



# A note on optimal fiscal policy in an economy with private borrowing limits<sup>☆</sup>



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## HIGHLIGHTS

- A model with non-distortionary taxes, heterogeneous households, and borrowing constraints is proposed.
- Tax financing tightens private borrowing constraints whereas public debt financing relaxes them.
- For high public debt, private borrowing constraints are fully relaxed and Ricardian equivalence holds.
- Optimal policy preserves binding borrowing constraints so as to reduce interest rates on public debt.

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## ABSTRACT

We consider the implications for optimal fiscal policy when taxes are non-distortionary and households are heterogeneous and borrowing constrained. The main result is that optimal policy keeps some households borrowing constrained in order to reduce interest rates on government debt.

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## 1. Introduction

How should a government finance a temporary public spending increase? The standard analysis of this question builds on the work of Barro (1979) and Lucas and Stokey (1983) who consider environments with distortionary taxes. According to this analysis, the government's desire to dynamically smooth tax distortions means that debt should be chosen to keep tax rates relatively constant over time.

In this note, we consider the answer to this question when taxes are non-distortive, and when households are heterogeneous

and borrowing constrained. Other work has emphasized the role of public debt in relaxing borrowing constraints, such as Aiyagari and McGrattan (1998), Holmstrom and Tirole (1998), Krishnamurthy and Vissing-Jorgensen (2012), and Woodford (1990). We complement this work by describing how the existence of private borrowing constraints impacts a government's optimal financing decision.

We consider a two-period model with rich and poor borrowing constrained households.<sup>1</sup> The government finances some initial public spending with lump sum taxes and debt. Tax financing tightens private borrowing constraints, whereas debt financing relaxes them. At high enough debt levels, the government fully

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<sup>1</sup> Bassetto (2014), Niepelt (2003), and Werning (2007) also consider extensions of Lucas and Stokey (1983) which introduce heterogeneity, though their work does not consider the role of private borrowing constraints.

relaxes borrowing constraints, and Ricardian Equivalence holds for marginal changes in debt. The main result is that even though such a policy is feasible, it is not optimal. The optimal policy of a utilitarian government keeps some households borrowing constrained in order to reduce interest rates on public debt.

## 2. Model and main result

We consider a simple two-period model with rich and poor borrowing constrained households. The government finances some initial public spending with lump sum taxes and debt.

### 2.1. Environment

There are two types of households indexed by  $i = \{L, H\}$  each of size  $1/2$ . Each household has a constant endowment  $y^i$  where  $y^H > y^L$  and faces the following budget constraints at  $t = 0$  and  $t = 1$ , respectively:

$$c_0^i + qb^i = y^i - \tau_0, \quad \text{and} \quad (1)$$

$$c_1^i = y^i - \tau_1 + b^i. \quad (2)$$

At date 0, households pay lump sum taxes  $\tau_0$  and they use their income net of taxes to purchase consumption  $c_0^i$  and public debt  $b^i$  at a price  $q$ . At date 1, they receive  $b^i$  and use their income net of taxes to finance consumption. Households cannot borrow so  $b^i \geq 0$ .<sup>2</sup> Households choose  $c_0^i$ ,  $c_1^i$ , and  $b^i$  to maximize their utility

$$\sum_{t=0,1} \log(c_t^i)$$

subject to their budget constraints and borrowing limits. This yields the following Euler equation:

$$q \geq \frac{c_0^i}{c_1^i}, \quad (3)$$

which is a strict inequality only if  $b^i = 0$ .

The government finances some initial public spending  $g > 0$  by raising taxes  $\tau_0 \geq 0$  and issuing public debt  $B \geq 0$ . Its period 0 budget constraint is thus

$$g = \tau_0 + qB. \quad (4)$$

In the second period, the government repays outstanding debt with taxes  $\tau_1$

$$\tau_1 = B. \quad (5)$$

The market clearing condition on government debt is

$$B = \frac{1}{2}b^L + \frac{1}{2}b^H. \quad (6)$$

The government is utilitarian and chooses taxes and debt to maximize social welfare:

$$\frac{1}{2} \sum_{i=L,H} \sum_{t=0,1} \log(c_t^i). \quad (7)$$

### 2.2. Competitive equilibria

Before characterizing optimal policy, we characterize the competitive equilibria which emerge under different levels of public debt. We show that for high levels of public debt, marginal changes in debt have no impact on allocations and welfare. In contrast, for low levels of public debt, marginal changes in debt affect allocations and welfare.

#### 2.2.1. High public debt

Let  $\bar{y} = \frac{1}{2}y^L + \frac{1}{2}y^H$  and define

$$B^* = \frac{g}{\bar{y} - g} \frac{y^H - \bar{y}}{2}.$$

**Lemma 1 (High Public Debt).** *If  $B > B^*$ , then (3) is an equality for  $i = L, H$ , and the values of  $\{c_t^i\}_{i=L,H}$  and  $q$  are uniquely defined and independent of the value of  $B$ .*

This lemma states that if the government supplies enough debt at date 0, then fiscal policy has no effect on the margin on household allocations and social welfare. The intuition for this result is as follows. If public debt is sufficiently high, then the level of taxation in the initial period is very low. Both rich as well as poor households rationally anticipate that taxes must rise in the future in order to finance this spending spree, so that both types of households own positive levels of public debt in order to save in anticipation of this tax increase. Consequently, if the government were to increase current taxes  $\tau_0$  by some amount  $\epsilon > 0$ , then households of all types would anticipate a decrease in future taxes  $\tau_1$  by  $\epsilon/q$  (since government debt is reduced) and they would therefore decrease their savings  $qb^i$  uniformly by  $\epsilon$ . Thus, the change in government policy has no impact on household allocations and interest rates.

This finding is in the spirit of the Ricardian equivalence result, though it relies on the level of debt being sufficiently high that all households participate in the savings market. This allocation and equilibrium interest rate are identical to those in an economy absent credit constraints. More specifically, substitution of (4)–(5) into (1)–(2) implies that:

$$c_0^i = y^i - g - q(b^i - B), \quad \text{and} \quad (8)$$

$$c_1^i = y^i + (b^i - B). \quad (9)$$

In the absence of a binding credit constraints, (3) binds for both household types. This fact, combined with (6), (8), and (9), implies that

$$q = \frac{\bar{y} - g}{\bar{y}}. \quad (10)$$

Substitution of (10) into (3) and (8)–(9) implies that

$$b^H - B = -b^L + B = B^*,$$

which is only feasible if  $B \geq B^*$  since  $b^L \geq 0$ . Thus, a high enough supply of public debt allows the government to effectively replicate private markets in economies in which such markets are non-existent. Interestingly, this implies that in contrast to economies in which debts are financed via distortionary taxes (e.g., Barro, 1979 and Lucas and Stokey, 1983), excessively high levels of public debt do not actually reduce social welfare on the margin.

#### 2.2.2. Low public debt

We characterize competitive equilibria when the government issues low levels of public debt.

**Lemma 2 (Low Public Debt).** *If  $B < B^*$ , then  $\{c_t^i\}_{i=L,H}$  and  $q$  are uniquely defined for every  $B$ . As the government increases  $B$  from below  $B^*$ , (i)  $q$  decreases, (ii)  $b^L$  is constant at 0 and  $b^H$  increases, (iii)  $c_0^L$  increases and  $c_0^H$  decreases, and (iv)  $c_1^L$  decreases and  $c_1^H$  increases.*

<sup>2</sup> All of our results hold if households can borrow up to a binding limit  $\underline{b}$ , so that  $b^i \geq \underline{b}$ .

The lemma states that if the supply of public debt is not too high, then fiscal policy affects equilibrium allocations and the interest rate. As the government increases debt and decreases initial taxes, the interest rate increases, the savings by the rich increases, consumption inequality at date 0 decreases, and consumption inequality at date 1 increases. Since  $b^L = 0$  in this region, substitution of (4)–(6) into (1)–(2) yields the following sequences of consumption:

$$(c_0^L, c_1^L) = (y^L - g + qB, y^L - B), \quad (11)$$

$$(c_0^H, c_1^H) = (y^H - g - qB, y^H + B), \quad (12)$$

and substitution into (3) which binds for  $i = H$  yields a bond price:

$$q = \frac{y^H - g}{y^H + 2B}. \quad (13)$$

The reason why the supply of public debt affects equilibrium outcomes is because the implied initial taxes are so high that poor households do not want to save and would instead prefer to borrow. However, these households cannot borrow since credit is unavailable to them. This means that the price of this debt is determined by the rich households' demand for it, and the inability of the poor households to short this debt implies that government debt will be sold at a premium to the rich. This additional premium commanded by government debt does not exist if  $B > B^*$ , since if such a premium existed, poor households could easily take advantage of it by simply purchasing fewer government bonds. Consequently, the supply of public debt has a real impact on the riskless interest rate, as any decrease in the supply of government bonds requires a decrease in the return to these bonds in order to convince the rich savers to lend fewer resources to the government.

More specifically, if the government increases initial taxes  $\tau_0$  by  $\epsilon > 0$ , then  $\tau_1$  declines by *more* than  $\epsilon/q$  since  $q$  rises (interest rates decline) as debt declines. If  $\tau_0$  rises and  $\tau_1$  falls, then poor households would ideally borrow more. However, because they are on their credit constraint ( $b^L = 0$ ), it is the case that  $c_0^L$  falls and  $c_1^L$  rises, which must imply from the resource constraint that  $c_0^H$  rises and  $c_1^H$  falls. Since rich households are not credit constrained, (3) binds, and consequently  $q$  falls to justify the reduction in the future consumption of the rich. Therefore, in contrast to the case for which  $B > B^*$ , the supply of debt affects equilibrium consumption and interest rates.

A government choosing a level of debt below  $B^*$  faces a tradeoff. The government can finance most of the spending via initial taxes as opposed to debt by choosing low levels of  $B$ . The benefit is that consumption inequality at date 1 is minimized because the rich do not receive much return on savings since public debt and the interest rate are low. Nevertheless, high initial taxes are very burdensome on the poor households so that consumption inequality at date 0 is high. By raising public debt, the government can reduce these initial taxes by making the rich bear a bigger initial burden of the public spending shock. The cost of this alternative is that it raises consumption inequality at date 1 when the rich are repaid the interest on their savings. Therefore, as in an economy with distortionary taxes, the government faces an intertemporal tradeoff. However, the objective of the government is not to determine the optimal intertemporal allocation of tax distortions, but the optimal intertemporal allocation of consumption inequality.

### 2.3. Optimal government policy

As a consequence of Lemmas 1 and 2, one can write the objective of the government as choosing a level of public debt

$B \leq B^*$  which maximizes

$$\frac{1}{2} \sum_{i=L,H} \sum_{t=0,1} \log(c_t^i) \quad \text{s.t. (11), (12), and (13)}. \quad (14)$$

The first order condition for the planner can be written as

$$\left( \frac{1}{c_0^L} q - \frac{1}{c_1^L} \right) + \left( B \frac{\partial q}{\partial B} \right) \left( \frac{1}{c_0^L} - \frac{1}{c_0^H} \right) \geq 0, \quad (15)$$

which is slack only if  $B = B^*$ . Note that  $\partial q / \partial B$  is negative from (13). At  $B = B^*$ , the first term on the left hand side of (15) equals zero since the poor agents are not borrowing constrained and (3) is an equality. Moreover, the second term must be negative since  $c_0^L < c_0^H$  so that the poor consume less than the rich. Therefore, (15) cannot hold at  $B = B^*$ .

**Proposition 1 (Optimal Policy).** *Optimal government policy sets  $B < B^*$ .*

This result states that the government chooses low levels of debt so that the poor feel borrowing constrained. The intuition behind this result is related to our discussion in the previous section. The government effectively wants poor households to be borrowing constrained in order to provide the government with an advantage in borrowing since debt is then sold at a premium to the rich. Imagine if such a premium were absent so that  $B = B^*$ . In this circumstance, every household's participation in the financial market implies that every household is indifferent on the margin between receiving  $\epsilon > 0$  units of consumption today versus  $\epsilon/q > 0$  units of consumption tomorrow. Consider the effect of an increase in initial taxes  $\tau_0$  by  $\epsilon$  for  $\epsilon > 0$  sufficiently small. This reduces poor households' (raises rich households') date 0 consumption by  $\epsilon$ . Importantly, because the perturbation raises  $q$ , it raises poor households' (reduces rich households') date 1 consumption by *more* than  $\epsilon/q$ . Therefore, the implied increase in consumption inequality in the initial period is offset by the implied reduction in consumption inequality in the second period, and the government's optimal choice of debt makes poor households borrowing constrained.

We would like to make a couple of comments regarding this result. First, this result is robust to allowing limited redistributive taxation. To see why, suppose the government can impose a linear tax rate  $\alpha_t \leq \bar{\alpha} < 1$  on income. In this case, it is straightforward to see that the optimal policy of the government sets  $\alpha_1 = \alpha_2 = \bar{\alpha}$  so as to achieve maximal redistribution. Moreover, our main results hold, since  $y^i$  in (1) and (2) is now replaced with  $y^i(1 - \bar{\alpha})$ . Second, this result is connected to that in Yared (2013) who shows that it is not optimal for the government to fully relax private debt limits in an economy with short- and long-term investment. In that work, fully relaxing private debt limits leads to production inefficiencies since households anticipating relaxed borrowing limits in the future underinvest in a short-term asset in the present. In contrast, in this work, fully relaxing private debt limits does not lead to production inefficiencies but instead leads to too much inequality.

### 3. Conclusion

While our analysis has focused on a simple two-period example, the main result from this example more broadly reflects the fact that whenever a government has an advantage over the private sector in repaying debt, it can exploit this advantage in order to reduce the interest that it pays, and in some circumstances, doing so is optimal. Note that while the model assumes that households cannot borrow, in practice, access to private credit exists, but is imperfect. Understanding how the market imperfection behind the private credit market interacts with the supply of government bonds is an interesting avenue for future research.

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