Redistribution and the Multiplier*

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May 30, 2011

[PRELIMINARY DRAFT]

Abstract

During a fiscal stimulus, does it matter, for the size of the government spending multiplier, which category of agents bears the brunt of the current and/or future adjustment in taxes? In an economy with heterogeneous agents and imperfect financial markets, the answer depends on whether or not New Keynesian features, such are price rigidity, are present. If prices are flexible, the tax-financing rule is either neutral or quasi-neutral. If prices are sticky, who bears the brunt of the adjustment, whether financially constrained borrowers as opposed to unconstrained savers, *does* matter. The differential effect on the multiplier, however, depends crucially on (i) the degree of persistence of the fiscal expansion, and (ii) on whether the expansion is balanced-budget as opposed to debt-financed.

*Prepared for the IMF-EUI Fiscal Policy, Stabilization and Sustainability Conference, Florence, June 6-7, 2011.

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1 Introduction

The recent literature has emphasized a series of theoretical channels that can critically affect the size the output multiplier of government spending. These channels include the presence of a zero lower bound constraint (Christiano et al., 2009, Correia et al., 2010), imperfect competition and price stickiness (Hall, 2010, Woodford, 2010), complementarity in preferences (Monacelli and Perotti, 2008, Bilbie, 2010), and alternative fiscal rules (Davig and Leeper, 2011, Corsetti et al. 2010).

In this paper we focus on a different channel: *redistribution*. We ask the following question: in implementing a fiscal expansion, does it matter, for the size of the multiplier, which category of agents in the population bears the brunt of the related adjustment in taxes? Whether debt-financed or conducted under a balanced budget, in fact, any given expansion in government spending must be accompanied by a current and/or future adjustment in taxes. Empirical evidence shows that, in the postwar US history, tax adjustments often feature a pronounced redistributive content.[1] This dimension, however, has been largely overlooked in the recent literature, being that literature largely based on the paradigm of a representative-agent economy with perfect financial markets.

We build a model economy featuring heterogenous agents and imperfect financial markets. Agents are heterogenous in terms of their impatience rates. This minimal form of heterogeneity gives rise, in equilibrium, to a natural distinction between borrowers and savers.[2] The impatient agents, in turn, are subject to a borrowing limit. One way to rationalize such a setup is to think of this distinction as ensuing from a recession, during which the likelihood that a fraction of the population faces constraints in borrowing is higher.

In this setup, we study whether the size of the multiplier of government spending depends on the assumed tax redistribution scheme, i.e., either pro-borrowers or pro-rich.

[1] See Monacelli and Perotti (2011) for a detailed documentation of this point.

[2] Alternatively, in the classic Bewley-Ayagari-Hugget heterogenous-agent framework, borrowing by some agents (and saving by others) is motivated by the presence of idiosyncratic shocks. In a section of Krusell and Smith (1998), idiosyncratic (as well as aggregate) uncertainty co-exists with heterogeneous impatience rates.

We first show an equivalence result, which constitutes our benchmark. If prices are flexible, there are constant returns to scale in production, and the steady state distribution of wealth is degenerate, the tax financing rule is neutral. Put differently, the size of the output multiplier is the same irrespective of whether it is borrowers or savers that bear the brunt of the adjustment in taxes. The only case in which the tax redistribution scheme affects the size of the multiplier is when equilibrium profits are non-zero, so that the assumed ownership structure of the firms is relevant.

Matters are different, however, under sticky prices. In this case, the economy is inherently dynamic, and hence the agents' heterogenous ability to substitute consumption intertemporally plays a crucial role. To better understand this argument, notice that the defining feature of an economy with borrowing-constrained agents is that intertemporal substitution affects some agents' decisions even if the *riskless* real interest rate is constant. This is because the consumption profile of the constrained agents depends on the *effective* real interest rate, which is inclusive of a credit premium (the shadow value of borrowing).

Hence the spending multiplier will be larger or smaller depending on whether it leads to looser or tighter financial conditions. Under general conditions, an expansion in government spending leads to a rise in inflation, and in turn, unlike a representative agent economy with perfect credit markets, to a redistribution of wealth from the savers to the borrowers. When taxes are increased to the savers only, the rise in government spending generates improved financial conditions for the constrained borrowers, so that their consumption will be *crowded-in.* This effect will strengthen the expansionary effect on output of the increase in government spending, easily generating output multipliers that exceed one. Conversely, when the borrowers are the ones who bear the brunt of the adjustment in taxes, the expansion in government spending leads to a tightening of their financial conditions, and the overall effect on the output multiplier is dampened.

In general we show that there exists a range of alternative compositions of the tax mix (from more to less biased against the borrowers) which are compatible with a multiplier above one: the larger the degree of price stickiness, the larger the borrowers' share of the tax burden which is still consistent with a multiplier greater than one.

We then study the implications of alternative tax financing rules in the case in which the government can issue debt. In this scenario, an additional dimension becomes crucial: how the *future* burden of adjustment of government debt is redistributed across agents. We show that, relative to a balanced- budget fiscal expansion, the tax mix that maximizes the output multiplier can be more strongly biased against the borrowers. The intuition for this result is as follows. When a rise in spending is debt-financed, the run-up in government debt puts an upward pressure on the credit premium in private financial markets. If government debt is held by the savers, a composition of the tax mix that penalizes the borrowers relatively more (and hence the savers relatively less) allows to slow down the accumulation of public debt and, somewhat paradoxically, to boost borrowers' consumption (via a stronger loosening of their financial conditions).This result follows from a rich general equilibrium interaction between tax policy, the evolution of government debt, and the conditions in private financial markets.

General equilibrium borrower-saver models build on the earlier analysis of Becker (1980), Becker and Foias (1987), Krusell and Smith (1998), Kiyotaki and Moore (KM, 1997). Campbell and Hercowitz (2004) extend this category of models to a standard real business cycle framework, whereas Iacoviello (2005) extends the KM framework to include features more typical of the New Keynesian monetary policy literature. Monacelli (2009) analyzes the implications for the monetary transmission mechanism of the presence of endogenous collateral constraints. Curdia and Woodford (2009) allow agents to differ in their impatience to consume, but (differently from our framework) limit the ability to borrow by assuming that agents can have access to financial markets (in the form of purchase of state contingent securities) only randomly. Curdia and Wooford (2009) use their setup to analyze the implications for optimal monetary policy of movements in credit spreads.

None of these models, however, have focused their analysis on the redistributional features of fiscal policy. Galí et al. (2007) build a model in which myopic "rule-of thumb" consumers co-exist with standard agents that perfectly smooth consumption. Our analysis differs from Galí et al. in two respects: first, the borrowers in our economy remain intertemporal maximizers, although subject to a suitably specified (either exogenous of or endogenous) borrowing constraint; second, the distribution of debt across agents is endogenous. Hence, movements in taxes and inflation generate wealth and intertemporal substitution effects that are absent in a model with rule-of-thumb consumers. More recently, Eggertson and Krugman (2011) use a borrower-saver model with New Keynesian features to analyze the effects of financial shocks and of the zero bound for monetary policy. The focus of their analysis, however, differs from ours, in that neither fiscal consolidations nor tax redistribution rules are analyzed.

2 Baseline model

The model economy features two types of agents, henceforth *borrowers* and *savers*. Borrowing is motivated by impatience. The impatient agents face a fixed borrowing limit, in the spirit of classic equilibrium models with incomplete markets such as Bewley (1983), Aiyagari (1994), and Hugget (1998). In its essence, our model can be seen as a simplified version of those models, in that we feature only two agents (as opposed to a continuum) and we abstract from capital accumulation. On the other hand, we add features of the recent New Keynesian monetary policy literature, such as imperfectly competitive goods markets and nominal price rigidity.[3]

The baseline setup is deliberately stylized, in order to shed light on the role of redistribution and imperfect financial markets as a channel of transmission. In particular, in the baseline version of the model, we assume that (i) taxes are non-distortionary, (ii) agents cannot invest in physical capital, (iii) the government does not issue debt. We then compare the implications of flexible price economies to the ones of sticky price economies.

[3] Another key difference with respect to the Bewley-Aiyagari-Hugget type of model is that we solve the model under certainty equivalence, and therefore analyze bounded dynamics in the neighborhood of the deterministic steady state. As a result, we rule out any role for uncertainty and for precautionary saving. Those elements, however, *could* in principle be analyzed also in our model, conditional on implementing a fully non-linear solution and on allowing the borrowing constraint to be only occasionally binding.

2.1 Households

There are two types of agents, indexed by $j = s, b$, who differ in their degree of (im)patience β_j,

$$\beta_s > \beta_b.$$

A generic agent of type j solves the following problem:

$$\max \mathbb{E}_0 \left\{ \sum_{t=0}^{\infty} \beta_j^t \left[\log c_{j,t} - \frac{n_{j,t}^{1+\varphi}}{1+\varphi} \right] \right\}$$

subject to the period-by-period budget constraint (expressed in units of consumption):

$$c_{j,t} + r_{t-1} d_{j,t-1} \leq d_{j,t} + w_t n_{j,t} - \tau_{j,t} + \sigma_j \mathcal{P}_t \tag{1}$$

where $c_{j,t}$ is consumption, $n_{j,t}$ is labor hours, $d_{j,t}$ is borrowing of agent j (in real terms), w_t is the real wage, $\tau_{j,t}$ are lump-sum taxes on agent j, and σ_j is the share of aggregate profits $\mathcal{P}_t$ that accrues to agent j (because of equity holdings).

The impatient agents (in equilibrium, the borrowers, $j = b$) face also the following constraint on borrowing:

$$d_{b,t} \leq \overline{d} \tag{2}$$

where $\overline{d} > 0$ is an exogenous upward limit. Notice that this borrowing limit is more stringent than a so called "natural" debt limit (Aiyagari 1994).

Let $\{\lambda_{j,t}\}$ and $\{\psi_t\}$ denote sequences of Lagrange multipliers on constraints (1) and (2) respectively. First order conditions of the above problem read:

$$\lambda_{j,t} = c_{j,t}^{-1} \tag{3}$$

$$n_{j,t}^{\varphi} = w_t \lambda_{j,t} \tag{4}$$

$$\lambda_{j,t} = \beta_j \mathbb{E}_t \left\{ r_t \lambda_{j,t+1} \right\} + \mathcal{I}_j \lambda_{j,t} \psi_t \tag{5}$$

for $j = s, b$, where $\mathcal{I}_j$ is an index variable that takes the values $\mathcal{I}_s = 0$ and $\mathcal{I}_b = 1$.

In the case $j = s$, equation (5) is a standard consumption Euler equation; for $j = b$, however, and if the borrowing constraint is binding ($\psi_t > 0$), that condition states that the marginal utility of consumption exceeds the (expected) marginal utility of saving.

Notice that for all (generic) equilibrium values of consumption, $c_t > 0$, and conditional on the borrowing constraint being binding (so that $\psi_t > 0$ for all t) the equilibrium conditions above imply

$$\lambda_{b,t} > \lambda_{s,t} \tag{6}$$

Hence the "impatience to consume" manifests itself in two ways. First, and regardless of borrowing restrictions being in place, via the assumption $\beta_s > \beta_b$. Second, in an equilibrium where the borrowing constraint is binding, via equation (6). Since constraint (2) is always binding in the steady state (to the extent that agents have different discount rates), condition (6) is also verified in the steady state (see more below on this point).

2.2 Firms

A perfectly competitive firm employs labor to produce a homogenous final good with the following production function:

$$y_t = F(n_t), \tag{7}$$

with $F^{'}(n_t) > 0$, and $F^{''}(n_t) \leq 0$. Notice that n_t denotes the firm's demand for labor.[4]

Hence, in equilibrium, the real wage equals

$$w_t = F^{'}(n_t), \tag{8}$$

and, using (8), aggregate profits are equal to

[4] Equivalently one can view the present model as isomorphic to one where the capital stock is fixed.

$$\mathcal{P}_t = F(n_t) - F^{'}(n_t)n_t \equiv \mathcal{P}(n_t)$$

Notice in the case $F^{''} = 0$, i.e., of a constant return to scale (in this case linear) production function, we have $F(n_t) = F^{'}(n_t)n_t$, and therefore $\mathcal{P}_t = 0$.

2.3 Government and tax financing rule

The government needs to finance an exogenous stream of government spending. It collects lump-sum taxes and redistribute them across the agents. Hence its budget constraint reads

$$g_t = \sum_j \tau_{j,t} \tag{9}$$

We assume that government spending follows the autoregressive stochastic process

$$g_t - g = (1 - \rho_\tau)g + \rho_g(g_{t-1} - g) + \varepsilon_{g,t} \tag{10}$$

where $\varepsilon_{g,t}$ is an iid innovation.

We will in general compare two extreme cases of tax financing rules, depending on whether variations in spending are respectively financed with taxes entirely levied on borrowers (τ_b *rule*) as opposed to savers (τ_s *rule*).

2.4 Equilibrium

An equilibrium with a binding borrowing constraint (i.e., $\psi_t > 0$ for all t) requires the following conditions to hold, for all t and $j = b, s$:

$$d_{b,t} = \overline{d} \tag{11}$$

$$\sum_j n_{j,t} = n_t \tag{12}$$

$$\sum_j d_{j,t} = 0 \tag{13}$$

Combining (1) with (9) one obtains

$$y_t = \sum_j c_{j,t} + g_t \tag{14}$$

Hence an equilibrium is a collection of processes for $\{c_{j,t}, n_{j,t}, d_{j,t}, w_t, \psi_t\}$ satisfying (1), (4), (5), (2), (14), for $j = b, s$ and for any given evolution of the government spending process $\{g_t\}$.

3 Steady state

In the steady state, the assumption $\beta_s > \beta_b$, guarantees that the borrowing constraint is always binding. From the steady state version of (5), in fact, we have (in the case $j = b$):

$$\psi = 1 - \frac{\beta_b}{\beta_s} > 0$$

For $j = s$, (5) implies $R = 1/\beta_s$. By combining (1) and (2) we can write the following non-linear expression that pins down steady-state consumption for the borrower:

$$c_b - c_b^{-\frac{1}{\varphi}} \left[1 - \delta_b \left(\frac{1}{\beta_s} - 1\right)\right] - \tau_b = 0 \tag{15}$$

where $\delta_b \equiv \overline{d}/n_b \geq 0$ is the borrower's steady-state debt-to-income ratio.

Following similar steps, the expression for the savers' steady state consumption reads:

$$c_s - c_s^{-\frac{1}{\varphi}} \left[1 - \delta_s \left(\frac{1}{\beta_s} - 1\right)\right] - \tau_s = 0 \tag{16}$$

where $\delta_s \equiv -\overline{d}/n_s \leq 0$.

Notice that if $\overline{d} > 0$, even if steady state taxes are the same across agents ($\tau_b = \tau_s$), we have:

$$c_b < c_s \tag{17}$$

Since the labor market is perfectly competitive, implying that both agents are paid the same wage, the steady state version of (4) implies

$$n_b > n_s \tag{18}$$

As a result, a steady state with a non-degenerate wealth distribution ($\overline{d} > 0$) is also one in which the borrowers consume less and work more than the savers. In the special case of a degenerate distribution of wealth, i.e., $\overline{d} = 0$, however, if $\tau_b = \tau_s$, consumption and labor supply will be equalized across agents:

$$c_b = c_s \tag{19}$$

$$n_b = n_s. \tag{20}$$

3.1 A neutrality result

Combining the above conditions, the equilibrium under flexible prices and binding borrowing constraint can be rewritten in a more compact form as a set of static equations in the five variables $\{c_{b,t},\ c_{s,t}, n_{b,t},\ n_{s,t},\ r_t\}$, for $j = b, s$:

$$c_{s,t} + \tau_{s,t} - (r_{t-1} - 1)\overline{d} = F^{'}(n_t)n_{s,t} + \sigma_s \mathcal{P}(n_t) \tag{21}$$

$$c_{b,t} + \tau_{b,t} + (r_{t-1} - 1)\overline{d} = F^{'}(n_t)n_{b,t} + (1 - \sigma_s)\mathcal{P}(n_t) \tag{22}$$

$$c_{s,t} n_{s,t}^{\varphi} = F^{'}(n_t) \tag{23}$$

$$c_{b,t} n_{b,t}^{\varphi} = F^{'}(n_t) \tag{24}$$

$$c_{s,t}^{-1} = \beta_s \mathbb{E}_t \left\{ r_t c_{s,t+1}^{-1} \right\} \tag{25}$$

and where it should be recalled that, in equilibrium, $n_t = \sum_j n_{j,t}$.

A few observations are in order. First, notice that the borrower's consumption Euler condition can be used to pin down the multiplier on the borrowing constraint residually.

Hence, this version of the model is one in which the different inability to substitute intertemporally between the two agents is irrelevant. This feature is important, for it is via the reduced ability to smooth consumption over time that the effects of borrowing constraints play out in the model.

Second, suppose that production features constant returns to scale. In that case, $F^{'}(n_t) = 1$ and $\mathcal{P}_t = 0$ for all t. Combining the equilibrium conditions above, and log-linearizing around the deterministic steady-state, we obtain:

$$\widehat{c}_{b,t} = -\frac{\tau_b}{\omega_b}\widehat{\tau}_{s,t} - \frac{\overline{d}}{\gamma}\widehat{r}_{t-1} \tag{26}$$

$$\widehat{c}_{s,t} = -\frac{\tau_s}{\omega_s}\widehat{\tau}_{s,t} + \frac{\overline{d}}{\gamma}\widehat{r}_{t-1} \tag{27}$$

where

$$\omega_j \equiv c_j + (c_j^{-\frac{1}{\varphi}}/\varphi) \qquad (j = b, s). \tag{28}$$

Equations (26) and (27) show how each agent's consumption responds, respectively, to tax changes and to past values of the real interest rate. Notice that three are the possible elements of asymmetry in the dynamics of consumption across agents: first, the steady state level of taxes; second, the coefficient ω_j (which depends on the level of consumption of agent j in the steady state); third, if $\overline{d} > 0$ (non-degenerate distribution of wealth), the current response to the past level of the real interest rate.

In the particular case of equal lump-sum taxation in the steady state ($\tau_b = \tau_s$) and degenerate wealth distribution ($\overline{d} = 0$), we also have (using (15), (16) and (28)) that $\omega_s = \omega_b$. Armed with this observation, we can state the following lemma:

Lemma 1 *In the economy with flexible prices and constant returns to scale in production, if the deterministic steady state is such that the agents are equally taxed ($\tau_b = \tau_s$), and the distribution of wealth is degenerate ($\overline{d} = 0$), then the tax financing rule is neutral.*

More precisely, neutrality of the tax rule means the following: for any given variation in government spending, it is irrelevant for the equilibrium allocations of consumption, employment and labor whether a balanced government budget is achieved via an adjustment in savers' taxes as opposed to borrowers' taxes.

Decreasing returns Matters differ when we assume that the production function exhibits decreasing returns to scale. In that case firms generate profits in equilibrium, and how these profits are redistributed among agents can be relevant for the implications of alternative tax financing schemes.

Figure 1 illustrates the effects of a temporary expansion of government spending on aggregate output and consumption for alternative tax financing rules and under the assumption that $\sigma_s = 1$ and $\sigma_b = 0$: i.e., the savers own the shares of the firm, and receive the profits in a lump-sum transfer. The calibration adopted in this exercise is presented in Table 1. Notice that, in this experiment, we assume that the debt limit is $\overline{d} = 0$.[5]

Table 1. Calibration in Simulation Exercise

Parameter	Description	Value
ρ_g	autoregressive parameter of g process	0.7
β_s	savers discount factor	0.99
β_b	borrowers discount factor	0.98
ϕ_π	coefficient on inflation in monetary policy rule	1.5
$\overline{g}$	steady state share of govt. spending in output	0.2
$\overline{d}$	steady state debt limit	0
σ	inverse of elasticity of substitution in consumption	1.5
φ	parameter governing Frisch elasticity of labor supply	1

Clearly, in this case, the neutrality result breaks down. Output expands more sharply when taxes are levied on the borrowers (dashed line) as opposed to the case in which taxes are levied on the savers. The bottom panel of figure (1) shows that the smaller expansion in output when taxes are levied on the savers depends on a corresponding larger contraction of aggregate consumption under that scenario. In turn this depends on

[5]In unreported results, in fact, we observe that the effect of raising the debt limit (and still remain consistent with a positive steady state level of consumption for the borrowers) on the differential impact of alternative tax rules is minimal.

the different response of labor supply by the two agents in the two scenarios (see Figure 2). When government spending rises, the agent whose taxes are increased correspondingly expands his/her labor supply. But under the assumed profit redistribution scheme, the savers increase their labor supply *by less,* since they simultaneously face also an increase in the rebated profits. A symmetric effect would emerge in the opposite polar case of $\sigma_b = 1$ and $\sigma_s = 0$.

Overall, the analysis so far conveys two main messages. First, under flexible prices, the *non-neutrality* of the tax rule during a fiscal expansion, and the corresponding size of the multiplier, depends essentially on the assumed profits redistribution scheme (which in turn relates to the assumed property structure of firms). Although this is a feature that it is usually overlooked in the analysis of fiscal multipliers in standard representative-agent models, it does not genuinely relates to the presence of financial imperfections. Second, regardless of the type of tax financing rule assumed, an expansion in government spending leads to a *crowding-out* of private consumption (although of different intensity depending on the type of tax redistribution scheme adopted). The latter is also a typical result in a standard neoclassical representative-agent type of economies (Baxter and King, 1993). We show below, however, that both results can radically change once we introduce New Keynesian features such as monopolistic competition and price stickiness.

4 Nominal rigidities

We next proceed to analyze the implications of nominal rigidities. We wish to show that in this case the tax financing rule is not neutral, and for reasons independent of the maintained assumption on the redistribution of profits. The main implication of nominal price stickiness is that it renders the model genuinely dynamic. As a result, the (in)ability to substitute consumption intertemporally is crucial in determining the behavior of private spending in response to a contraction in government spending.

We assume a standard New Keynesian setting with monopolistic competition and price rigidity. A perfectly competitive firm purchases intermediate differentiated goods to

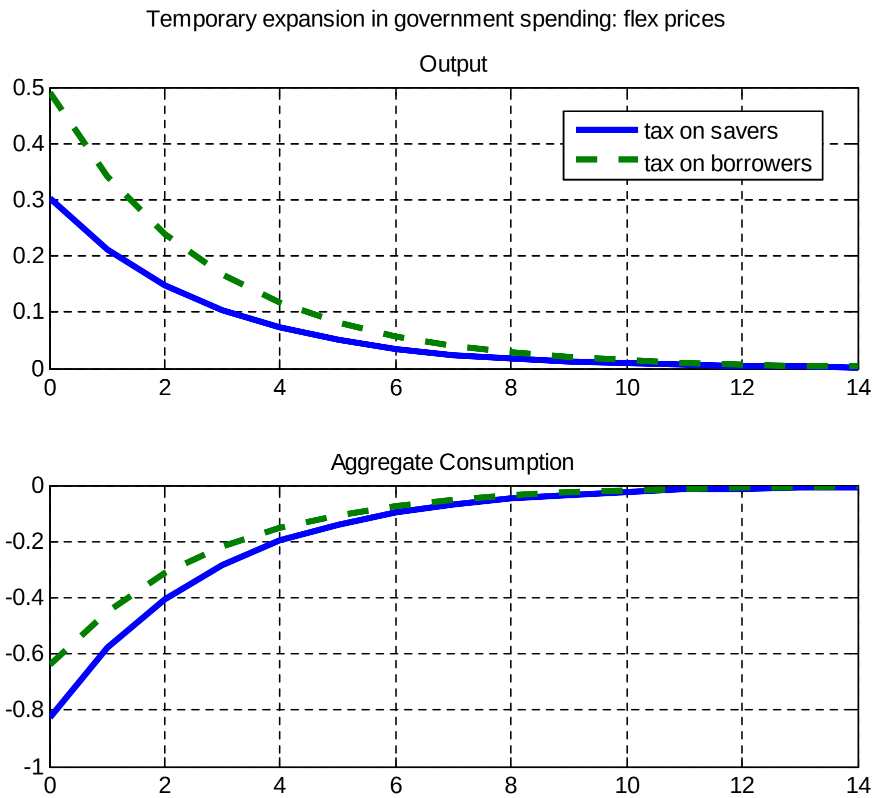

Figure 1: Responses of aggregate output and consumption to a temporary expansion in government spending under a decreasing returns production function and profits rebated to savers: $\sigma_s = 1$ and $\sigma_b = 0$.

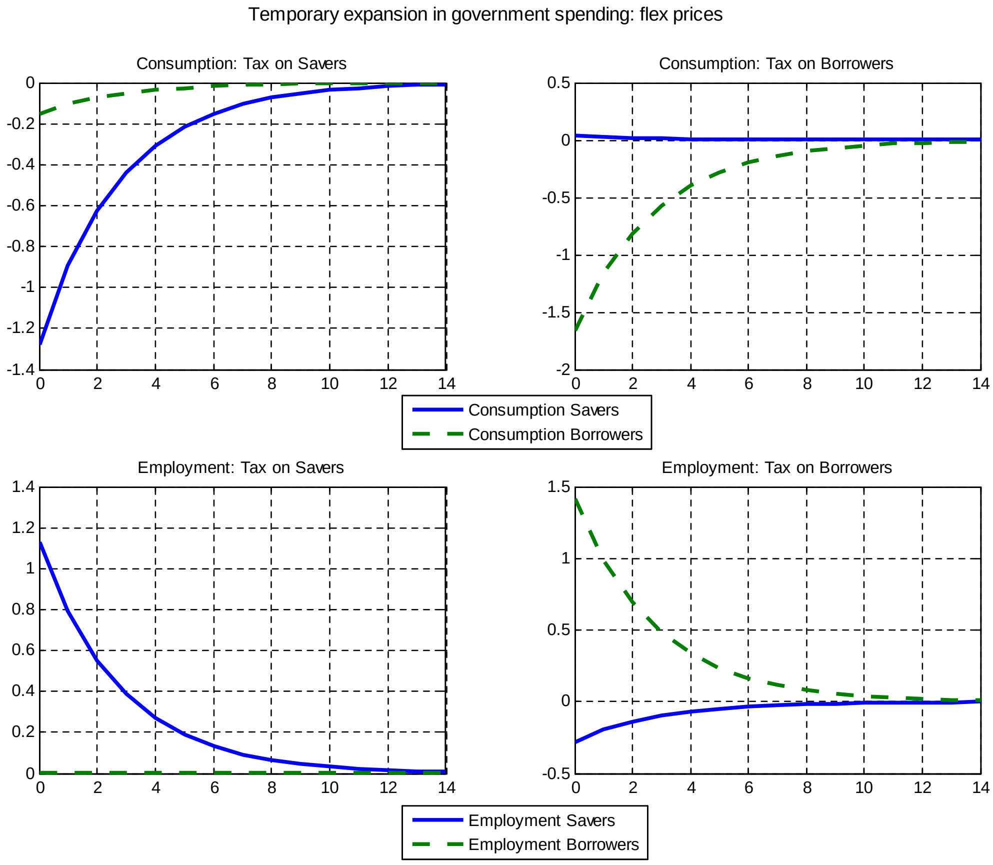

Figure 2: Responses of individual consumption and employment to a temporary expansion in government spending under a decreasing returns production function and profits rebated to savers: $\sigma_s = 1$ and $\sigma_b = 0$.

produce a final homogenous good via the production function

$$y_t = \left(\int_0^1 y_t(z)^{(\varepsilon-1)/\varepsilon} dz \right)^{\varepsilon/(\varepsilon-1)},$$

where $\varepsilon > 1$ is the elasticity of substitution across varieties.

A continuum of mass one of firms (indexed by z) produce the differentiated varieties employing labor according to the production function:

$$y_t(z) = F(n_t(z)) \qquad z \in [0, 1]$$

where $n_t(z)$ is total demand of labor by firm z.

The monetary authority is assumed to set the short-term nominal interest rate i_t according to the feed-back rule

$$i_t = r\pi_t^{\phi_\pi} \tag{29}$$

where r is the steady-state real interest rate, π_t is the rate of inflation, and $\phi_\pi > 1$.

In a symmetric equilibrium each firm z employs the same amount of labor and pays the same nominal wage, both to borrowers and savers. In the same equilibrium it must hold:

$$\sum_j n_{j,t} = n_t(z) = n_t, \tag{30}$$

for $j = b, s$ and $z \in [0, 1]$.

The first order conditions of the household's problem can be written:

$$c_{j,t} n_{j,t}^{\varphi} = \frac{w_t}{p_t}, \tag{31}$$

$$c_{j,t}^{-1} = \beta_j \mathbb{E}_t \left\{ \frac{i_t}{\pi_{t+1}} c_{j,t+1}^{-1} \right\} + \mathcal{I}_j c_{j,t}^{-1} \psi_t, \tag{32}$$

where w_t now denotes the *nominal* wage. In the following we assume that the shares of firms are owned by the savers, so that the profit redistribution rule is such that $\sigma_s = 1$ and $\sigma_b = 0$.

4.1 A fiscal expansion under rigid prices

In order to analyze the implications of nominal price rigidity, let's assume, for the sake illustration, that prices are fixed for at least two periods, between time t and $t+1$. From (29) this implies (since p_{t-1} is predetermined as of time t) that i_t is fixed , and, in turn, that also the ex-ante *real* interest rate $r_t \equiv \mathbb{E}_t \{i_t/\pi_{t+1}\}$ is constant. Alternatively, as in Woodford (2010), we could think of constructing an equilibrium in which the central bank, via (29), keeps the real interest rate fixed at a level $r_t = \overline{r} > 1$. Notice that the latter scenario, like ours of temporarily fixed prices, would not be feasible under flexible prices.

Under a fixed real interest rate, (32) implies, for agents of type $j = s$,

$$c_{s,t} = \overline{c}_s \quad \text{for all t.}$$

The same, however, does not hold for agents of type $j = b$, due to the shadow value ψ_t being time-varying. For those agents, in fact, it will hold

$$\overline{r}\beta_b \mathbb{E}_t \left\{ \frac{c_{b,t}}{c_{b,t+1}} \right\} = 1 - \psi_t \tag{33}$$

Thus borrowers' ability to substitute consumption intertemporally depends on the shadow value ψ_t even though movements in the *riskless* real interest rate do not take place in equilibrium. Variations in the multiplier ψ_t, in fact, are akin to variations in a credit/finance premium.

If current prices are fixed, the symmetric equilibrium price level of variety z reads:

$$p_t(z) = \overline{p} = \mu_t \frac{w_t}{F'(n_t)}, \tag{34}$$

where μ_t is the possibly time-varying markup of prices over the nominal marginal cost of production, which corresponds to $w_t/F'(n_t)$. In the case of flexible prices, $p_t(z)$ can vary in response to current economic conditions, thereby allowing firms to keep the markup aligned with the optimal level $\mu_t = \mu^* \equiv \varepsilon/(\varepsilon - 1) > 1$, which is constant. But under rigid prices, movements in the nominal marginal cost will force the markup to deviate from its optimal desired value.

Condition (34) allows to derive an implicit aggregate labor demand schedule:

$$n_t = \mathcal{N}\left(\frac{w_t \mu_t}{\overline{p}}\right), \tag{35}$$

where $\mathcal{N}(\cdot) = F^{-1}\left(F'\left(\frac{w_t\mu_t}{\overline{p}}\right)\right)$, with $\partial\mathcal{N}/\partial\mu < 0$.

The *aggregate* labor supply schedule can then be derived by combining the conditions in (31):

$$n_t = n_{s,t} + n_{b,t} = \left(\frac{w_t}{\overline{p}}\right)^{\frac{1}{\varphi}} \left(\overline{c}_s^{-\frac{1}{\varphi}} + c_{b,t}^{-\frac{1}{\varphi}}\right) \tag{36}$$

Under our assumed fixed-price equilibrium, the aggregate market clearing condition (14) reads:

$$y_t = \overline{c}_s + c_{b,t} + g_t \tag{37}$$

Equation (37) suggests that both the sign and the size of the output multiplier of government spending depend crucially on the behavior of *borrowers*' consumption under any given tax financing rule.

Equivalently, one can assess the role of borrowers' consumption for aggregate labor market quantities (and hence aggregate output) by evaluating the equilibrium described by the schedules (35) and (36). This is illustrated in Figure 3. Notice that the position of the aggregate labor supply schedule (36) depends on the value of borrowers' consumption c_b, whereas savers' consumption is considered as constant.

Under fixed prices, and since firms are assumed to meet all the available demand at that given price, the rise in government spending will induce firms to decrease their markups, and therefore increase their demand for labor at any given real wage.

The outward shift in labor demand can be decomposed in two steps. An initial increase in labor demand (and therefore a rise in the marginal cost and a fall in the markup) *holding borrowers' consumption constant* (point B in the figure). This first effect, which is common to both tax rules scenarios, corresponds to an outward shift of the aggregate labor demand schedule from $N(\mu, c_b)$ to $N(\mu^{'}, c_b)$, with $\mu^{'} < \mu$. The final position of the aggregate labor demand curve, however, depends on the equilibrium behavior of borrowers' consumption. If borrowers' consumption rises (as illustrated in the figure) this produces a further shift in the labor demand schedule to $N(\mu^{'}, c_b^{'})$, and therefore a further contraction in the markup to $\mu^{''} < \mu^{'}$

The final equilibrium level of aggregate employment, and therefore output, will depend on the position of the aggregate labor supply schedule, $N(\bar{c}_s, c_b)$, which also depends on the behavior of borrowers' consumption. In the case in which borrowers' consumption rises ($c_b^{'} > c_b$), the aggregate labor supply schedule shifts inwards, thereby positioning the system at point C. As we argue below, however, the equilibrium response of borrowers' consumption will depend on the type of tax financing rule being in place.

Savers' taxes adjust Consider, first, a temporary balanced-budget expansion in government spending financed via an increase in *savers*' taxes. We will assume that the borrowing limit $\bar{d}$ is fixed and equal to zero. Under our assumed equilibrium, savers' consumption will remain constant.

Two factors, specific to the context with sticky prices, contribute to a loosening of the financial conditions for the constrained borrowers. For one, the outward shift of the labor demand schedule induced by a rising real marginal cost, pushes inflation up. But higher inflation lowers the outstanding real service cost of debt (being the latter denominated in nominal terms). Second, to the extent that the rise in labor demand determines also a higher equilibrium real wage, this will also make the borrowing constraint for the impatient agents looser.

Both factors (higher inflation and a rising real wage) induce a fall in the shadow value of borrowing ψ_t: this is akin to a fall in the borrowers' finance premium (or, alternatively, in the borrowers' *effective* real interest rate). The fall in the finance premium, in turn, induces the borrowers, via the Euler condition (33), to increase current consumption relative to future consumption. From Figure 3, we observe that the rise in borrowers' consumption

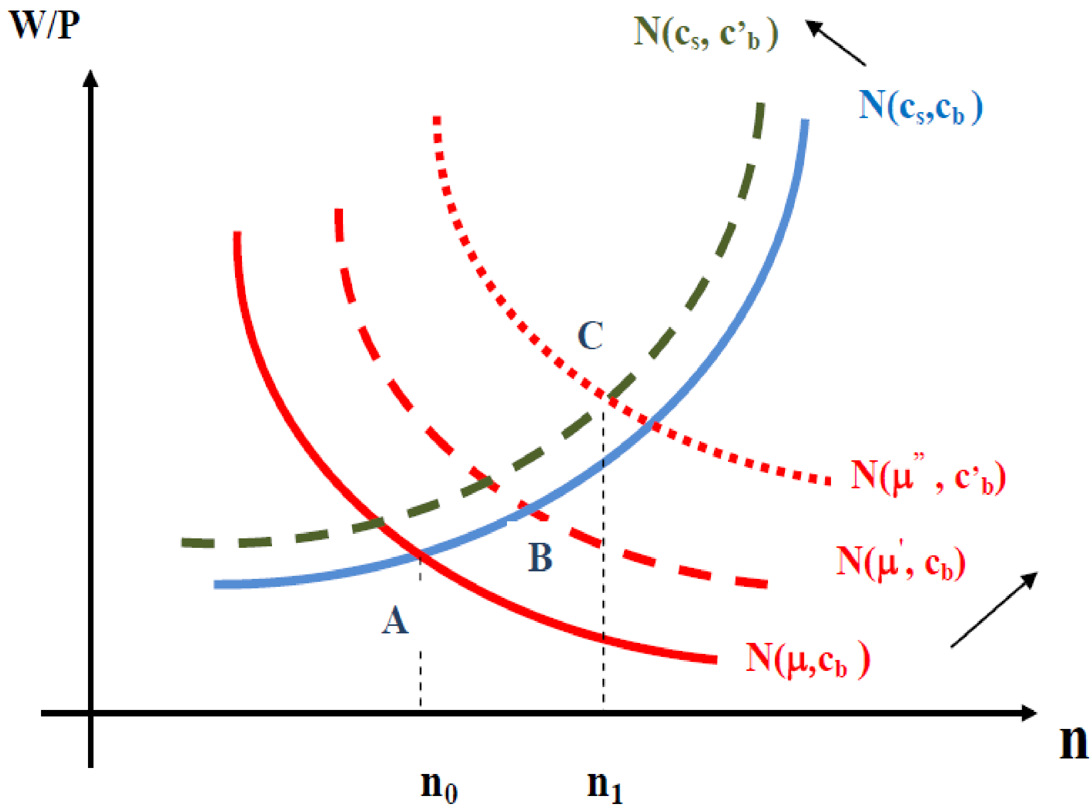

Figure 3: Effect on the aggregate labor market equilibrium of a rise in government spending under rigid prices.

causes a further shift in the aggregate labor demand schedule, thereby strengthening the rise in employment generated by the initial expansion in public consumption. Although the simultaneous inward shift in the labor supply schedule partly dampens this second-round expansion in employment, the net effect of the rise in borrowers' consumption, and consistent with equation (37), is to *amplify* the employment/output multiplier.

Borrowers' taxes adjust Let's contrast the above case with the one in which taxes are increased to the *borrowers*. Savers' consumption is still constant, due to the fixed riskless real interest rate. The initial outward shift in the labor demand schedule (to point B), illustrated in Figure 3, remains unaltered, as well as the rise in inflation. But now, for agents of type b, the rise in taxes will tend to tighten the borrowing constraint, competing with the positive effect on financial conditions stemming from the rise in the real wage and inflation. *Ceteris paribus*, the rise in borrowers' taxes will induce a tightening of the borrowing constraint, and therefore a rise in the shadow value ψ_t. In the final equilibrium, borrowers' consumption will have to rise by less (relative to the case in which taxes are reduced to the savers), or even fall, thereby dampening the equilibrium output multiplier relative to the previous case in which the government budget adjusts only via higher taxes on the savers.

4.1.1 Dynamics under staggered prices

Our analysis so far has been based on the limit assumption that prices remain fixed for (at least) two periods. In the standard Calvo model of pricing, however, it is assumed that intermediate goods producers get the opportunity to reset their price only randomly, and with a constant probability. We assume that the probability of resetting prices is equal to $(1-\vartheta)$. In this scenario, the aggregate price level will adjust slowly, and the monetary authority will implement a certain path of the real interest rate via the policy rule (29). As a result, savers' consumption will no longer be exactly constant.

When the point of approximation is the zero-inflation steady state, the optimal price-setting strategy for the typical firm choosing its price in period t can be written in terms of the (log-linear) rule :

$$\widetilde{p}_t^* = \log\left(\frac{\varepsilon}{\varepsilon - 1}\right) + (1 - \beta\vartheta)\sum_{k=0}^{\infty}(\beta\vartheta)^k \ \mathbb{E}_t\{\widetilde{mc}_{t+k} + \widetilde{p}_{t+k}\} \tag{38}$$

where $\widetilde{p}_t^*$denotes the (log) of newly set prices, which is identical across reoptimizing firms, and mc_t denotes the (log) real marginal cost of production,

$$\widetilde{mc}_t = -\log(\mu_t).$$

The evolution of the aggregate price level, in log-linear terms, reads:

$$\widetilde{p}_t = \vartheta\widetilde{p}_{t-1} + (1 - \vartheta)\widetilde{p}_t^* \tag{39}$$

Equations (38) and (39) constitute the pricing block of the model.

Figure 4 displays the responses of aggregate output and consumption to a balanced-budget temporary expansion in government spending under the two alternative tax financing rules. The probability of not resetting prices in any given quarter, ϑ, is chosen in order to match a frequency of price changes of four quarters, and the price elasticity of demand ε is set equal to 8.[6] As we can see, and in line with our previous reasoning under the limit case of fixed prices, output expands more sharply when taxes are increased to the savers relative to the case in which taxes are increased to the borrowers. This result is in stark constrast with the one obtained under flexible prices. Under flexible prices, in fact, the output multiplier was dampened when taxes were increased to the savers.

Noticeably, aggregate consumption behaves very differently in the two scenarios. In the case in which taxes are increased to the borrowers, consumption falls, thereby dampening the expansion in output. However, when taxes are increases to the savers, the rise in government spending produces a *crowding-in* of aggregate consumption, in turn magnifying the expansion in output, and leading to a multiplier that exceeds one.

The intuition for the sharply different behavior of aggregate consumption in the two alternative scenarios of tax rules lies in our previous discussion, and can be supported by

[6] The remaining parameters are set as in Table 1 above.

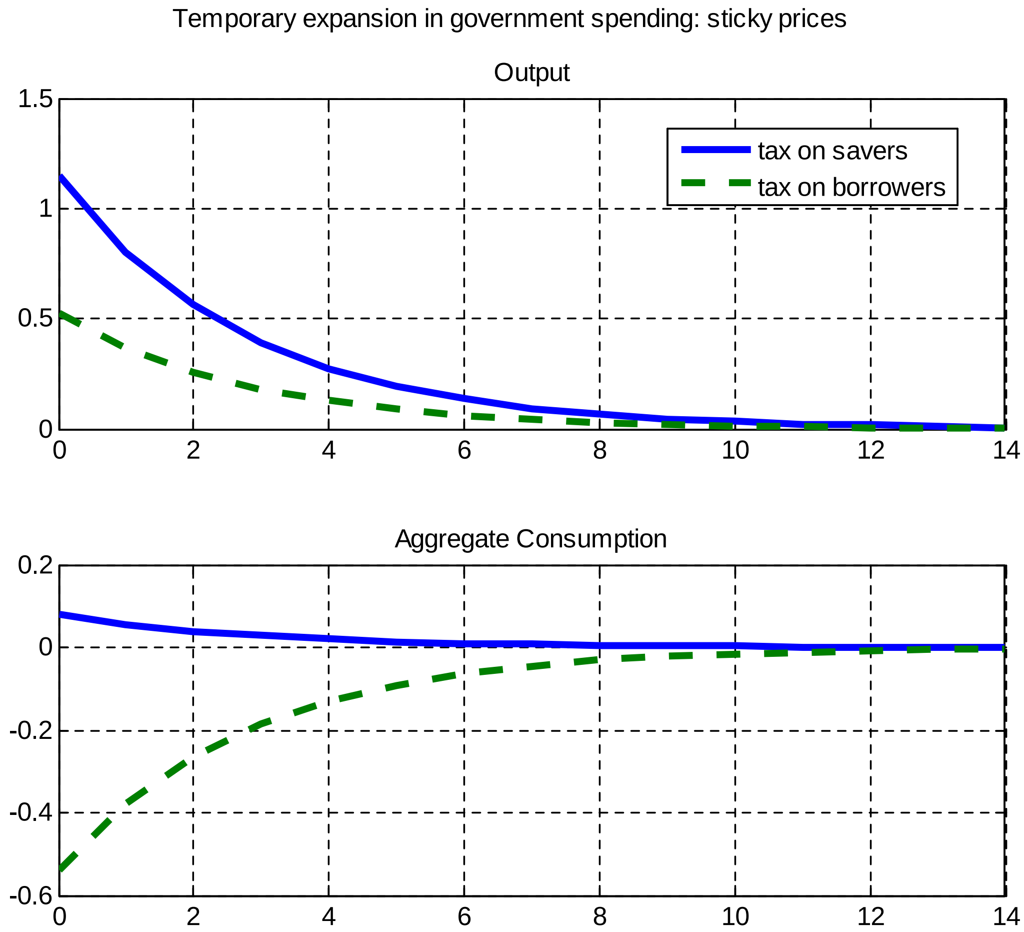

Figure 4: Effects on aggregate output and consumption of a rise in government spending under sticky prices.

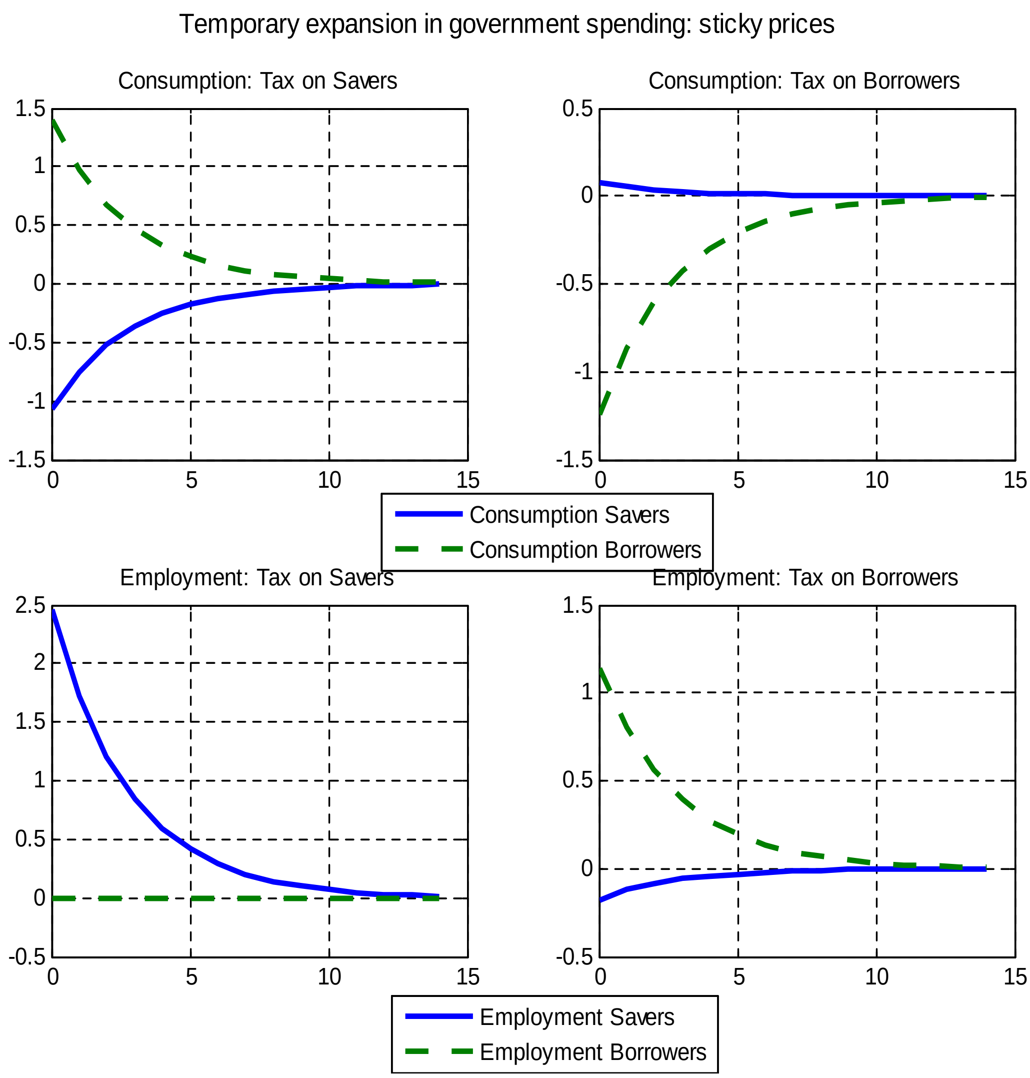

Figure 5: Responses of individual consumption and employment to a rise in government spending under sticky prices.

inspecting Figure 5 below. As it is clear, when taxes are increased to the savers, their consumption falls, due to the combined effect of a higher real interest rate and higher taxes. But, in contrast, borrowers' consumption rises, due to the fall in the finance premium ψ_t. The net effect is a moderate expansion in aggregate consumption (*crowding-in*). In contrast, in the scenario in which taxes are increased to the borrowers, their consumption falls, but savers' consumption barely reacts, for it is orthogonal to movements in the finance premium, which is now rising, due to the tightening of the borrowing constraint (the effect on savers' consumption depends only on the riskless real interest rate, but this effect is dampened under sticky prices). The result is a typical crowding-out effect of (aggregate) consumption.

To summarize, in our economy with sticky prices and imperfect financial markets, output multipliers exceeds one when the expansion in government spending produces a loosening in the borrowing conditions, which in turn crowds-in the consumption of the borrowing-constrained agents. Loosened financial conditions emerge when the brunt of the adjustment is borne by the savers, in the sense that it is only the savers that face the rise in taxes necessary to insure a balanced government budget.

4.1.2 How much pro-savers can the tax mix be?

The above observation raises the following question: how sensitive is the multiplier to the composition of the tax adjustment? In other words: to what extent can the tax scheme be skewed against the borrowers without sacrificing too much in terms of the size of the multiplier? Figure 6 displays the effects on the size of the (impact) output multiplier of varying the share of taxes levied on the borrowers, under alternative degrees of prices stickiness (measured in quarters of duration).

Several results stand out. First, in all cases considered, the larger the share of taxes levied on the constrained agents, the smaller the multiplier. Second, unless the degree of price stickiness exceeds two quarters, the multiplier never exceeds one, regardless of the assumed tax redistribution scheme. Third, in the baseline case of four-quarter price stickiness, the output multiplier exceeds one for a share of taxes on the borrowers that

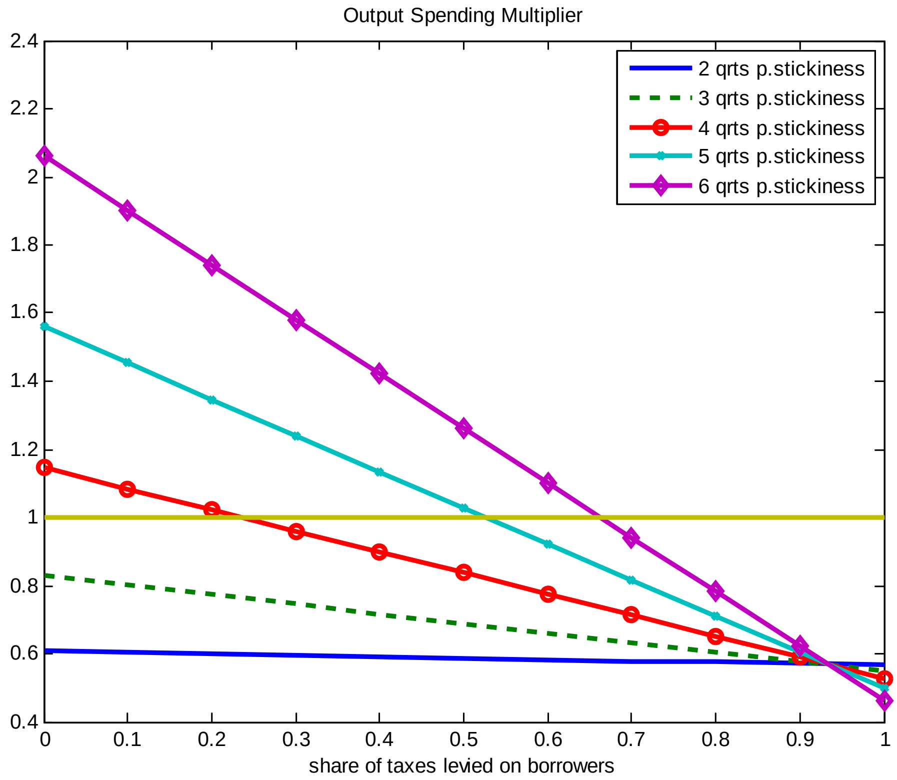

Figure 6: Effect on the mulitplier of varying the share of constrained borrowers' taxes for alternative degrees of price stickiness.

can reach up to 25 percent. Fourth, increasing the degree of price stickiness produces a twofold effect on the relationship between the multiplier and the tax mix: that relationship simultaneously shifts outward and becomes steeper. As a result, for a share of borrowers' taxes equal to zero, the multiplier can reach a value as high as two; and for degrees of price stickiness that exceed four quarters, the tax mix can become severely biased against the borrowers (i.e., being strongly regressive) and still a fiscal expansion produce output multipliers that exceed one. For instance, in a scenario with a degree of price stickiness equal to four quarters, the borrowers' share of the tax burden can reach up to 70 percent and the multiplier still exceed one.

4.1.3 The role of persistence

Usually output multipliers are particularly enhanced by the persistence of government spending shocks. This holds, for instance, in the seminal analysis of Baxter and King (1993), which is based on a representative-agent, perfect financial market neoclassical model. Intuitively, relatively more persistent shocks to government spending exert a stronger impact on permanent income, thereby enhancing the wealth effect on labor supply. In our economy with sticky prices and borrowing frictions, however, the implications of persistence are somehow the opposite.

Let $dY_g^j(k)$ be the impulse response of output at horizon k to a temporary unanticipated balanced-budget expansion in government spending under tax financing rule j (i.e., $j = s$ indicates that taxes are increased to the savers, whereas $j = b$ indicates that taxes are increased to the borrowers). Figure 7 displays the gap, $\Delta Y_g(1)$, between the impact multiplier on output obtained under the savers' tax financing rule and the one obtained under the borrowers' tax financing rule, i.e.,

$$\Delta Y_g(1) \equiv dY_g^s(1) - dY_g^b(1).$$

The gap $\Delta Y_g(1)$ is plotted against a range of values for the persistence in the government spending process (ρ_g in equation (10)).

A few observations are in order. First, notice that the lower the persistence of the government spending innovation, the larger the gap between the multiplier obtained under the savers' tax financing rule and the one obtained under the borrowers' tax financing rule. The intuition for this result is as follows. Lower persistence makes the inability of borrowers to smooth consumption particularly limited. As we have concluded from the previous analysis, however, it is essentially the behavior of borrowers' consumption that affects the magnitude of the output multiplier in response to variations in government purchases. Hence the more temporary the expansion in government spending, the larger the fall in the finance premium, and therefore the larger the expansion in borrowers' consumption. This heightened sensitivity of borrowers' consumption makes output multipliers larger under the savers' tax financing rule relative to the borrowers' tax financing rule.

Second, notice that the multiplier gap $\Delta Y_g(1)$ tends to zero, and becomes even negative, as the persistence parameter in the government spending shock approaches 1. In other words, as the fiscal expansion tends to be permanent, the role of intertemporal substitution in consumption tends to vanish.

Thus the main implication of Figure 7 is that the effect on the output multiplier of varying the tax financing rule depends crucially on the strength of the intertemporal substitution effect relative to the wealth effect. When the shock tends to be permanent, the wealth effect tends to be the only driver of the variation in government spending. In that case, our main result is reversed: it is fiscal expansions financed via an increase in *borrowers*' taxes that produce larger output multipliers (from which it follows that $\Delta Y_g(1)$ tends to be negative as $\rho_g \to 1$). Intuitively, the intensity of the wealth effect on labor supply is stronger for borrowing-constrained agents than for unconstrained agents. Hence, when their taxes are increased, the borrowers will increase their labor supply relatively more than the savers.[7]

5 Debt-financed fiscal expansions

So far we have limited our attention only to balanced-budget fiscal expansions. As a result, a rise in government spending had to be accompanied by a simultaneous rise in taxes of equal magnitude (on either category of agents). In this section we turn our attention to the determinants of the government spending multiplier when fiscal expansions are *debt-financed* .

In order to introduce a role for government debt we modify our economy as follows. We assume that government bonds are purchased by the patient agents, who also save in the

[7]Notice that, strictly speaking, the picture is not informative about the impact of unanticipated *permanent* rises in government spending (i.e., the effect of a permanent shock to spending is not the limit effect of a temporary, but highly persistent shock, as $\rho_g \to 1$). A permanent variation in government spending implies a permanent change in the steady state, and therefore standard local log-linearization techniques (as the ones employed so far) cannot be applied to solve for the transitional dynamics. In unreported results, however, we obtain that the insights of our analysis survive also in the case of purely permanent shocks.

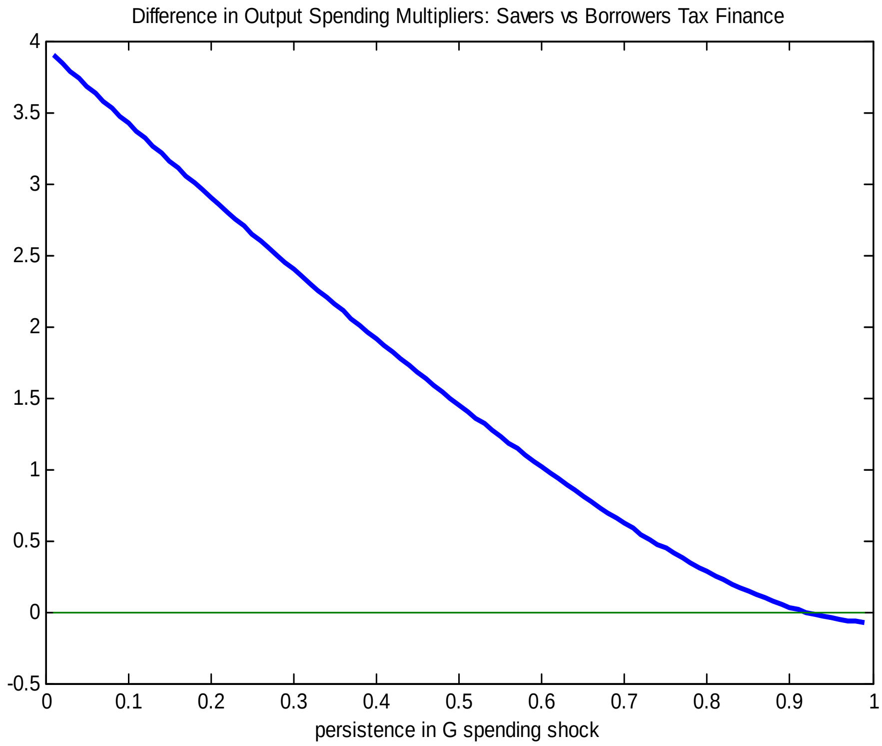

Figure 7: Effect of varying the persistence of the government spending innovation on the difference ouput multiplier $\Delta Y_g(1)$.

form of riskless nominal deposits. Deposits are intermediated by a financial sector, that in turn lends to the impatient agents, the ultimate borrowers. Intermediation frictions generate a wedge between the cost of borrowing faced by the impatient agents and the remuneration of deposits obtained by the savers.

The savers' budget constraint reads:

$$c_{s,t} + s_t + \mathcal{B}_t = \frac{i_{t-1}(s_{t-1} + \mathcal{B}_{t-1})}{\pi_t} + \frac{w_t}{p_t} n_{s,t} - \tau_{s,t} + \mathcal{P}_t, \tag{40}$$

where s_t denotes holdings of riskless nominal deposits, $\mathcal{B}_t$ denotes the holdings of government debt (both expressed in real consumption units), and i_t now denotes the nominal one-period interest rate on government bonds. Notice that nominal deposits and government bonds are perfectly substitutable in the savers' portfolio, and that all firms' profits accrue to the savers.

The borrowers' budget constraint reads:

$$c_{b,t} + \frac{(1 + i^d_{t-1}) d_{b,t-1}}{\pi_t} = d_{b,t} + \frac{w_t}{p_t} n_{b,t} - \tau_{b,t}, \tag{41}$$

where i^d_t is the nominal interest rate on one-period nominal private loans. Borrowers continue to face the following constraint on borrowing

$$d_{b,t} \leq \overline{d}_b \tag{42}$$

As in Curdia and Woodford (2009), we assume that the process of originating private loans by financial intermediaries requires the consumption of real resources.[8] The amount of resources needed to generate $d_{b,t}$ units of private loans is given by the increasing and convex function $\Omega\left(d_{b,t}\right) = (\kappa/\eta) d^{\eta}_{b,t}$, with $\eta > 1$ and $\kappa \geq 0$.

The balance sheet of the financial intermediaries therefore reads:

$$s_t = d_{b,t} + \Delta\left(d_{b,t}\right).$$

[8] We abstract here from other possible sources of credit spreads, such as risk of default.

Perfect competition among financial intermediaries implies:

$$(1 + i_t^d) = (1 + i_t)(1 + \delta_t),$$

where $\delta_t \equiv \Delta'(d_{b,t})$. Along with ψ_t (the multiplier on the borrowing constraint (42)), movements in δ_t constitute an additional source of variation in the borrowers' financial conditions.

The government finances an exogenous stream of government spending $\{g_t\}$ by issuing debt and by raising lump-sum taxes. Government spending follows the process:

$$g_t = (1 - \rho_g)g + \rho_g g_{t-1} + \varepsilon_{g,t} \tag{43}$$

The government budget constraint can be written:

$$g_t + \frac{(1 + i_{t-1})\mathcal{B}_{t-1}}{\pi_t} = \mathcal{B}_t + \sum_{j=s,b} \tau_{j,t} \tag{44}$$

Fiscal policy can be described by the following set of tax feedback rules:

$$\tau_{j,t} = (1 - \rho_\tau)\tau_j + \rho_\tau \tau_{j,t-1} + \phi_j^B \mathcal{B}_{t-1} + \varepsilon_{j,t} \qquad j = b, s \tag{45}$$

where $\phi_j^B > 0$, and $\varepsilon_{j,t}$ is an iid random disturbance. Finally, monetary policy continues to obey the feedback rule (29).

Our specification of the fiscal rules is deliberately simple. Each tax instrument evolves persistently and responds in the current period to the inherited real level of government debt. This specification rules out, for instance, any discretionary motive for output stabilization, as well as any explicit correlation between tax innovations and spending innovations.[9]

Parameters ϕ_j^B are the key redistribution parameters. We need to make an assumption on the value of ϕ_s^B relative to ϕ_b^B. In other words, when the government implements a

[9] See Leeper et al. (2010) for the specification and estimation of more elaborate tax rules. Notice that, for the sake of clarity, we rule out "reversals" in government spending. See Corsetti et al. (2010) for a detailed analysis of government spending reversals.

contraction in spending, and government debt therefore starts rising, how is the burden of the *future* adjustment of government debt distributed between the agents?

We study a temporary but persistent fiscal contraction under the following assumptions. We set $\phi_g^B = -0.1$, $\rho_g = \rho_\tau = 0.7$, and $\phi_s^B = 0.1$. We then let the burden of tax adjustment on borrowers, ϕ_b^B, vary from zero to alternative positive values (which also include $\phi_b^B = \phi_s^B = 0.1$, i.e., the case of equally-shared burden of adjustment).[10]

Figure 8 reports the effect on aggregate output and consumption of a rise in government spending under *flexible* prices and alternative values of parameter ϕ_b^B. In the baseline case ($\phi_b^B = 0$, solid line) the rise in government spending is financed by a simultaneous rise in government debt and by subsequent reductions in savers' taxes only. Higher values of ϕ_b^B correspond to alternative cases in which the burden of adjustment is phased in more equally. In general, output rises and we observe a (standard) crowding-out effect on consumption. More interestingly, we notice that the composition of the tax adjustment matters only to a very limited extent.

Figures 9 and 10 report the effects of the same experiment under the assumption of *sticky* prices. The effects of alternative tax distribution schemes are now significantly more pronounced, with output rising more sharply and persistently for higher values of ϕ_b^B. The key difference in the scenario with sticky prices is the (short-run) *crowding-in* of aggregate consumption, which contrasts sharply with the crowding-out effect under flexible prices.

We begin by analyzing the baseline case of $\phi_b^B = 0$, i.e., when only *savers*' taxes adjust to insure the future reversal in debt (solid line in both figures). Accordingly, savers' consumption falls, whereas borrowers' consumption rises, due to the fall in the finance premium (financial conditions improve for the borrowers due, once again, to the simultaneous rise in inflation and the real wage).

Notice that the dynamic of government debt differs significantly across the scenarios considered. Government debt rises more quickly and persistently in the baseline case of

[10]We calibrate $\kappa = 0.01$, $\eta = 1.01$. These values, combined with $\beta = 0.97$ and $\gamma = 0.99$, yield a steady state finance premium $\psi = 1\%$, and an interest rate spread $(1 + i^b)/(1 + i) \approx 2\%$.

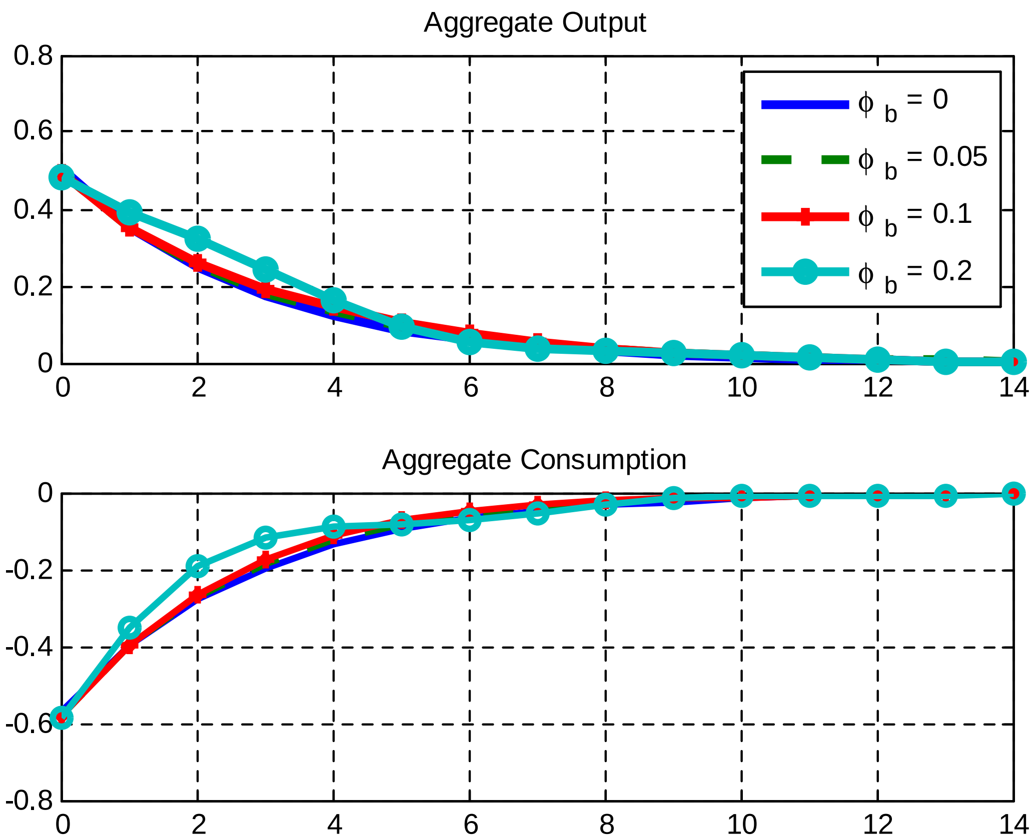

Figure 8: Responses of aggregate output and consumption to a rise in government spending under alternative values of parameter ϕ_b^B (ϕ_s^B kept equal to 0.1): *flexible* prices

$\phi_b^B = 0$, i.e., the case in which it is only savers' taxes that adjust to insure the future reversal in debt. Intuitively, it is by encouraging saving by the holders of government bonds (the savers) that the rise in government debt can be more quickly absorbed. The evolution of government debt, however, impacts on the equilibrium in the (private) credit market. A quicker run-up in government debt puts an upward pressure on the shadow value of borrowing (the finance premium). In the savers' portfolios, in fact, government bonds and banks' deposits are perfectly substitutable. When saving is more biased towards an increase in government bonds as opposed to deposits, the fall in the finance premium is more muted.

Higher values of ϕ_b^B tend to spread the adjustment of taxes between the two agents more evenly. Hence, for $\phi_b^B > 0$, also borrowers' taxes start to rise. For higher values of ϕ_b^B, the expansion in saving happens relatively *less* via government debt and relatively more via a rise in deposits, implying a stronger downward pressure on the finance premium. Hence the model generates an interesting general equilibrium relationship between the path of government debt and the finance premium in private credit markets. Noticeably, this channel is absent in the version of the model without government debt.

To summarize, the quicker the run-up in government debt, the less pronounced the reduction in the finance premium. But the slope of the run-up in government debt depends on the type of tax redistribution scheme. The more biased the tax adjustment in favor of the savers, the slower the run-up in government debt, and therefore the more pronounced the relaxation of the financial constraint for the borrowers.

Thus, somewhat paradoxically, the borrowers *gain* in the short-run from sharing part of the rise in the tax burden. Figure 9 shows in fact that the output multiplier rises for higher value of ϕ_b^B. Higher values of ϕ_b^B, however, tend to steepen the time profile of output, which more rapidly falls below steady state in the subsequent periods. Overall, these results highlight interesting general equilibrium interactions between tax policy, the evolution of government debt, and the conditions in financial markets.

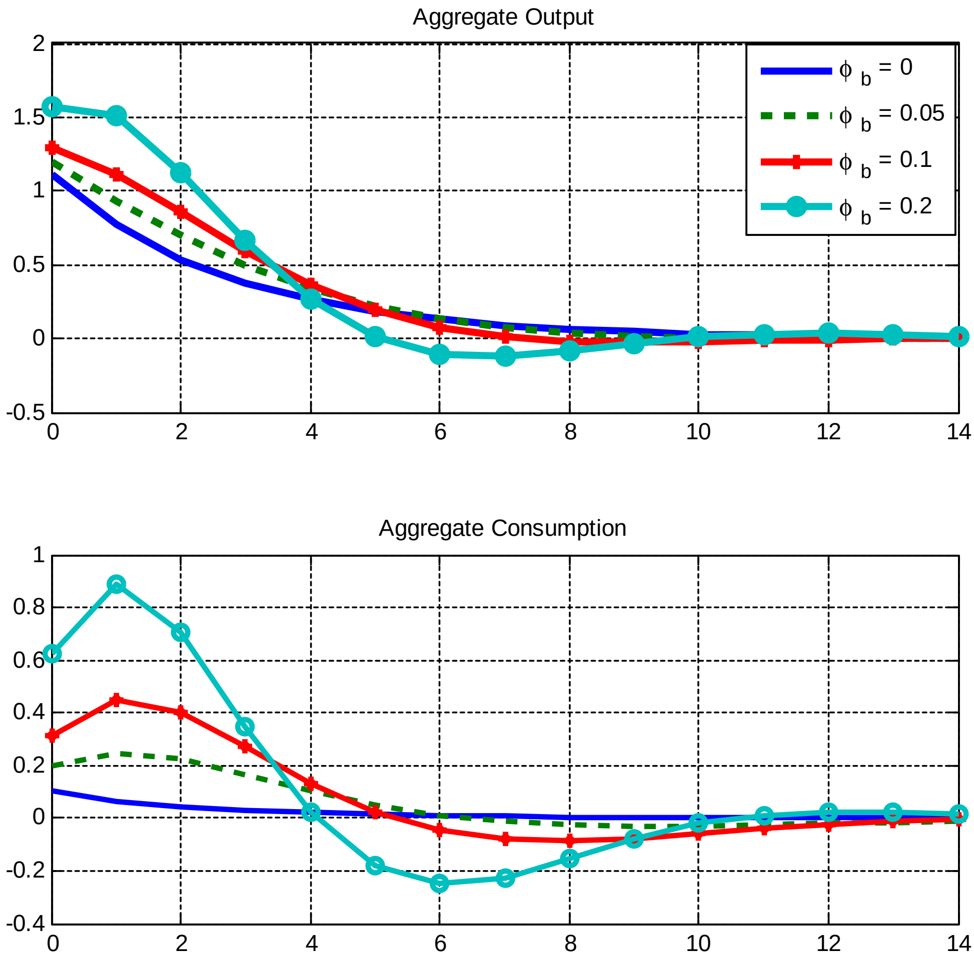

Figure 9: Responses of aggregate output and consumption to a rise in government spending under alternative values of parameter ϕ_b^B (ϕ_s^B kept equal to 0.1): *sticky* prices

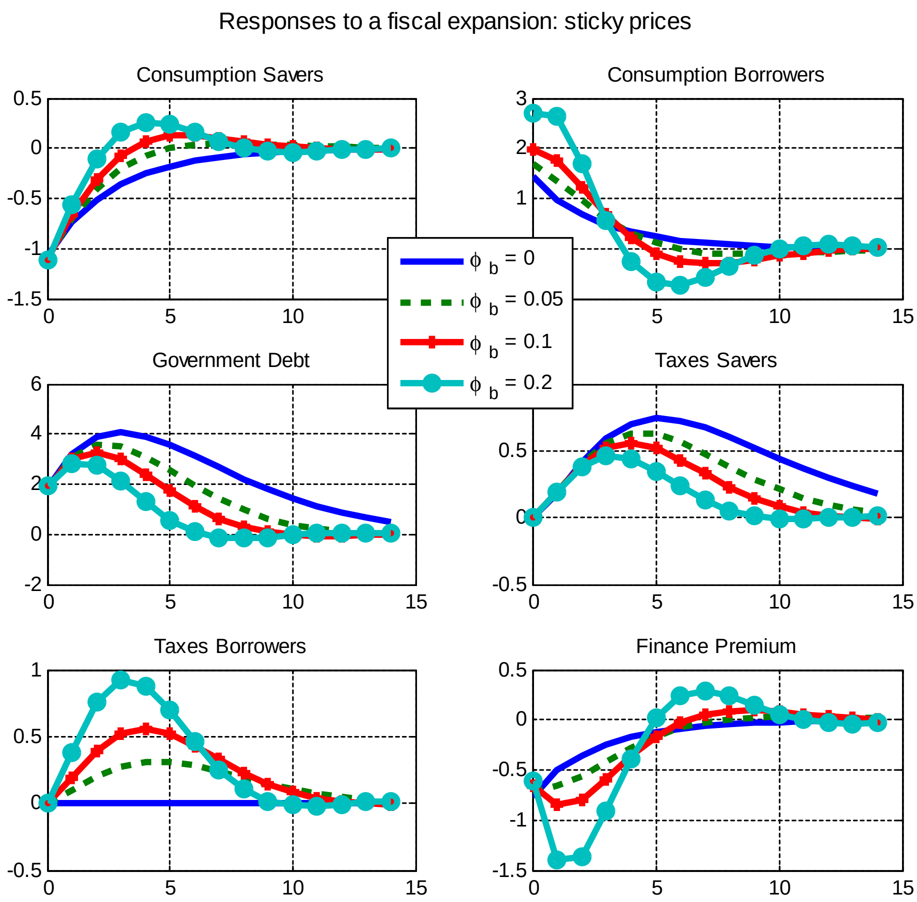

Figure 10: Responses of selected individual variables to a rise in government spending under alternative values of parameter ϕ_b^B (ϕ_s^B kept equal to 0.1): *sticky* prices

6 Conclusions

In the standard analysis of the multiplier of government spending, whether based on a neoclassical or NK model, any given rise in government spending must be financed with a rise in taxes. When these taxes are lump-sum (as it is often assumed), the same rise in taxes generates, at most, a wealth effect. In our framework with heterogenous agents and borrowing constraints, a given change in lump-sum taxes triggers, via redistribution, significant intertemporal substitution effects. This feature, coupled with price rigidity, can yield multipliers comfortably above one.

For any given degree of price stickiness, the multiplier is larger the more skewed the tax redistribution in favor of the borrowers. For a sufficiently high degree of price stickiness, however, even tax redistribution schemes that are heavily biased against the borrowers can be consistent with multipliers that exceed one. When a rise in spending is debt-financed, the run-up in government debt puts an upward pressure on the credit premium in private financial markets. If government debt is held by the savers, taxing the borrowers can be more beneficial (relative to the balanced-budget scenario), for it allows to slow down the accumulation of debt and, via a relaxation of their borrowing constraint, boost their consumption.

Our analysis aims at highlighting the role of tax redistribution as a determinant of the multiplier of government spending. For the sake of illustration, however, the focus has remained deliberately simplified. Features that have remained outside the analysis include the role of: distortionary taxation, capital accumulation, and the endogenous determination of a risk premium on government debt. The development of these features will be the subject of future related research.

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