2 Y_2) / (1+r)$
 - where $at_1^2 Y_1$ and $at_2^2 Y_2$ represent the excess burden of the taxes in periods 1 and 2, respectively.
 - A Lagrangian can be formed to represent the problem of minimizing the burden of financing a given revenue.
 - $\mathcal{L} = t_1 Y_1 + at_1^2 Y_1 + (t_2 Y_2 + at_2^2 Y_2) / (1+r) + \lambda [T - t_1 Y_1 - t_2 Y_2 / (1+r)]$
 - Differentiating with respect to t_1 and t_2 yields:
 - $Y_1 + 2at_1 Y_1 = \lambda Y_1$
 - which after division by Y_1 can be written as: $1 + 2at_1 = \lambda$
 - and
 - $(Y_2 + 2at_2 Y_2) / (1+r) = \lambda Y_2 / (1+r)$
 - which can be written as: $1 + 2at_2 = \lambda$
 - These two first order conditions imply that:
 - $1 + 2at_1 = \lambda = 1 + 2at_2$
 - or
 - $t_1^* = t_2^*$
 - .
 - Minimizing the burden of taxation requires equal tax rates through time, given our assumptions about excess burden.**
 - The specific tax rate also has to be sufficient to produce revenue
 - .
 - $T = t_1 Y_1 + t_2 Y_2 / (1+r)$ so $t^* = T / [Y_1 + Y_2 / (1+r)]$
 - .
- If expenditures do not exactly equal to $t_1 Y_1$ and $t_2 Y_2$ then **borrowing (or saving) will be necessary** to minimize the burden of taxation.
 - The above analysis of tax smoothing can be generalized easily to N time period governmental taxation for a given present value of tax revenues.
- vi. Note also that government **bonds are not net wealth from this perspective**, because they are offset by an equal amount of future tax payments (a point stressed in Barro 1974)
- If taxpayers are forward looking (as postulated by Ricardo and by Barro), then the timing of taxes is less relevant than the present value of the revenues generated (and their associated burdens).
 - (Gordon Tullock once argued that since the governments can normally borrow at lower interest rates than taxpayers can, it makes sense to borrow all the money used to finance government services. Does this argument make sense? Why or why not?)
- D. An additional efficiency case for debt finance is associated with Keynesian macroeconomic theory.
- If one accepts Keynesian reasoning with respect to debt, debt may also be used to increase aggregate demand to reduce the losses associated with business cycles (recessions).
 - Unfortunately, the politics of Keynesian macro policy tends to be biased in favor of debt finance (and larger governments).
 - During a recession, deficits reduce unemployment.
 - During a boom, deficits also reduce unemployment.
 - So, if one attempts to minimize unemployment, deficits should always be run.
 - It seems clear that Keynesian ideas have clearly contributed to the magnitude of recent deficits in the US.
 - Macroeconomic arguments consistent with the school of macroeconomics are routinely heard in Congress, especially among Democrats.
- E. However, that deficits are run in both boom times and in recessions in most democracies, suggests that the politics of deficits is not

entirely driven by Ramsay tax norms or Keynesian macroeconomic theory.

See Buchanan and Wagner (1977) for a book length discussion of the implicit biases favoring deficit finance associated with Keynesian macroeconomics.

III. Distributional Effects of Debt Finance

- A. Government borrowing (tax-timing) has a variety of distributional effects, because the pool of taxpayers will change between the time that the debt is issued and the time at which it will be paid.
 - i. Some of the distributional effects are analogous to those previously analyzed for taxation.
 - a. The income of some groups rise and others fall between the time that a bond is issue and sold, and the time that it is redeemed.
 - b. These changes can affect the progressivity of taxation and/or the fiscal package as a whole (including government services such as schools).
 - c. (Develop a case for making school children pay for their schools and teachers via bonds paid off with future income taxes paid by the taxpayers educated at those schools. Now critique that case.)
 - ii. Other distributional effects occur regarding the distribution of the burden **among generations** of tax payers and beneficiaries.
 - a. New taxpayers are born, while existing ones age and eventually die.
 - b. Long term debt financing, consequently, tends to affect **inter-generational distribution of taxation** and excess burden.
 - (At the micro-economic level of analysis, the children of persons who do not hold government bonds equal to their future tax burden, will bear a relatively greater “inherited” tax burden than those who inherit such bonds.)
 - c. Not all tax payers will be alive when the taxes are collected to pay off the bonds issued, and not all future taxpayers are connected via

inheritance to bond holders in the borrowing generation of tax payers (Buchanan and Roback, 1987).

- B. Other controversies with respect to debt finance are centered on the extent to which “buy now pay later” arrangements tend to bias government finance in favor of debt or away from capital intensive services, because of effects on the politics of government finance.
- C. If there is a bias that favor’s debt financing over taxation at the margin, such a bias may undermine long term growth by reducing the supply and accumulation of capital.
 - i. Several papers argue that government debt finance tends to “crowd out” private debt finance and capital formation and therefore reduces economic growth.
 - a. Aschauer (1989), Ganelli (2003)
 - b. Diamond (1965), Kumar and Woo (2010)
 - c. See Elmendorf and Mankiw (1998) for a survey of this literature.
 - ii. The crowding out hypothesis is a long run argument that suggests that even if deficits can increase aggregate demand in the short run, there are long run costs that need to be taken into account.
- D. Overall, these distributional effects and debt illusion effects will affect price paid by voters for government services, and thereby the politics of government spending and finance.

IV. The Simple Politics of Debt under Perfect Information

- A. The actual level of public debt reflects political decisions rather than the recommendations of economists (except insofar as these may affect voter opinions).¹
- B. In a competitive democracy, political outcomes reflect the perspective of the median voter.²
 - i. The median voter is the voter whose ideal fiscal package lies exactly in the middle of all voter ideal points.

¹ The lecture notes below are based on Congleton’s 1992 survey of issues regarding the political economy of debt, which still provide a good overview of issues associated with the politics of debt finance.

² In the stochastic voting literature, candidates are assumed to be only imperfectly informed of voting behavior. In such models, vote maximizing candidates converge to the average voter's ideal point rather than the median voter's position.

- ii. (The median voter model and related public choice models will be have been developed earlier in the course.)
- C. Recall that in two party elections, candidates converge to the median voter's position and, would, if they have any desire to be reelected, behave as good agents for the electorate and enact the policies that they were elected to implement.
 - a. That is to say, in first-past-the-post elections, candidates who deviate from the median position of the electorate will not be successful in the electoral contest.
 - b. This is largely true under proportional representation as well, if representatives rather than coalitions (parties) are voted on.³
- i. If we accept the median voter model as a first approximation of political decision making in democracies, the current deficit reflects the fiscal circumstances and discount rate of the median voter at a given moment, and the cumulative debt is a consequence of the series of median voter preferences, circumstances, and political incentives in previous periods.
- ii. We can, thus, use “single decision-maker” models to characterize a variety of debt-taxation choices.

V. Barro, Debt Neutrality, and the Median Voter

- A. In Barro (1974, 1979) controversial papers on the national debt, he reinvents and extends what is known as the **Richardian Equivalence** of debt and taxes.
 - i. Barro's models assume that the population of voters is homogeneous, and consequently all voters make identical decisions about the optimal debt level.
 - This lack of dissension is not the principal focus of Barro's analysis.
 - The homogeneity of voters is used to facilitate analysis of other problems, but it turns out to be an important assumption nonetheless..

- ii. Within an electoral context, every voter in the Barro model agrees with the every other voter (including the median voter), and thus the policy result is Pareto optimal.
- B. The principal insight of Barro's original piece (1974) public debt was to note that even finite lived individuals might have an infinite planning horizon if they care about the welfare of their descendants.
 - i. An implication of the infinite planning horizon result is that for purposes of analysis one can neglect intergenerational aspects of the politics of government finance.
 - ii. Each person acts as if they will live forever.
- C. The following two-period model of the median voter's choice captures essential features of the Barro model, and is used for illustrative purposes throughout the paper.
 - i. For the purposes of this paper, assume that individuals have infinite planning horizon, which in the context of a two period model implies that voters in period 1 act as if they will be alive in period 2.
 - ii. The median voter faces both private and public budget constraints. He faces a private budget constraint that requires the present discounted value of disposable income to equal the present value of personal consumption,
$$(1-t_1)Y_1 + (1-t_2)Y_2/(1+r) = C_1 + C_2/(1+r).$$
 - Number subscripts denote time periods, Y is income, and C is private consumption.
 - The discount rate is r, and the marginal tax rates are t1 and t2.
 - In addition, in his role as a voter, the median voter faces a public budget constraint that requires the present discounted value of tax receipts to equal the discounted value of government expenditures,
$$n(t_1Y_1 + t_2Y_2/(1+r)) = G_1 + G_2/(1+r),$$
 - where n is the number of taxpayers, and G1 and G2 are the public services provided in periods 1 and 2 respectively.

³ In the absence of substantial party discipline (and monopoly power) the policies adopted will tend to reflect the position of the median legislator, the median of the district medians. However, if party elites determine representation and platforms, internal party politics become important. To the extent that party leadership is determined via winner take all elections among party members, the pivotal voter is the median member of the dominant political party. This may also be the case in coalition government, although party driven coalition government is more complex and depends on strategies adopted by the dominant and marginal members of the coalition. However, to the extent that the dominant party is the agenda setter on major policy issues, policies will tend to reflect the interests of the median voter of the dominant party.

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- iii. The median voter's utility function is concave and increasing in personal consumption and government services in the two periods, $U = u(C_1, G_1, C_2, G_2)$.
- First order conditions for the implied Lagrangian optimization problem may be used to characterize the utility maximizing levels of taxes, consumption, and government services through time.

iv. The Lagrangian equation is:

$$L = u(C_1, G_1, C_2, G_2) + \lambda_1 [(1-t_1)Y_1 + (1-t_2)Y_2/(1+r) - C_1 - C_2/(1+r)] + \lambda_2 [n(t_1Y_1 + t_2Y_2/(1+r)) - G_1 - G_2/(1+r)](1)$$

v. and partial derivatives over the control variables: C_1, C_2, G_1, G_2, T_1 and T_2 , are:

$$L_{C_1} = U_{C_1} - \lambda_1 = 0 \tag{2.1}$$

$$L_{C_2} = U_{C_2} - \lambda_1/(1+r) = 0 \tag{2.2}$$

$$L_{G_1} = U_{G_1} - \lambda_2 = 0 \tag{2.3}$$

$$L_{G_2} = U_{G_2} - \lambda_2/(1+r) = 0 \tag{2.4}$$

$$L_{t_1} = -Y_1 \lambda_1 + nY_1 \lambda_2 = 0 \tag{2.5}$$

$$L_{t_2} = (-Y_2 \lambda_1 + nY_2 \lambda_2)/(1+r) = 0 \tag{2.6}$$

$$L_{\lambda_1} = (1-t_1)Y_1 + (1-t_2)Y_2/(1+r) - C_1 - C_2/(1+r) = 0 \tag{2.7}$$

$$L_{\lambda_2} = n(t_1Y_1 + t_2Y_2/(1+r)) - G_1 - G_2/(1+r) = 0. \tag{2.8}$$

- (Subscripted variables denote partial derivatives with respect to the variables subscripted.)

vi. Equations 2.3 and 2.4 imply that the public service levels favored by the median voter will satisfy the usual criteria for intertemporal choice:

$$U_{G_1}/U_{G_2} = (1+r) \tag{3}$$

- a. Public services will be provided at the level where the marginal rate of substitution between government services in period 1 and period 2 equals the intertemporal rate of transformation.
 - b. A similar condition holds for private consumption.
- vii. However, the partial derivatives with respect to taxes, equations 2.5 and 2.6, do not contain tax rates as a variable, and hence tax rates are not adjusted in the same manner as public and private services.
- a. Because of the implicitly assumed neutrality of debt, **the timing of taxes does not affect utility as long as the budget constraints are satisfied.**⁴
 - b. This is the Ricardian Equivalence theorem within the context of an electoral model.
 - Individuals are indifferent between debt and taxes as fiscal instruments.
 - Not only are the politics of debt formation in this model marked by unanimity, but also by indifference.
 - A model where individuals are fiscally homogeneous and debt is neutral has no direct implications regarding debt formation in equilibrium.⁵

VI. Buchanan and the Median Voter

- A. The Buchanan approach drops the assumed homogeneity of tax payer-voters.
 - i. Buchanan allows for individual diversity, not only in incomes and tastes, but also in future tax obligations.

⁴ Note that both equations 2.5 and 2.6 are satisfied as long as the two budget constraints are satisfied. The first order conditions imply that $Y_1 \lambda_1 = nY_1 \lambda_2$, and $Y_2 \lambda_1/(1+r) = nY_2 \lambda_2/(1+r)$. Dividing the first equation by the second yields: $Y_1(1+r)/Y_2 = Y_1(1+r)/Y_2$ which always is true. In a pure Barro type model, debt is neutral in that debt levels do not affect relative prices of government and private services, income levels or interest rates.

⁵ In Barro's (1979) extension of his neutrality paper, debt levels are adjusted to minimize collection costs which vary with tax collection and income levels. In this paper, taxes (and debt) may be non-neutral because of dead weight losses generated by the tax code and its associated enforcement process. Minimizing collection costs allows an "optimal" time path of debt and taxes to be characterized.

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- In the Buchanan model, Ricardian equivalence may hold for the average tax payer but not for the entire distribution of tax payers.
 - Buchanan demonstrates that such individual differences tend to affect the level of current deficits and thereby the level public debt amassed through time.
- ii. Consider the following modified Barro model which is a variation of the Buchanan and Roback (1987) model.
- a. Assume that the distribution of income has a positive skew so that the median voter pays less than the average tax in both the present and future periods.
- The lower price of government services tends to increase the quantities of public services demanded relative to the original Barro setting.
 - However, this sort of voter heterogeneity does not affect the choice of fiscal tools as long as the ratio of the median voter's tax obligation to the total tax burden is the same in each period.
- b. In addition, suppose that the median voter's relative cost share differs substantially in the two periods.
- This would be the case for a median voter who expects to retire in period two.
 - It would also be the case in an explicit intergenerational context for voter-taxpayers whose children have *relatively* poor prospects for future income or, indeed voters without children at all.
 - In such cases the median voter has a clear incentive to borrow in the period of high taxes and repay the loans in period where "his" expected tax is relatively small.
- iii. To see this point, suppose that the median voter expects to earn less income in period 2 than in period 1.⁶

- a. Given the variation in individual incomes now assumed for the two periods, the public budget constraint becomes:

$$\sum_{i=1}^n t_1 Y_{1i} + \sum_{i=1}^n t_2 Y_{2i} / (1+r) = G_1 + G_2 / (1+r) \quad (4)$$

where the i-th individual's income in period t is denoted as Y_{ti} .

- i. This new constraint changes the first order conditions for the partial derivatives with respect to taxes. The new first order conditions 2.5' and 2.6' become:

$$L_{t1} = -Y_1 \lambda_1 + \sum Y_{1i} \lambda_2 = 0 \quad (2.5')$$

$$L_{t2} = (-Y_2 \lambda_1 + \sum Y_{2i} \lambda_2) / (1+r) = 0 \quad (2.6')$$

- a. Again, neither of these expressions contain taxes as a variable. \So no unique interior solution obtains for taxes.
- b. These two first order conditions imply that tax rates in the two periods should be set such that:

$$Y_1 / \sum Y_{1i} = Y_2 / \sum Y_{2i} \quad (5)$$

- c. which is impossible unless the ratio of median personal to aggregate income is the same in both periods.
- d. Absent this, **a corner solution for taxes will hold.**
- ii. If, as assumed here, the left hand side is greater than the right hand side, services in both periods will be paid for by taxes in the second period. In other words, first period services will be *entirely debt financed*.⁷

⁶ The model in Buchanan and Roback is cast in terms of an intergenerational model, where some individuals are less connected to future generations than others. The effect in an overlapping generations model would occur when one's descendants are expected to pay a smaller tax than the current generation. Mathematically, the above model is identical to a two generation model with an altruistic first generation. Period 2 results can be interpreted as second generation results.

⁷ This extreme conclusion is a consequence of debt neutrality. If the level of period 1 debt modestly affects period 2 income or income, period 1 services will be less than fully debt financed. However, only in cases where there are extreme non-neutrality would an individual who expects to earn below average income in period 2 prefer balanced budgets in both period to first period debt.

- a. If the right hand side is smaller than the left-hand side, services in period 2 would be entirely funded with a surplus generated in period 2.
- b. The assumed neutrality of debt, implies that the median voter will impose taxes in periods where his tax obligations are minimized for the desired service levels.

VII. Tabellini and Alesina

- A. The Tabellini and Alesina (1990) model adds electoral uncertainty to the median voter's policy decision.
 - i. They assume that the current median voter can not commit future governments (median voters) to specific fiscal policies.
 - ii. That is to say, the current median voter directly controls only the current tax and service levels.
 - iii. However, to the extent that current tax and borrowing policies constrain future political decisions, current tax/debt decisions become an instrument by which the current policy makers can influence, indeed even control, future public policy decisions.
- B. The Tabellini and Alesina analysis can also be captured with a minor extension of the simplified Barro model developed above.⁸
 - i. Suppose there are two possible political outcomes in period two.
 - a. The current median voter may get to decide public service in period 2 as well.
 - b. Or, some other voter set tax and expenditure policies in period 2, given fiscal obligations (debt or surplus) adopted in period 1.
 - c. Let α be the probability of the first electoral scenario and $(1-\alpha)$ be the probability of the second.
 - d. In this case the objective function of the median voter of period 1 becomes:

$$U^e = \alpha u(C_1, G_1, C_2, G_2) + (1-\alpha) u(C_1, G_1, C'_2, G'_2) \quad (5)$$

- ii. The median voter solves two related constrained optimization problems.
 - a. The first one is identical to the problem described above.
 - b. The second optimization problem takes account of the possibility that the current median voter will not be the median voter in period 2.
 - In this case, C'_2 , G'_2 and T'_2 are not control variables for the median voter of period 1.
 - However, the current median voter's choice of T_1 indirectly affects the second median voter's opportunity set by altering the amount of discretionary income available to the government in period 2.
 - In the Tabellini and Alesina model future governments **can not renege on debt obligations incurred by past governments.**)
 - c. To capture these effects, a third constraint, the reaction function of the new median voter which specifies T'_2 (and thereby, indirectly, G'_2 and C'_2) as a function of the tax rates in the first period, is added to the model.⁹
 - d. The original Lagrangian is denoted as L_1 and the second Lagrangian as L_2 , so the joint Lagrangian is:

$$L = \alpha L_1 + (1-\alpha) L_2 \quad (6)$$

- e. Differentiating with respect to the control variables yields the following first order conditions:

$$L_{C_1} = \alpha(U_{C_1} - \lambda_1) + (1-\alpha)(U'_{C_1} - \lambda_1) = 0 \quad (7.1)$$

⁸ Vaughn and Wagner (1992) argue that all the various approaches to debt can be combined into single unified theory. This could easily be done here by adding electoral uncertainty to the Buchanan model. However, such a combined model would not serve the purpose of this paper which is to demonstrate that various forms of imperfect information and consequent fiscal uncertainty has clear effects in all three models.

⁹ The second Lagrangian is $L_2 = u(C_1, G_1, C_2, G_2) + \lambda_1 [(1-t_1)Y_1 + (1-t_2)Y_2/(1+r) - C_1 - C_2/(1+r)] + \lambda_2 [n(t_1 Y_1 + t_2 Y_2/(1+r)) - G_1 - G_2/(1+r)] + \lambda_3 (T'_2 - t(T_1))$

$$L_{C2} = \alpha U_{C2} - \alpha \lambda_1 / (1+r) = 0 \quad (7.2)$$

$$L_{G1} = a(U_{G1} - \lambda_2) + (1-a)(U'_{G1} - \lambda_2) = 0 \quad (7.3)$$

$$L_{G2} = \alpha U_{G2} - \alpha \lambda_2 / (1+r) = 0 \quad (7.4)$$

$$L_{t1} = -Y_1 \lambda_1 + nY_1 \lambda_2 - (1-\alpha)T'_{2t1} \lambda_3 = 0 \quad (7.5)$$

$$L_{t2} = \alpha(-Y_2 \lambda_1 + nY_2 \lambda_2) / (1+r) = 0 \quad (7.6)$$

$$L_{\lambda 1} = (1-t_1)Y_1 + (1-t_2)Y_2 / (1+r) - C_1 - C_2 / (1+r) = 0 \quad (7.7)$$

$$L_{\lambda 2} = n(t_1 Y_1 + t_2 Y_2 / (1+r)) - G_1 - G_2 / (1+r) = 0 \quad (7.8)$$

$$L_{\lambda 3} = (1-\alpha)(T'_2 - t(t_1)) = 0 \quad (7.9)$$

- f. Focussing again on the rate of tax substitution between periods 1 and 2 characterized by equations 7.5 and 7.6, we find that tax rates will be set such that:

$$\begin{aligned} [Y_1 \lambda_1 + (1-\alpha)T'_{2t1} \lambda_3] / \alpha [Y_2 \lambda_1] / (1+r) \\ = nY_1 \lambda_2 / \alpha [nY_2 \lambda_2] / (1+r) \end{aligned}$$

- or simplifying:

$$T'_{2t1} = 0 \quad (8.0)$$

- which is a function of tax rates in period 1.

- iii. An interior solution is possible in this case even with the assumed debt neutrality.
- a. Setting the marginal influence of current taxes on next period taxes equal to zero implies that period 1 tax rates are set to maximize the tax receipts in period 2.

- b. By maximizing tax receipts, the current median voter indirectly maximizes his control over expenditure levels.
- c. Whether strategic elements of government finance implies deficit finance is a matter of the specific geometry of the reaction (best reply) function of the anticipated alternative median voter in period 2.
- d. In general, there is no particular implication regarding debt levels.¹⁰ Deficit finance arises if the desired expenditure level is above the revenue generated by the optimal rate in period 1 ($nt^*_1 Y_1 < G_1$).¹¹

VIII. Uncertainty and Fiscal Choice

- A. The above analysis of the level and causes of government debt indicates that under complete certainty there are a number of factors which can generate significant use of debt finance as a method of shifting the burden of public programs to other tax payers (and their heirs) or as a means of constraining the choices of successive governments.
- B. The third part of the lecture examines whether various kinds of uncertainty may have similar effects on the timing of taxation or expenditures.
- C. The Buchanan and Tabellini and Alesina models characterized above suggest that changes in the original Barro model which affect expected future tax burdens or service levels may thereby affect debt levels.
- Imperfect information may similarly affect expected tax burdens and service levels.
 - For example, note that if the Barro model is modified to reflect uncertainty about whether the current median-voter-taxpayer (or his

¹⁰ Tabellini and Alesina (1990) analyze a less general model in which individuals consume only two government services. Because voters have a zero discount rate, and debt is completely neutral, any debt level is possible in period 1. Consequently, ambiguity over debt levels also occurs in the Tabellini and Alesina model. However, the absence of private consumption alternatives in their model, makes debt a perfect method of controlling government expenditure levels in period 2.

¹¹ Note that corner solutions are not ruled out by equation 8. If period 2 tax rates tend to rise as period 1 tax rates fall over the entire range, then the same corner solution as in the Buchanan analysis is implied, as current taxes are reduced to zero and the entire period 1 government service level is debt financed.

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children) will survive to be taxpayers in period 2, anticipated future tax burdens are clearly reduced relative to the original model.

- a. This transforms the Barro model to one resembling the Buchanan model previously analyzed.
- b. Consequently, uncertain survival of the median voter and his progeny causes taxes to be proposed in order to minimize the expected tax burden for the current median voter and his heirs.

D. Uncertain Costs and the Timing of Government Services

- i. A similar effect can arise if voters are uncertain about the costs of future services.
 - a. Fiscal uncertainty can also affect the *timing of public services as well as taxes* in a manner which increases debt levels.
 - b. Uncertain future service levels or future costs tend to encourage substitution of the more certain current services for future services relative to the original complete certainty model.
- ii. To see this, consider the following modification of the Barro model. Suppose that the average cost of government services in period 2 may be one of three amounts: $1-k$, 1 , or $1+k$, each with probability one third.
 - a. The median voter's optimization problem becomes maximize:

$$L = (L^- + L^0 + L^+)/3 \tag{9}$$

- b. where L^- is the original Lagrangian with the balanced budget constraint modified to account for the lower cost of government services, $1-k$,
- c. L^0 is the original Lagrangian, and L^+ is the original Lagrangian with the balanced budget constraint modified to account for the higher cost of government services.
- d. The median voter can still select a value for G_2 , but both T_2 and C_2 are now determined by the actual cost of government services, and consequently they are no longer control variables.
- e. Differentiating with respect to the remaining control variables yields the following first order conditions. (Terms superscripted

with a "-", "o" or "+" are evaluated at period 2 government prices $1-k$, 1 , $k+1$ respectively.)

$$L_{C1} = [(U^-_{C1} - \lambda_1) + (U^0_{C1} - \lambda_1) + (U^+_{C1} - \lambda_1)]/3 = 0 \tag{10.1}$$

$$L_{G1} = [(U^-_{G1} - \lambda_2) + (U^0_{G1} - \lambda_2) + (U^+_{G1} - \lambda_2)]/3 = 0 \tag{10.2}$$

$$L_{G2} = [(U^-_{G2} - \lambda_2(1-k)/(1+r)) + (U^0_{G2} - \lambda_2)/(1+r) + (U^+_{G2} - \lambda_2(1+k)/(1+r))]/3 = 0 \tag{10.3}$$

$$L_{t1} = -Y_1 \lambda_1 + nY_1 \lambda_2 = 0 \tag{10.4}$$

$$L_{\lambda 1} = (1-t_1)Y_1 + (1-t_2)Y_2/(1+r) - C_1 - C_2/(1+r) = 0 \tag{10.5}$$

$$L_{\lambda 2} = n(t_1Y_1 + t_2Y_2/(1+r)) - G_1 - G_2/(1+r) = 0 \tag{10.6}$$

- iii. The marginal rate of substitution between current and future government expenditures is:

$$\frac{[(U^-_{G1} + U^0_{G1} + U^+_{G1})]/3}{[(U^-_{G2} + U^0_{G2} + U^+_{G2})]/3} = 1+r \tag{11}$$

- iv. Government services in the two periods are timed so that the ratio of the expected marginal utility from government services in period 2 to the expected marginal utility of government services in period 1 equals one plus the discount rate.
- v. Equation 11 is, in expected value terms, analogous to equation 3 above.
- vi. For any given values of current and future consumption and government service levels, the expected marginal utility of G_2 is now below that of the original, risk-free, choice.
 - a. The concavity of U implies that U^+ G_2 closer to U^0 G_2 than U^- G_2 . Consequently, $U_{G2} > [(U^-_{G2} + U^0_{G2} + U^+_{G2})]/3$.

- b. The numerator of equation 11 is approximately U_{G_1} .¹²
- c. Only a single value of G_1 is used to evaluate U_{G_1} .
- d. In order to return the marginal rate of substitution to its equilibrium ratio, consumption of G_1 must be increased relative to that of the complete certainty case.
- vii. Future cost uncertainty leads to the substitution of current for future government services.
- viii. The constraints under this probabilistic choice are equivalent to those of the original complete certainty case in an expected value sense.¹³
 - a. Since tax burdens are again assessed to minimize the median voter's tax share, cost uncertainty has no direct effect on the median voter's preferred timing of tax receipts.
 - b. Consequently, while total tax revenues may decline somewhat under future government service cost uncertainty as planned future service levels decline, there is no particular reason for changing the timing of taxation.
 - Debt is still neutral.
 - c. However, for any given tax rate in period 1, the size of the deficit implied under service cost uncertainty is larger than it would have been under the initial Barro assumptions.
 - Similar conclusions hold for the Buchanan, and Alesina and Tabellini models.
 - The debt effects of their extensions of the Barro model arise because of changes in the fiscal constraints that affect the timing of taxation.

- In this example, government debt increases because government cost uncertainty affects the timing of government services.

IX. Finite Planning Horizons and Rational Ignorance

- A. Several other informational problems exist which also tend to increase incentives for debt finance beyond that implied in the certainty models of debt formation.
 - i. For example, (1) planning horizons may be shorter than the duration of a particular government, which allows the possibility that budgets may not be balanced in the "long run."
 - ii. The fact that forecasting errors rise rapidly as values further and further into the future are estimated implies that there comes a point where additional forecasts and planning are essentially without value.
 - iii. If this occurs before all debt is expected to be retired, long term borrowing becomes effectively a "costless" method of funding current government services.
 - iv. Given debt neutrality, a planning horizon shorter than the anticipated debt repayment schedule clearly encourages debt finance.
- B. Given positive information costs, individuals may not uniformly gather information about government services, and moreover may remain ignorant of whole areas of fiscal policy.
 - i. In many cases the expected benefits associated with being informed on an issue are below the costs of obtaining the information.
 - ii. Moreover, the same residual uncertainty that diminishes the benefits of becoming "informed" about future programs also tends to increase the cost of becoming "informed" about such programs.

¹² Under the separable utility function used by Tabellini and Alesina, $U_{G_1 G_2} = 0$, and the numerator is exactly U_{G_1} . In other cases the effect of uncertain levels of service costs and therefore levels in period 2 are still approximately equal to U_{G_1} as long as the increase in the marginal utility of G_1 induced by a decline in G_2 is approximately equal to that of the decrease in the marginal utility of G_1 caused by an increase in G_2 . As long as extreme complementarity between current and future government services does not exist, the expected marginal utility of G_1 will increase relative to the expected marginal utility of G_2 .

¹³ The mathematical equivalence occurs because of the assumed average (expected) price being equal to the original uncertainty value of 1. Here, $G_2((1-k) + 1 + (1+k))/3 = G_2$.

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- a. Consequently, fiscal ignorance about future programs tends to exceed that of fiscal ignorance about current programs.
 - b. The extent to which any consequent biases affect the timing of taxation and expenditures is a matter of the extent and direction of the biases engendered.
 - iii. As developed above, if fiscal ignorance merely increases uncertainty about the costs of future programs, it would still affect the timing of public service levels and thereby debt levels.
 - a. Moreover, if future benefits of government programs or future tax burdens are systematically underestimated, the result would be an increase in debt levels.
 - b. A decline in the benefits of future services makes current service relatively more attractive, while a decline in the anticipated future tax burden tends to cause the median voter to shift tax burdens into the future.¹⁴
- C. In a model augmented with the effects of politically active special interest groups, policies open to the influence of interest groups are determined at the margin by the relative power of alternative interest groups.
 - D. The Buchanan model indicates that the median voter may himself have a special interest in the timing and composition of government finance.¹⁶
 - i. The analysis of this section demonstrates that interest groups will tend to find debt finance an attractive fiscal means to advance their ends.
 - ii. There are many interest groups who are directly affected by government decisions concerning the level and timing of taxation and who therefore have an active interest in fiscal policies.
 - a. For example, Alesina (1988) argues that the history of West European debt defaults (monetization) and repayment reflects changes in the relative power of three coalitions: rentiers, entrepreneurs and workers.
 - b. Many other politically active groups also have an interest in the timing of taxation and government services.
 - c. For example, pro-service interest groups often appear to believe (or at least argue) that their particular area of interest is at a "crisis point" and therefore require *immediate* increases in government services.
 - d. Here, the environmental, and education lobbies come to mind.¹⁷

X. Interest Groups, Voter Ignorance, and Government Finance

- A. In this section of the lecture, the possible influence of debt-oriented interest groups on fiscal policies is analyzed.
- B. In a pure voting model of government finance, the median voter (if one exists) indirectly determines the distribution of government services and the financial means used to attract economic resources into the public sector.¹⁵

¹⁴ Such an effect, as seen above in the Buchanan model, causes debt finance to increase as tax burdens are shifted to periods in which anticipated burdens are reduced. Such biased assessments of tax burdens are easy to imagine. For example, individuals (and the Congress) may easily underestimate the extent to which current policies increase future unfunded fiscal liabilities. This might be argued of various government sponsored insurance programs in the U. S., which causes future tax burdens to be underestimated. In the case of insurance to the Banking industry, or social insurance, future tax obligations can not be known with certainty until the actual insurance liability arises in the future.

¹⁵ In cases where a combination of voting rules and party discipline gives particular parties control of government, then the rather than the median voter, the median party member may be decisive. In such cases, changes in parties will cause substantial policy shifts, since the median party member's ideal point may be substantially distant from the median voter's ideal point. This modification does not significantly change the above analysis, which is cast in terms of the decisive voter. Moreover, in coalition governments, the decisive coalition member is often a centrist party.

¹⁶ Cukierman and Meltzer (1989) demonstrate this point in a somewhat richer over-lapping generations model. However, their model of debt finance is not neutral in the sense of Barro or Alesina and Tabellini. In the Cukierman and Meltzer (1989) model, government debt issues bid up interest rates and crowd out private investment rates which reduces growth rates and future income levels.

¹⁷ It bears noting that the degree of intergenerational altruism or foresight is not a decisive variable in this context. Many of the groups that favor speeding up the delivery of public services are, at least in public, motivated by concern about effects on future generations. For example, environmentalists argue that reducing current emissions of

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E. If voters are perfectly informed, and a stable institutionally determined voting equilibrium exists, then special interest group influence is essentially ruled out.

- i. In such cases, voter preferences directly determine fiscal policies as weighted by the collective decision making arrangements.
- ii. On the other hand, if voters are only partially informed about fiscal issues or remain completely ignorant of fiscally relevant policy details, several perfectly legal non-voting opportunities arise by which interest groups may strategically manipulate information costs to affect policy decisions.
- iii. Illegal means also arise as a consequence of the imperfect knowledge of voters, but for the purposes of this paper it is assumed that bribery and other such efforts have only minor effects on general fiscal policy decisions.
- iv. Interest groups are assumed to sponsor messages which affect voter expectations rather than encourage representatives to sacrifice general constituent interests for personal profit.¹⁸

F. Interest Group Influence

- i. The above analysis suggests that interest groups who are able to persuade the median voter that current government services are relatively more valuable than future government services, and/or that future taxes will be less burdensome than current taxes will thereby increase the stock of debt generated in the current period.
 - a. Casual observation suggests that the messages of groups favoring immediate service levels and tax postponement are more commonly heard than those espousing policies that encourage government account surpluses.
 - b. If this assessment is true, the balance of interest group power tends to increase the level of current deficits at the margin.

G. The extent to which such groups have effects on political outcomes beyond their votes, is a matter of their ability to invest resources to persuade voters or their representatives of the relative merits of their positions.

- i. The extent to which a given array of interest groups is able to influence public policy is partly a matter of local institutional arrangements, partly a matter of the resources invested by other groups, and partly a matter of the persuadability of voters and/or their representatives.¹⁹
 - ii. Incentives to organize and become politically active are a matter each respective interest group's expected relative gains net of organizational costs, see Olson (1965).
- H. The same uncertainty, and imperfect information that tends to encourage median voters to use deficit finance, tends to make groups favoring immediate public services paid with future taxes larger and more effective groups than those groups favoring surpluses and postponement of government services.
- i. Such groups tend to have both greater interests at stake and lower organization costs than anti-deficit groups.
 - ii. (1) Future tax payers are clearly not personally active current policy debates.
 - a. Their interests are represented only to the extent that current tax payers have a direct interest in reduced deficit spending or believe that their children will be relatively better off than they themselves are. In an environment where median income is rising at a substantially slower rate than average income, the interests of future taxpayers be under represented.
 - b. Groups favoring debt finance will have a greater interest in debt increasing programs than those advocating fiscal restraint and thus potentially will command greater resources.

"green house" gases will benefit future generations and reduce the long run cost of achieving a desirable distribution of global temperatures.

¹⁸ Under some institutional arrangements, direct monetary incentives are legal and provide a more direct method by which interest groups may affect the votes of elected representatives. For example, a firm might hire a representative as a consultant, or director on its board of directors; or purchase services from firms in which a representative has an indirect economic interest. These indirect "purchases" of votes are neglected here in order to focus on informational aspects of vote-determined political processes. Analysis of the purely economic methods by which votes may be influenced is beyond the scope of this paper. See Buchanan Tollison and Tullock (1980) for an overview the rent-seeking approach to such political "markets."

¹⁹ It is clear that if individuals were entirely unpersuadable, because they were perfectly informed or ideological zealots, resources would not be invested in information based lobbying activities, since such efforts would be ineffective. See Congleton (1991).

- iii. (2) The same relatively ease with which current program benefits and taxes can be assessed, implies that the **organizational costs of groups favoring debt finance are lower than for groups supporting delayed services or increases in current taxes.**
- iv. Potential supporters are, as discussed above, less inclined to remain ignorant of policies affecting current benefits and taxes than of policies which provide only future benefits and costs.

XI. Persuasion and Fiscal Uncertainty

- A. It bears noting that, even if a policy debate is balanced in the sense that equally persuasive messages are sponsored by pro and anti debt interest groups, to the extent that policy debate *increases uncertainty*, the lobbying process will, itself, tend to increase the size of deficits.
- B. To see how such a process might operate, consider the following model of persuasion, based on Congleton (1986), in which two groups attempt to influence the decisive voter's expectation about the cost of a future government service.
 - i. Suppose that campaign and other messages have at least a minor affect on his assessment of the likely consequences of the policies of interest.
 - a. In particular, suppose that the median voter (or his representative) has Bayesian priors on the range of possible costs that might occur, and updates these priors based on messages sent by the lobbying groups.
 - b. In such a setting, it is easy to find cases where the process of public debate increases rather than decreases variance.
 - ii. For purposes of illustration assume that initially the average cost of future services can only be any one of three levels, $1-k$, 1 , and $1+k$.
 - a. The median voter's uninformed prior is that each of these prices is equally likely, $P(1+k) = P(1) = P(1-k) = 0.333$.
 - b. Consequently, the expected average cost of future services before any persuasive efforts are undertaken by the lobbying groups is 1 .

- iii. Interest groups who favor increased current government services have an incentive to send messages that future prices will be higher than expected, since as demonstrated above, higher expected future costs tends to cause substitution away from future programs toward current programs.
 - a. Similarly, interest groups who favor postponement of government services (or regulations) would send messages that the average cost of future services will be lower than expected.
 - b. Given the assumed range of costs, the former can plausibly argue that actual costs will be $1+k$; while the latter would argue that future service costs will be only $1-k$.
- iv. The median voter is naturally skeptical of messages sent by special interest groups, but believes that each message is slightly more likely to be true than false.
 - a. For purposes of illustration, let the probability that a particular message is heard be $.4$ if the stated value it is true and $.3$ if one of the other values actually obtains.
 - b. For example, the probability that a message that the future costs equals $1+k$ is heard is $P(M^+ | 1+k) = .4$ if $1+k$ is the true value and is $P(M^+ | 1) = .3$ if 1 is the actual value, and is $P(M^+ | 1-k) = .3$ if $1-k$ is the actual value.
 - c. (Superscripted "-", "o", and "+" are used to denote messages regarding the cost of future government services.)
- v. The probability of hearing a particular message is the probability that it would be heard under one of these three circumstances.
 - a. Either it is true or false and one of the other cost levels obtains.
 - b. For messages M_j : $j = 1, 2, 3$ and average cost levels C_i , $i = 1, 2, 3$; the probability of hearing message M_j is $P(M_j) = \sum P(C_i)P(M_j | C_i)$, which given the assumed values of $P(M_j | C_i)$ is $(.33)(.4) + (.33)(.3) + (.33)(.3) = .33$ for all three messages.
- vi. The voter updates his priors after hearing the various messages using Bayes Law.²⁰

²⁰ Any process of updating which has qualitatively the same effects would yield similar conclusions. That is to say, as long as $dP(M^+)/dM^+ > 0$, messages will be persuasive at the margin.

a. The posterior probability assigned to $1+k$ is the following after a M^+ message is:

$$P(1+k | M^+) = [P(1+k)P(M^+ | 1+k)]/P(M^+) \quad (12)$$

or substituting:

$$P(1+k | M^+) = (.33)(.4)/(.33) = 0.4$$

b. The M^+ message is persuasive in the sense that it causes the individual to revise his assessment of the probability that service costs equals $1+k$, from 0.33 to 0.4.

vii. In this quasi Bayesian model of learning and persuasion, messages modestly influence an individual's probability assessment of alternative cost levels and thereby affect his expectations about the costs of future programs.

viii. Table 1 reports successive posteriors for an alternating sequence of M^+ and M^- messages, and the mean and variance of each prior/posterior distribution.

Table 1

Average Cost of Government Services	Original prior	M^+ message (1)	M^- message (2)	M^+ message (3)	M^- message (4)
1-k	0.33	0.3	0.36	0.32	0.41
1	0.33	0.3	0.27	0.24	0.17
1+k	0.33	0.4	0.36	0.43	0.41
Expected Cost	1	1+0.1k	1	1 + 0.108k	1

Variance	$.66(k)^2$	$.7(k)^2$	$.728(k)^2$	$.756(k)^2$	$.826(k)^2$
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- ix. Note that each successive message has a small effect on both the expected cost of the government service and the variance of the estimate.
 - a. Each successive message is somewhat persuasive, and consequently the expected cost moves in the direction of the the message heard.
 - b. The final assessment reflects the values of the original priors and the cumulative effect of all the messages heard. In the case represented in the table, the same number of M^+ and M^- messages were heard with generally offsetting effects on expected costs.
 - c. However, although the expected cost of services was not affected, the message series did *increase* the variance of the estimated future cost of government services.
 - d. **A series of "extreme" messages tends to increase the variance of the distribution of posteriors.**
- x. A series of extreme messages. thus, may effect policies even if they do not expect expected (mean) costs.²¹
 - a. The effect of such policy debates are the same as those associated with the move from a certain future cost environment to an uncertain future cost environment analyzed above.
 - b. Except in cases where extreme complementarity exists between future and current government expenditures, the end result of the competitive persuasion will be an increase in current (period 1) government expenditures and thereby, caeterus paribus, an increase in current deficits (or a reduction in current surpluses).
 - c. The proponents of increased current government service levels do not have to win the public debate to at least partially achieve their policy goals.
 - d. It is sufficient to increase the uncertainty of future alternatives.

²¹ See Husted, T. A., Kenny, L. W. and Morton, R. B. (1991) for general empirical support for this Bayesian approach to messages. They find that voters often have expectations with greater error variances associated with them after U. S. Senate elections. See table 2.

XII. Conclusion

- A. Tabellini and Alesina (1990) argue that many of the neutrality results of the Barro type approach are the consequence of an assumed permanence in the polity's ability to make decisions.
- i. They show that if decisive power in government changes from time to time, that each successive "polity" has an incentive to attempt to manipulate the choices of their successors through the choice of fiscal policy.
 - a. While such strategic interdependence between current and future decisions makers is doubtless important, their results can be reinterpreted in fiscal uncertainty and insurance terms.
 - b. Uncertainty about future service levels can be reduced in their model by substituting debt financed current services for tax financed future services.
 - c. This lecture has argued that other sorts of fiscal uncertainty may have similar effects on the level of debt issue.
 - ii. Even in cases where voters (or at least the median voter) have unbiased expectations about the costs of future government programs, uncertainty itself may cause current programs to be substituted for future expenditures.
 - a. Risk averse political decision makers will prefer the relatively greater certain benefits of present programs to the increasingly unpredictable benefits of future programs.
 - b. Similarly, voters prefer the uncertain taxes of future periods to certain ones in the present.
 - c. In this manner, uncertainty itself tends to increase deficit spending.
- B. The existence of costly and imperfect information creates an opportunity for interest groups to invest in the strategic dissemination of policy relevant information.
- i. This is generally what lobbying, per se, entails.
 - ii. The analysis above demonstrates that imperfect information may thereby increase the tendency for governments to engage in deficit finance if the future - tax current - expenditure lobby is able to generate greater influence than their pro-surplus oriented opponents.

- iii. Moreover, even in cases where interest groups are not able to materially change the expectations of pivotal decision makers, it is still possible that the debate will *increase* perceived uncertainty, and thereby encourage government programs to be implemented sooner rather than later.
- iv. **Imperfect information, itself, often has non-neutral implications about the level of debt in a society.**

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