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TAXATION AND CAPITAL MARKET LIBERALIZATION:
A POLITICAL-ECONOMY MODEL

Edith Sand

*Taxation and Capital Market Liberalization:*
*A Political-Economy Model*

**EDITH SAND**

## Abstract

This paper investigates the effects of financial liberalization on the welfare state from a political-economy point of view. Most research on the subject does not treat financial liberalization as a political process, but take the changing economic environment as exogenously given. This is the essence of the tax competition literature, which reaches the conclusion that under full capital mobility countries compete over a fixed amount of international capital by undercutting each others' tax rates, effectively engaging in a "race to the bottom" in tax rates. The present paper addresses these issues, but unlike the basic line of argument of the tax competition literature, it concentrates on the domestic political forces that could have contributed to the process of financial liberalization. Within an OLG political-economy framework, decisions regarding capital tax rates and the extent of capital market liberalization are made concurrently. The model's main result is that when the tax rate on capital income is established in the political process along with the restrictions on capital outflows, and when income of foreign origin cannot be taxed, there is a positive correlation between the two policy decisions. This positive correlation occurs because the tax rate is chosen in the political process so as to offset the effect of capital flight due to less restriction on capital outflows. In addition, the effect of a change in the distribution of income resulting from the aging process is tested. In a closed economy, an increase in the proportion of the population that derives its income from capital lowers the tax rate on capital income. The introduction of an additional policy target, the extent of capital mobility, creates additional forces that have offsetting effects. An increase in the proportion of the elderly generates political pressure for a more liberal capital controls policy. A less restrictive policy toward capital outflows, in turn, leads to heavier capital taxation in order to offset the depletion of the economy's capital-tax base.

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# 1  Introduction

According to a vast body of literature dealing with the effect of globalization on the welfare state, there is an underlying impact of financial liberalization on the tax system which creates downward tax competition (surveyed by Wilson (1999), and Fuest et al. (2005)). The tax competition literature predicts that removing restrictions on capital mobility, leads countries to compete over foreign investment. The process of doing so is said to reduce tax differentials among nations and results in a downwards convergence of countries' tax rates. Although there has been a substantial financial liberalization in recent years, the notion of an increasing "race to the bottom" in capital taxes, which has been the subject of a growing theoretical literature, has been supported by little empirical evidence.

There has been some inconclusive empirical evidence regarding the correlation between the degree of openness to capital flows and the rates of taxes on capital across countries. Garrett (1996, 1998a,b) finds that capital market liberalization is not correlated with total revenues or personal income, consumption, corporate, or social security taxes as shares of GDP in developed capitalist democracies over the period 1970-1990. Quinn (1997) considers a group of 64 countries with annual data averaged over the years 1974–89 and concludes that corporate taxation is positively associated with financial liberalization. These findings are supported by Swank (1998). In a panel regression for 17 industrialized countries (mainly OECD countries) for the period 1966–93, he finds that three different measures of capital mobility are positively related to the proxy of corporate taxation. On the other hand, some studies reach somewhat different results. Rodrik (1997) considers a large set of countries (more than one hundred) over the period 1985-1992 and shows that relaxing capital restrictions is associated with declines in effective tax rates on capital. Slemrod (2003) finds that measures of openness are negatively associated with statutory corporate rates, although not with revenues collected as a fraction of GDP. Mendoza and Tesar (2005) calibrate a Neoclassical general equilibrium model of tax competition according to a sample of European countries over the period 1970-1996, and find that the fact that there is no "race to the bottom" in capital taxes could be explained by the labor tax adjustments that maintains fiscal solvency. A recent paper by Mateos-Planas (2009), which calibrates an overlapping-generations model where agents live for many periods, and tax rates are determined through voting by forward-looking agents according to US data, shows that a shift towards an elderly voting-age population leads to a sharp increase in capital taxation.

These empirical examinations of tax competition have considered certain patterns of capital taxation, in particular convergence, or "race to the bottom", as evidence of tax competition. However, this conclusion is not convincing in the absence of some notion of what the pattern of tax rates over time would have been in the absence of international competitive pressures. The patterns of capital tax rates might indicate that the domestic determinants of capital tax rates, rather than competitive pressures, have converged. In other words,

convergence may be due to the fact that countries, or at least those aspects of countries that influence the setting of capital tax rates, have grown more alike. This is the main contribution of the present paper, which offers an alternative explanation to that offered by the tax competition literature, and illustrates how domestic political forces could have contributed to the empirical evidence regarding both the capital market liberalization process of recent years and the existence of offsetting forces on capital tax rates which could explain the ambiguity in the empirical evidence regarding convergence or a "race to the bottom", in capital tax rates.

By considering the financial market liberalization process not as an exogenous given, as does the "tax competition" literature, but rather as an endogenous policy variable, different results are obtained. The tax competition literature predicts that capital taxation is lower under full capital mobility than under zero capital mobility, as raising taxes has the additional cost of leading to outflows of capital. In contrast, the present paper shows that when the tax rate on capital income is established in the political process along with the restrictions on capital outflows there is a positive correlation between the two policy decisions when income of foreign origin cannot be taxed. This positive correlation occurs because the tax rate is chosen in the political process so as to offset the effect of capital flight due to less restrictions on capital outflows.

There is some empirical evidence that supports the fact that domestic political forces could have been one of the driving forces behind the process of capital market liberalization and could have influenced the formation of capital taxation. Examining a sample of fifteen OECD countries over the period 1970 to 1990, Garrett (1995) finds that countries dominated by left-wing parties and the trade unions had more controls on cross-border capital flows. In addition, he finds that the combination of left-labor power and high levels of capital and trade liberalization lead to increased government spending and budget deficits. Another paper by Alesina, Grilli and Milesi-Ferretti (1994) offers additional empirical support by analyzing a panel of 20 OECD countries in the period between 1950 and 1989. According to their empirical findings, left-wing governments have indeed been slightly more prone to impose capital controls than right -wing governments. Another paper confirming this empirical finding is that by Alfaro (2004), which shows that when the median representative is a worker (capitalist), capital-importing countries will tend to be more open (closed) to capital flows while capital-exporting countries will tend to be  more closed (open) to capital flow, according to a sample of 20 OECD countries in the period between 1966 and 1994.

Surprisingly few theoretical studies have treated the capital market liberalization process as deriving from domestic political forces. Alesina and Tabellini (1989) have analyzed the optimality of imposing capital controls for the purpose of maintaining a large tax base from a political economy perspective. In their model there are two social groups, "workers" and "capitalists", and two parties, each representing one of the social groups. The political uncertainty regarding future economic policies generates a fear of future capital taxation imposed by a left-wing government, which induce capitalists to export capital. Schulze (1992,

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1999) removes the dichotomy of capitalists and workers and allows individuals to own different amounts of capital and labor in order to use the median voter theorem. In his model restricting capital outflows (by imposing a tax on dividends earned abroad) increases domestic capital, and hence increases wage and reduces capital gains. Thus, individuals' preferences over capital control will be determined by their capital endowment relative to labor endowment, which will lead to the result that if the median voter's factor ownership ratio is below average, capital exports will be restricted only if the marginal product of domestic capital is lower than the interest rate abroad. Another paper by Bjerksund and Schjelderup (1998) considers a similar framework with an endogenously given labor supply and finds that a small open economy will restrict the free movement of capital regardless of the shape of the political support function of the government given that residence taxation of foreign source income is unenforceable, although these restrictions will be tighter if the government places more emphasis on the well-being of workers relative to capitalists. Moreover, they show that with imperfect capital mobility, it is optimal to levy a positive source-based tax on capital income as well as a positive labor tax. Bartolini and Drazen (1997) suggest that capital market liberalization can act as a signal of lower capital tax in the future. Countries with good alternative sources of revenue will allow free capital mobility in order to achieve a higher expected capital tax levy but a lower capital tax levy in bad states of nature, while governments without such alternative sources will restrict capital, and will benefit from a higher capital tax levy in bad states of nature but a lower expected capital tax levy.

The main conceptual difference of the current research is that it considers the political determination of both policy variables- capital taxation and capital control restriction- under the assumption that foreign source income cannot be effectively taxed, which reveals a mutual offsetting effect between the two policy decisions. This is due to the fact that a more open policy towards capital flows can lead to a lower capital tax base, which can in turn increase the preferred tax rate. In addition, the paper considers the effect of a change in the political balance of power between individuals with different shares of capital income, resulting from the process of aging. An increase in the political power of the old individuals who have a higher share of income derived from capital accumulation, increases the demand for greater openness of the economy towards capital outflows. The tax rate on the other hand is affected by offsetting forces: on the one hand a change in the political balance of power lowers the demand for higher capital tax rates, but on the other hand, since higher openness to capital outflow reduces the tax base of the economy, it can lead to an opposite effect on capital tax rates.

Within an OLG political-economy framework, decisions regarding capital tax rates and the extent of capital market liberalization are made concurrently. A single good is produced using capital and labor as production factors. Tax is levied on old domestic capital income and the revenue is redistributed to both cohorts. Each cohort lives for two periods, supplying labor when young and earning income at the net rental rate from capital accumulation when old. Assuming an exogenously given world rate of interest, capital income may be

generated by investing either in the domestic economy or abroad up to a ceiling rate that represents the capital-control policy. The young make investment decisions according to the difference between the domestic and foreign net return to capital, either by investing a maximal or minimal amount of capital abroad. Capital-control policy is set endogenously in the political-economy system along with the tax rate on domestic income. The paper considers two perfect Markov equilibria: the first equilibrium is with restricted forecasting ability that allows for analytical insights and the second equilibrium with perfect forecasting ability, obtained numerically by relaxing the myopic characterization of voters. The model's main result is that when the tax rate on capital income is established in the political process along with the restrictions on capital outflows, and when income of foreign origin cannot be taxed, there is a positive correlation between the two policy decisions. This positive correlation occurs because the tax rate is chosen in the political process so as to offset the effect of the capital flight due to less restriction of capital outflows. In a closed economy, an increase in the share of the population that derives its income from capital lowers the tax rate on capital income. The introduction of an additional policy target, the extent of capital mobility, creates additional forces that have offsetting effects. An increase in the proportion of the elderly generates political pressure for a more liberal capital-control policy. A less restrictive policy toward capital outflows, in turn, leads to heavier capital taxation in order to offset the depletion of the capital-tax base of the economy.

The outline of the rest of the paper is as follows. Section 2 sketches the general framework of the economy. Section 3 describes the political economy equilibrium in two settings: the first is the perfect Markov equilibrium with restricted forecasting ability and the second is the perfect Markov equilibrium with perfect forecasting ability. Section 4 examines the effect of aging. Section 5 concludes.

## 2   The Model

The model is populated by overlapping generations of individuals who live for two periods. The population growth rate is constant. When young, an individual works and supplies one unit of labor inelastically. When old, the individual retires, earns income at the rental rate from capital accumulation, and pays a flat tax on domestic capital income. Transfer payments are paid in both periods.

Labor and capital are used as inputs to manufacture a homogenous final good according to the standard Cobb-Douglas production function,

$$Y_t = N_t^\alpha K_{d,t}^{1-\alpha}, \tag{1}$$

where $\alpha \in (0,1)$, $Y_t$ is output, $N_t$ are the number of individuals born and working in period $t$, and $K_{d,t}$ is the domestic capital stock in period $t$. In other words, the domestic saving of the young in period $t-1$ generates the domestic capital stock that produces the output in period $t$ in combination with the labor supplied by the young in period $t$. The population grows at a constant growth

rate $n$, so that $N_t = N_o(1 + n)^t$. Capital is assumed to depreciate completely at the end of the period.

The utility of a young individual born in period $t$ is an additively logarithmic function:

$$U(c_t^y, c_{t+1}^o) = Log(c_t^y) + \beta Log(c_{t+1}^o), \tag{2}$$

where $c_t^y$ and $c_{t+1}^o$ denote his consumption when young and old respectively, and $\beta \in (0, 1)$ is the discount rate. His life-time budget constraint is:

$$c_t^y + \frac{c_{t+1}^o}{1 + \overline{R}_{t+1}} = w_t + b_t + \frac{\theta b_{t+1}}{1 + \overline{R}_{t+1}}, \tag{3}$$

where $\overline{R}_{t+1}$ is the net-of-tax interest rate, $w_t$ is the wage rate and $b_t$ and $b_{t+1}$ are transfer payments in periods $t$ and $t + 1$. The parameter $\theta$ refers to the amount of intragenerational transfer payments: the case where transfers are paid uniformly to both generations is represented by $\theta = 1$, whereas $\theta = 0$ represents the case where transfers are paid only to the young[1].

The economy is small and open, but with restricted capital mobility. Capital income can be obtained by investing either in the domestic economy or abroad, up to a ceiling rate. The net-of-tax interest rate $(\overline{R}_{t+1})$, which consists of the average sum of the net-of-tax interest rate of the domestic economy $(R_{t+1})$ and the world net-of-tax interest rate $(R^*)$ weighted by the individual's percentage of capital holding invested abroad $(\gamma_{t+1})$, is given by[2]

$$1 + \overline{R}_{t+1} = [(1 + R_{t+1})(1 - \gamma_{t+1}) + (1 + R^*)\gamma_{t+1}], \tag{4}$$

where the world rate of interest $(R^*)$ is assumed to be exogenously given and constant over time. The percentage of capital that individuals are permitted to invested abroad is limited to a ceiling rate $(\overline{\gamma})$, which represents the restriction on capital outflows from the economy:

$$\gamma_{t+1} \leq \overline{\gamma}_{t+1}. \tag{5}$$

The tax-transfer system is pay as you go, where the government is assumed to levy a flat capital-income tax, denoted by $\tau_t$, which fully finances the transfer payment in the same period. Under the assumption that foreign-source income cannot be taxed, tax is levied only on domestic capital income. In other words, the domestic capital taxation of the old in period $t$ is redistributed to the young

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[1] The effect of aging on the steady state is obtained for $\theta = 0$ analytically. Appendix I derives numerical results for the general case where tax revenue, are redistributed to both young and old (i.e. $\theta = 1$). Note that both cases yield the same qualitative results regarding the effect of aging on the policy variables.

[2] Note that writing capital controls in absolute terms does not change the results; it is just a matter of notation. Since the amount of capital saved in the last period is given, instead of referring to capital controls as a proportion of savings, which sets the amount of capital invested abroad at $\gamma_t K_t$, with the rest, $(1 - \gamma_t)K_t$, invested domestically, one could change the notation to $B_t$ and $K_{d,t}$ respectively, where if the total amount of capital is $K_t$, the following equation should hold: $K_t = K_{d,t} + B_t$.

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and old of the same period (depending on the value of $\theta$), which generates the following balanced government budget constraint:

$$b_t(N_t + \theta N_{t-1}) = \tau_t r_t s_{d,t} N_{t-1}, \tag{6}$$

where $r_t$ is the domestic interest rate and $s_{d,t}$ is the average input of domestic savings (per old). Since the number of the young in each period is $(1+n)$ times greater than the number of the old, re-arranging the expression yields:

$$b_t = \frac{\tau_t r_t s_{d,t}}{1 + \theta + n}. \tag{7}$$

The wage rate and rate of return are determined by the marginal utility conditions:

$$w_t = \alpha(1+n)^{\alpha-1} k_{d,t}^{1-\alpha} \tag{8}$$

$$r_t = (1-\alpha)(1+n)^{\alpha} k_{d,t}^{-\alpha} - 1, \tag{9}$$

where $k_{d,t}$, is the average domestic capital stock per old.

Young individuals choose their level of savings $(s_t)$ and the percentage invested abroad $(\gamma_{t+1})$, so as to maximize their utility subject to their life-time budget constraint. The young have to decide on the percentage to invest abroad $(\gamma_{t+1})$. The decision on the percentage to invest abroad depends on the ratio of the next-period net return to capital in the domestic economy and abroad, and is given by

$$\gamma_{t+1} = \begin{cases} 0 & if \quad R_{t+1} > R^* \\ \overline{\gamma}_{t+1} & otherwise \end{cases}. \tag{10}$$

The saving-consumption decision is given by:

$$s_t = \begin{cases} \frac{1}{1+\beta}(\beta(w_t + b_t) - \frac{\theta b_{t+1}}{1+R_{t+1}}) & if \quad R_{t+1} > R^* \\ \frac{1}{1+\beta}(\beta(w_t + b_t) - \frac{\theta b_{t+1}}{1+\overline{R}_{t+1}}) & otherwise \end{cases}. \tag{11}$$

Without loss of generality, foreign investment is assumed to be zero. According to the market clearing condition, the savings of the young generate next-period capital:

$$s_t = k_{t+1}(1+n), \tag{12}$$

where domestic capital invested per capita is defined by

$$k_{d,t+1} = \begin{cases} k_{t+1} & if \quad R_{t+1} > R^* \\ k_{t+1}(1 - \overline{\gamma}_{t+1}) & otherwise \end{cases}. \tag{13}$$

This completely describes the private sector decisions and aggregate variable formation given the tax-control policy. By deriving the economic response to a given policy, we can proceed to define the political equilibrium of the economy. The general setting of the political process is first described and then two different versions of the political equilibrium will be presented.

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# 3   The Political-Economic Equilibrium

The political mechanism through which policies are chosen is a probabilistic voting framework. The election involves two identical politicians, who offer policy platforms to the voters in order to maximize their vote share. The main feature of the probabilistic voting model is that it introduces uncertainty from the candidate's viewpoint about the mapping of voting behavior. For example, as we further assume, candidates can have a distribution of ex-ante evaluations of the voters' ideological positions. Thus parties choose their platforms to maximize the expected number of voters, which can be viewed as maximizing the weight sum of the group's utility, where the weights stand for the degrees of "responsiveness" of each group. This framework also helps to solve the equilibrium of games with multidimensional policy conflict as described in this paper. These cases are often characterized by discontinuity in the objective function, which creates a cycling problem and no Condorcet winner. The probabilistic voting framework smoothes out the policy objective, which allows the existence of a Nash equilibrium.

Note that the results of the model also holds in a majority voting model with initial agents endowment heterogeneity. According to the conclusion of a representative agent model (Sand (2003)), a similar positive correlation between capital income tax and capital control policy arises, leading to an offsetting effect on capital income taxes following a change in the initial income distribution.

The political process of probabilistic voting can be formalized in the following way: denote the ideological bias toward candidate $B$ of voter $i$ from group $j \in \{y, o\}$, where $y$ and $o$ refer to the young and old respectively, by $\sigma^{ij}$. This parameter has a uniform and symmetrical distribution around zero, with the cumulative distribution function $F^j$, and the density parameter $f^j$. Then, voter $i$ from group $j$ has a preference for the policy implemented by candidate $A$ that can be summarized by $v^j(\pi_t^A)$, while his preference for the policy implemented by candidate $B$ can be written as

$$v^j(\pi_t^B) + \sigma^{ij}, \tag{14}$$

where $\pi_t = (\tau_t, \overline{\gamma}_t)$ is the policy platform vector offered by the candidates, which consists of the tax and openness policy, and $v^j$ is the indirect utility function of voter $i$ from group $j$.

Then, voter $i$ from group $j$ will vote for candidate A if,

$$\sigma^{ij} \leq v^j(\pi_t^A) - v^j(\pi_t^B), \tag{15}$$

to which the candidate assigns the following probability:

$$F^j(v^j(\pi_t^A) - v^j(\pi_t^B)), \tag{16}$$

Note that since the problem is symmetrical both politicians converge to the same platform. The maximization problem of the representative is to select an election platform, $\pi_t^A = (\tau_t^A, \overline{\gamma}_t^A)$, that maximizes the expected number of votes ($V$), given his competitor's platform ($\pi_t^B$):

$$E(V) = \max_{\pi_t^A}(1+n)F^y(v^y(\pi_t^A) - v^y(\pi_t^B)) + F^o(v^o(\pi_t^A) - v^o(\pi_t^B)). \qquad (17)$$

The two political equilibrium concepts discussed are based on the Markov perfect equilibrium notion. In the first case, agents are assumed to have restricted foresight abilities and thus do not take into account the Markov strategy which had been used by previous generations. This assumption greatly simplifies the problem and allows us to derive analytical results for the case where transfer payments are paid only to the young, i.e. $\theta = 0$. In the second case this assumption is relaxed, allowing agents to have perfect foresight abilities, in the sense that they internalize the fact that next-period strategies are derived from a Markov strategy profile.

The Markov Perfect equilibrium definition for the restricted foresight model is as follows:

**Definition 1** *A sub-game Markov perfect political equilibrium is defined as a vector of policy decision rules $\Pi = (T, G)$ and private decision rule $S$, where $T : [0, 1] \longrightarrow [0, 1]$ is the tax policy rule $\tau_t = T(k_t)$, and $G : [0, 1] \longrightarrow [0, 1]$ is the capital control policy rule $\gamma_t = G(k_t)$, and $S : [0, \infty)-> [0, \infty)$ is the saving decision rule $k_{t+1} = S(k_t, \pi_t, \pi_{t+1}^*)$, such that the following functional equations hold:*

*1. $\widehat{\Pi}(k_t) = \arg\max_{\pi_t^A} E(V(k_t, \pi_t^A, \pi_t^B, \pi_{t+1}^*))$ where $\pi_{t+1}^*$ denotes the vector of exogenous future decision rules and $\pi_t^B$ denotes the competitor's platform.*

*2. $S(k_t, \pi_t, \pi_{t+1}^*) = \frac{1}{1+\beta}(\beta(w_t + b_t) - \frac{\theta b_{t+1}}{1+\overline{R}_{t+1}})$.*

*3. The fixed-point condition requires that if the next-period policy outcome is derived from a given exogenous vector of future decision rules $\pi_{t+1}^* = \Pi(k_{t+1})$, the maximization of the expected number of votes subject to the law of motion of the capital stock will reproduce the same law of motion, $\widehat{\Pi}(k_t) = \Pi(k_t)$.*

**Proposition 2** *The equilibrium equations are given implicitly in the appendix [3]. The steady state equations for the case where transfer payments are redistributed only to the young (i.e. $\theta = 0$) are given explicitly by the following equations:*

$$\begin{array}{ll} \overline{R}(k, \overline{\gamma}^*, \tau^*) - \alpha\frac{\beta}{1+\beta}(1-\tau^*)(1-\overline{\gamma}^*)r(k, \overline{\gamma}^*) = \frac{f^o}{f^y} & if \quad R(\tau^*, \overline{\gamma}^*) < R^* \\ \overline{R}(k, \tau^*) - \alpha\frac{\beta}{1+\beta}(1-\tau^*)r(k) = \frac{f^o}{f^y} & if \quad R(\tau^*) > R^* \end{array}$$
$$(18)$$

$$\begin{array}{ll} (1+n)(1-\alpha)[\frac{-\overline{R}(k,\overline{\gamma}^*,\tau^*)}{1-\overline{\gamma}^*}\frac{(1+b)}{b} + \alpha(1-\tau^*)r(k, \overline{\gamma}^*)] = & \\ \frac{f^o}{f^y}(R(k, \overline{\gamma}^*, \tau^*) - R^* - \alpha r(k, \overline{\gamma}^*)(1-\tau^*)) & if \quad R(\tau^*, \overline{\gamma}^*) < R^* \\ \overline{\gamma}^* = 0 & if \quad R(\tau^*) > R^* \end{array}$$
$$(19)$$

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[3] Note that the restricted foresight equilibrium is obtained for a close enough range around the steady state due to the complexity of the first order conditions, which only allows the formation of linerarized decision rules around the steady state.

$$k = \left( \tfrac{\beta}{1+\beta}(1+n)^{\alpha-1}(1-\overline{\gamma}^*)^{1-\alpha}(\alpha+(1-\alpha)\tau^*) \right)^{\frac{1}{\alpha}} \quad if \quad R(\tau^*,\overline{\gamma}^*) < R^*$$

$$k = \left( \tfrac{\beta}{1+\beta}(1+n)^{\alpha-1}(\alpha+(1-\alpha)\tau^*) \right)^{\frac{1}{\alpha}} \quad if \quad R(\tau^*) > R^*$$

$$(20)$$

The intuition for the equilibrium is as follows[4]. The optimal tax rate policy is set by equalizing the marginal increase in the expected number of young voters and the marginal decrease in the expected number of old voters; whereas capital control policy has the opposite effect. There are two contradictory effects of each of the policy variables on the young and old utility functions (given that the other policy variable is fixed): On the one hand, a higher tax rate increases the utility of the young by raising the transfer payment received, and lowers the utility of the old by decreasing the current net return from capital. On the other hand, a less restrictive policy toward capital outflows reduces domestic capital investment. Less capital reduces the wage rate and transfer payments of the young, and thereby decreases their utility, while it increases the current return to capital of the old, which raises their utility. In addition, there is a positive correlation between capital control policy and capital income taxes. Less restriction on capital results in a higher tax rate: a marginal increase in the tax rate raises the utility of the young less (since the tax base is smaller when there are less restrictions); but lowers the utility of the old even less (since it not only affects the domestic return to capital but also opens up investment opportunities abroad) due to lower control. In other words, the old are less reluctant from a marginal increase in the tax rate, resulting in higher tax on capital income.

The Markov Perfect equilibrium definition for the perfect foresight case, where agents internalize the fact that next-period strategy is derived from a Markov strategy profile, is as follows:

**Definition 3** *A Markov perfect political equilibrium is defined as a vector of policy decision rules $\Pi = (T, G)$ and private decision rule $S$ where $T : [0,1] \longrightarrow [0,1]$ is the tax policy rule $\tau_t = T(k_t)$ and $G : [0,1] \longrightarrow [0,1]$, is the capital control policy rule $\gamma_t = G(k_t)$, and $S : [0,\infty) -> [0,\infty)$, is the saving decision rule $k_{t+1} = S(\pi_t, \pi_{t+1}, k_t)$, such that the following functional equations hold:*

*1. $\widehat{\Pi}(k_t) = \arg\max_{\pi_t^A} E(V(k_t, \pi_t^A, \pi_t^B, \pi_{t+1}))$, where $\pi_{t+1} = \Pi(k_{t+1})$ denotes the vector of endogenous future decision rules and $\pi_t^B$ denotes the competitor's platform.*

*2. $S(k_t, \pi_t, \pi_{t+1}) = \frac{1}{1+\beta}(\beta(w_t + b_t) - \frac{\theta b_{t+1}}{1+\overline{R}_{t+1}})$.*

*3. The fixed-point condition requires that if the next-period policy outcome is derived from a given vector of endogenous future decision rules, $\pi_{t+1} = \Pi(k_{t+1})$, the maximization of the expected number of votes, subject to the law of motion of the capital stock, will reproduce the same law of motion, $\widehat{\Pi}(k_t) = \Pi(k_t)$.*

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[4]The case where tax revenues are redistributed to both young and old (i.e. $\theta = 1$), which is derived numerically, is characterized by lower policy variables than the case where transfer payments are redistributed only to the young (i.e. $\theta = 0$). The intuition for this result is explained in the appendix.

The equilibrium equations and the steady state are given explicitly in the appendix [5]. Numerical simulations of the perfect foresight equilibrium steady state reveal that both policy variables are higher in the perfect foresight case. This results from the fact that in the perfect foresight equilibrium, voters take into account that both next-period policy variables are increasing in the capital state variable. This positive correlation creates an additional effect of current tax-control policy variables on the next-period return to capital in the perfect foresight equilibrium. A marginal increase in present capital control (tax rates) reduces (raises) savings and thereby has an additional effect increasing (decreasing) the next period rate of return due to lower (higher) next period tax-control policy[6]. This means that a marginal increase in present capital control (tax rates) decreases (increases) the young's utility less in the perfect foresight case leading to greater capital control (lower tax rates). Due to the tax base effect, lower capital restrictions in the perfect foresight case leada to capital outflows which in turn have an offsetting effect on the tax rate, resulting in a higher tax rate as well.
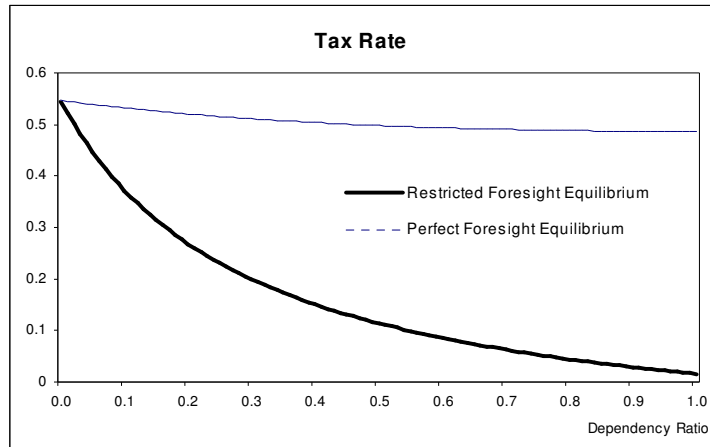


[5] Note that the perfect foresight equilibrium is also obtained for a close enough range around the steady state. The simulation results are for the following set of parameters and different population growth rate parameters in the range $n \in [0, 1]$ $\alpha = 0.3, \beta = 0.7, \overline{R} = 4.5, f^y = 0.2, f^o = 0.8, L = 1$

[6] However, higher next-period tax-control policy has the opposite effects on next period returns to capital: according to the simulation result, lower savings have the overall effect of raising next period returns to capital.

**Capital Control**
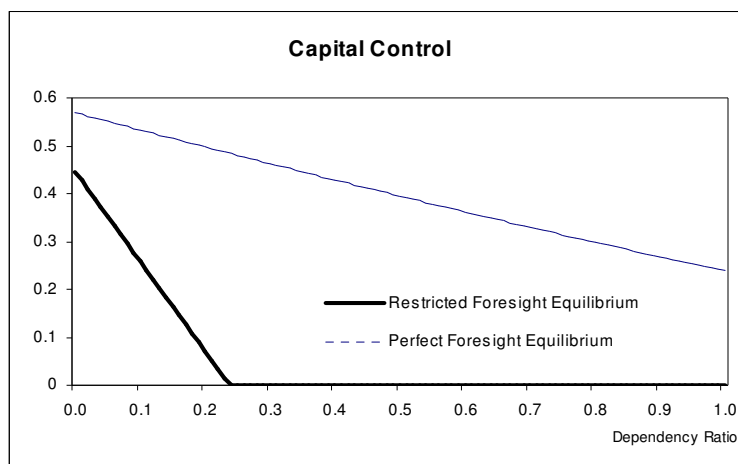


# 4 The Effect of aging

We are now in a position to conduct a comparative statics analysis across demographic regimes. Aging is specified by a reduction in the native-born population growth rate. (Life expectancy is assumed to be exogenously fixed.) We analyze the effect of aging on the size of the social-security system and on market-factor liberalization according to the two equilibria presented. We then compare the main results of aging with the literature on the sustainability of the social-security system in aging societies.

By testing the effect of aging in a closed economy, we find that the main expected political-economy forces are at work: aging increases the political power of the old, thereby favoring less capital taxation, but it also raises the tax rate preferred by the young, who thereby receive larger transfer payments. However, when the rate of capital taxation is determined within a political-economy framework in concurrence with a decision about restricting capital outflows, additional forces that have offsetting effects come into play. An increase in the share of the population that derives its income from capital generates political pressure that leads to a more liberal policy on capital outflows. Capital outflows may, in turn, lead to heavier capital taxation in order to offset the depletion of the economy's capital-tax base. Viewed in comparison with perfect-foresight equilibrium, aging has a stronger effect on both policy variables under the restricted-foresight approach. The effect of aging in both equilibria is described, followed by a brief discussion on capital taxation in aging societies according to the economic literature.

**Proposition 4** *When the domestic interest rate is lower than the world interest rate, aging lowers capital controls, which, by reducing the tax base for capital taxation, boosts the tax rate on capital income.*

The appendix proves the proposition for the case where the transfer pay-

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ments are redistributed only to the young (i.e. $\theta = 0$). The case where transfer payments are redistributed to both young and old (i.e. $\theta = 1$), which is derived numerically, yields the same qualitative results of aging[7]. The intuition is as follows. A rise in the ratio of the elderly, whose income is derived mainly from capital, reduces the tax rate and the restriction on capital outflows (direct effect). Since foreign source income cannot be taxed, a more liberal controls policy leads to capital outflows, which in turn increases the optimal tax rate (indirect effect).

The direct effect of aging consists of two contrasting components: The dominant component increases the proportion of old voters, who aggregately prefer a lower tax rate and less capital restrictions. However, aging also has a secondary direct effect through factor prices, which change the preference of each voter. Aging, which increases transfer payments and the wage rate and lowers the domestic net rate of return, raises the gain to the young (old) voter and lowers the loss to the old (young) from a higher tax rate (capital control policy) leading to a higher preferable tax rate (lower capital control). The indirect effect results from the tax base effect: the more open the economy is, the higher is the preferred tax rate, since the old are less reluctant to face a rise in the tax rate, which only lowers the domestic rate of return.

Compared to the perfect foresight equilibrium, aging has a stronger effect on both policy variables under the restricted foresight approach, since voters do not take into account that both next-period policy variables are increasing in the capital state variable as in the perfect foresight equilibrium. Aging in the perfect foresight equilibrium has an additional negative effect on the next-period return to capital. This results from the fact that aging, by increasing the income of the young, raises next-period tax-control policy through savings. Perfect foresight voters internalize the fact that a marginal increase in present capital control (tax rates) reduces (raises) savings and thereby has an additional effect that increases (decreases) the next-period rate of return less (more) as n falls. Due to the tax base effect, aging has a partial offsetting effect also on capital income tax in the perfect foresight equilibrium, resulting in a stronger effect of aging on both policy variables in the restricted foresight equilibrium.

Since a social-security system typically relies more heavily on labor taxation, most literature on the implications of population aging on social-security systems approach the matter from a labor-taxation point of view. The present study analyzes how the aging process affects capital-income taxation and asks whether it can come to the rescue of the social-security system. Razin, Sadka, and Swagel (2003), basing themselves on a sample of ten European countries in 1970–1996, argue that aging leads to higher taxes on capital income. They explain this finding by claiming that, although aging increases the political power of the anti-tax coalition and thereby leads to a lower tax rate, an additional effect may be at work: as the ratio of the elderly to the young increases, so does the total amount of capital tax collected. Thus, redistribution becomes

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[7]A numerical simulation for the general case where transfer payments are redistributed to both young and old (i.e. $\theta = 1$) is given in appendix II.

less costly to the young, who, in turn, become less averse to heavier taxation of capital income. The main economic and political forces discussed by Razin, Sadka, and Swagel (2003) are also present in the current model: aging amplifies the political power of the old, favoring lower capital taxation, but also raises the tax rate preferred by the young, who receive larger transfer payments. While the specification in their model emphasizes the latter effect, creating consistency with the data, the present model also predicts the positive correlation between aging and capital-income taxation observed, but identifies it as the result of a different channel of influence. The amplified political power of the elderly contributes to a capital-market liberalization process that, by depleting the economy's capital-tax base, induces higher rates of capital taxation. In addition, the perfect-foresight equilibrium reveals that when voters anticipate the effect of current policy outcomes on next-period policy variables, aging has additional offsetting effects that mitigate its impact on the tax-control policy.

## 5   Concluding Remarks

Recent demographic changes and the global integration process are argued to team up together to downscale the welfare state. On the one hand, the combination of increased longevity and a reduced birth rate that characterizes aging societies creates a net burden on social-security systems. On the other hand, global economic forces are generally accused of limiting the ability of the welfare state to assure future social protection as a consequence of international competition or overflows of the factors of production. The present study combines these two phenomena and assesses their implications for the sustainability of the welfare state within a political-economy framework. Instead of treating global economy forces as exogenously given, however, it focuses on the inherent political forces within the nation-state that may contribute to the process of market integration. The volume of global capital flow is determined in a political process as the resolution of a conflict of interests between the young and old over the size of the PAYG social-security system.

In the model, a perishable consumption good is produced by means of both the capital and labor inputs. Tax is levied on the elderly's domestic capital income and the revenue is redistributed to both cohorts. Each cohort lives for two periods, supplying labor when young and earning income at the net rental-rate from capital accumulation when old. Assuming an exogenously given world rate of interest, capital income may be generated by investing either in the domestic economy or abroad up to a ceiling rate that represents the capital-control policy. The young make investment decisions in according to the difference between the domestic and foreign net return to capital, either by investing a maximal or minimal amount of capital abroad. Capital-control policy is set endogenously in the political-economy system along with the tax rate on domestic income. The main result of the model, which is derived from the assumption that income of foreign origin cannot be taxed, reveals that the tax-rate policy is correlates positively with the capital-control policy. This happens

because the tax rate is chosen so as to offset the effect of capital flight occasioned by the weakening of restrictions on capital outflows. A similar claim was made by Rodrik (1996), who empirically showed that the more open economies are to trade the bigger their government is, and concluded that the increase in exposure to external risk should be compensated for by larger government spending.

The study compares two equilibria, one with restricted forecasting ability that allows for analytical insights, and one with perfect forecasting ability, obtained numerically by relaxing the myopic characterization of voters. Numerical simulations of the perfect-foresight equilibrium steady state reveal that both policy variables are higher in the perfect-foresight case. This results from the fact that in the perfect foresight equilibrium, voters take into account that both next-period policy variables are increasing in the capital state variable. This positive correlation creates an additional effect of current tax-control policy variables on the next-period return to capital in the perfect foresight equilibrium, resulting in a higher tax-control policy.

The effect of aging is then tested within both frameworks and compared to a closed-economy framework. In the closed-economy framework, aging amplifies the political power of the anti-tax coalition leading to a lower tax rate, but at the same time reduces the resistance of the young to a higher tax rate. In an open economy where capital taxation and capital control are both at stake, additional forces that have offsetting effects are at work. An increase in the share of the population that derives its income from capital generates political pressure for a more liberal capital-control policy. Capital outflows, in turn, may lead to heavier capital taxation in order to offset the depletion of the economy's capital-tax base. Characterizing voters by a perfect-foresight property does not change the result qualitatively. Aging has the overall effect of raising the level of capital-income taxation in both models. However, it has a stronger effect on both political variables in the restricted-foresight equilibrium, because its effect on next-period variables through the capital-state variable is not taken into account.

# 6    Appendix

## 6.1    Proposition I:

The restricted foresight equilibrium is obtained for a close enough range around the steady state. This is due to the fact that the complexity of the first order conditions does not allow for explicit decision rule formation as in the labor model. Thus, we first conjecture the next period decision rule, $\Psi(k_{t+1})$, and linearize the first order condition near the steady state. We then require that the next-period linearization of the decision rule is equal to its present linearization. In addition, we check the (local) stability of the system, which requires that the derivative, $\frac{dk_{t+1}}{dk_t}$, be less then one in absolute value. The first order conditions of the optimal tax and openness rates, are given respectively by the following

equations (for the case where $R_t(\tau_t^*, \overline{\gamma}_t^*) < R^*$):

$$(1+n)f^y[U'(c_t^y)\frac{\partial b_t}{\partial \tau_t^*}+\beta U'(c_{t+1}^o)(\frac{\partial(1+\overline{R}_{t+1})}{\partial k_{t+1}}k_{t+1}+\frac{\partial \theta b_{t+1}}{\partial k_{t+1}})(\frac{\partial k_{t+1}}{\partial \tau_t^*})]+f^o\frac{\partial U(c_t^o)}{\partial \tau_t^*}=0$$
$$(21)$$

$$(1+n)f^y[U'(c_t^y)\frac{\partial(w_t+b_t)}{\partial \gamma_t^*}+U'(c_{t+1}^o)(\frac{\partial(1+\overline{R}_{t+1})}{\partial k_{t+1}}k_{t+1}+\frac{\partial \theta b_{t+1}}{\partial k_{t+1}})(\frac{\partial k_{t+1}}{\partial \gamma_t^*})]+f^o\frac{\partial U(c_t^o)}{\partial \gamma_t^*}=0,$$
$$(22)$$

where the derivative of the next period savings is given by

$$\frac{\partial k_{t+1}}{\partial \tau_t^*}=\frac{\frac{\partial b_t}{\partial \tau_t^*}}{1+\beta\frac{\partial(1+\overline{R}_{t+1})}{\partial k_{t+1}}\frac{U'(c_{t+1}^o)}{U''(c_t^y)}+\beta(1+\overline{R}_{t+1})\frac{U''(c_{t+1}^o)}{U''(c_t^y)}(\frac{\partial((1+\overline{R}_{t+1})k_{t+1}+\theta b_{t+1})}{\partial k_{t+1}})}\geq 0$$
$$(23)$$

$$\frac{\partial k_{t+1}}{\partial \gamma_t^*}=\frac{\frac{\partial w_t}{\partial \gamma_t^*}+\frac{\partial b_t}{\partial \gamma_t^*}}{1+\beta\frac{\partial(1+\overline{R}_{t+1})}{\partial k_{t+1}}\frac{U'(c_{t+1}^o)}{U''(c_t^y)}+\beta(1+\overline{R}_{t+1})\frac{U''(c_{t+1}^o)}{U''(c_t^y)}(\frac{\partial((1+\overline{R}_{t+1})k_{t+1}+\theta b_{t+1})}{\partial k_{t+1}})}\leq 0,$$
$$(24)$$

Comparing the case where transfer payments are paid only when young (i.e. ■ = 0) to the more general case where they are paid to both generations (i.e. ■ = 1) results in lower policy variables in the more general case[8]. The intuition is as follows. Transfer payments to the old change the consumption-saving decision. This change results from the fact that individuals choose the level of savings, while taking the level of transfer payments as given. Thus, transfer payments to the old induce a lower amount of savings. This leads to a looser (tighter) preferred capital controls (taxation) policy, which increases savings. Due to the tax base effect, lower capital-controls lead to capital outflows, which in turn have an offsetting effect on the tax rate, resulting in a lower tax rate as well.

## 6.2 Proposition II:

**Proof.** In order to determine the effect of aging on the steady state variables in the case where transfer payments are redistributed only to the young (i.e. $\theta = 0$) and the economy is subject to capital outflows, the total derivatives of the policy variables are obtained:

$$\frac{\partial \tau^*}{\partial n}=\frac{\frac{\partial E_\tau(V)}{\partial \overline{\gamma}^*}\frac{\partial E_{\overline{\gamma}}(V)}{\partial n}-\frac{\partial E_\tau(V)}{\partial n}\frac{\partial E_{\overline{\gamma}}(V)}{\partial \overline{\gamma}^*}}{\frac{\partial E(V)}{\partial^2 \tau^*}\frac{\partial E(V)}{\partial^2 \overline{\gamma}^*}-\left(\frac{\partial E(v)}{\partial \overline{\gamma}^*\partial \tau^*}\right)^2}$$
$$(25)$$

$$\frac{\partial \overline{\gamma}^*}{\partial n}=\frac{\frac{\partial E_{\overline{\gamma}}(V)}{\partial \tau^*}\frac{\partial E_\tau(V)}{\partial n}-\frac{\partial E_{\overline{\gamma}}(V)}{\partial n}\frac{\partial E_{\overline{\gamma}}(V)}{\partial \tau^*}}{\frac{\partial E(V)}{\partial^2 \tau^*}\frac{\partial E(V)}{\partial^2 \overline{\gamma}^*}-\left(\frac{\partial E(v)}{\partial \overline{\gamma}^*\partial \tau^*}\right)^2}$$
$$(26)$$

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[8]The simulation results are for the following set of parameters: $\alpha = 0.3, \beta = 0.7, \overline{R} = 5, f^y = 0.2, f^o = 0.8, L = 1$
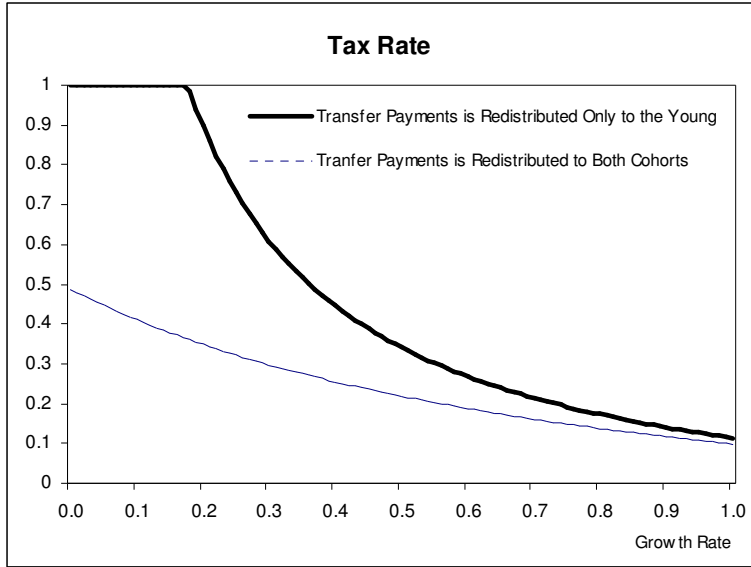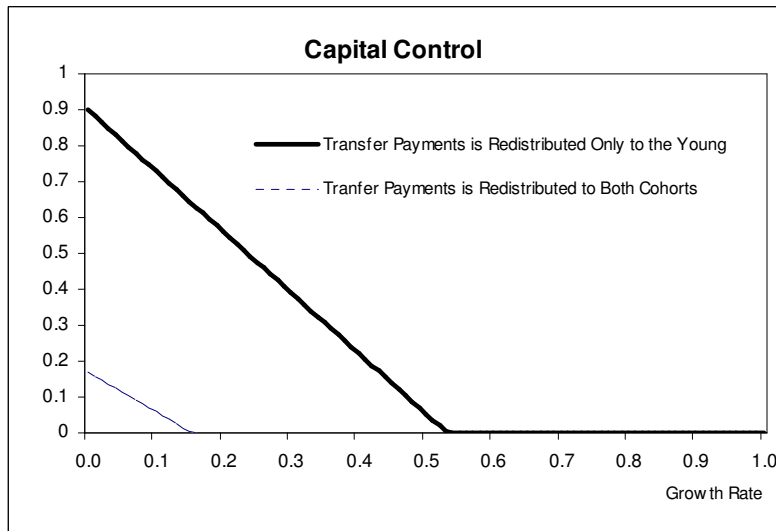
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Figure 1:



Figure 2:

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After some algebraic manipulations, it can be proved that the denominator (which is identical in both equations 25 and 26) is positive, while the nominators are negative, given by the following equations respectively:

$$\frac{-(-\alpha\frac{r}{k^\alpha}\frac{\beta}{1+\beta}(1-\alpha)(1+n)^{\alpha-1}(1-\gamma)^{1-\alpha}(1-\tau)-r)(1-\gamma)f^o\alpha}{\left((1+n)f^y(1-\alpha)\frac{(1+\beta)}{\beta}+f^o\right)} > 0$$

$$-\frac{f^o}{1+n}\left(-R+R^*+(1-\tau)r\right)(1-\alpha)\left(-R+R^*+\alpha(1-\tau)r\right) < 0 \qquad (27)$$

$$\frac{f^o}{1+n}\left(-\alpha\frac{r}{k^\alpha}\frac{\beta}{1+\beta}(1-\alpha)(1+n)^{\alpha-1}(1-\gamma)^{1-\alpha}(1-\tau)-r\right)\left(-R+R^*+\frac{\alpha\beta}{1+\beta}(1-\tau)r\right) < 0$$
$$(28)$$

This means that aging increases the tax on capital income while it reduces capital controls. Otherwise, the economy is not subject to capital outflows $(R > R^*)$, and aging will reduce the tax rate, as the derivative of the tax rate by the population growth rate is positive:

$$\frac{\partial\tau^*}{\partial n} = \frac{\frac{\partial E_\tau(V)}{\partial n}}{-\frac{\partial E(V)}{\partial^2\tau^*}} = \frac{\frac{r}{1+n}(1-\tau)}{\left(\alpha\frac{r}{k^\alpha}\frac{\beta}{1+\beta}(1-\alpha)(1+n)^{\alpha-1}(1-\gamma)^{1-\alpha}(1-\tau)+r\right)} > 0,$$
$$(29)$$

∎

## 6.3 The Perfect Foresight Equilibrium

The equilibrium and steady-state equations of the tax-controls policies are given respectively by (for the case were $R_t(\tau_t, \overline{\gamma}_t) > R^*$):

$$\widehat{T}(k_t):$$
$$(1+n)f^y[U'(c_t^y)\frac{\partial b_t}{\partial\tau_t^*}+\beta U'(c_{t+1}^o)(\frac{\partial(1+\overline{R}_{t+1}(\Pi(k_{t+1})))}{\partial k_{t+1}}k_{t+1}+\frac{\partial\theta b_{t+1}(\Pi(k_{t+1}))}{\partial k_{t+1}})(\frac{\partial k_{t+1}}{\partial\tau_t^*})]+f^o\frac{\partial U(c_t^o)}{\partial\tau_t^*}=0$$
$$(30)$$

$$\widehat{G}(k_t):$$
$$(1+n)f^y[U'(c_t^y)\frac{\partial(w_t+b_t)}{\partial\overline{\gamma}_t^*}+\beta U'(c_{t+1}^o)(\frac{\partial(1+\overline{R}_{t+1}(\Pi(k_{t+1})))}{\partial k_{t+1}}k_{t+1}+\frac{\partial\theta b_{t+1}(\Pi(k_{t+1}))}{\partial k_{t+1}})(\frac{\partial k_{t+1}}{\partial\overline{\gamma}_t^*})]+f^o\frac{\partial U(c_t^o)}{\partial\overline{\gamma}_t^*}=0$$
$$(31)$$

$$(1+n)f^y[U'(c^y)\frac{\partial b}{\partial\tau^*}+\beta U'(c^o)(\frac{\partial(1+\overline{R}(\Pi(k))}{\partial k}k+\frac{\partial\theta b(\Pi(k))}{\partial k})(\frac{\partial k}{\partial\tau^*})]+f^o\frac{\partial U(c^o)}{\partial\tau_t^*}=0$$
$$(32)$$

$$(1+n)f^y[U'(c^y)\frac{\partial(w+b)}{\partial\overline{\gamma}^*}+\beta U'(c^o)(\frac{\partial(1+\overline{R}(\Pi(k))}{\partial k}k+\frac{\partial\theta b(\Pi(k))}{\partial k})(\frac{\partial k}{\partial\overline{\gamma}^*})]+f^o\frac{\partial U(c^o)}{\partial\overline{\gamma}^*}=0,$$
$$(33)$$

The fixed-point condition requires that the aggregation function of individuals, preferences reproduces the law of motion of the policy variable: $\widehat{T}(k_t) = T(k_t)$, $\widehat{G}(k_t) = G(k_t)$. Note that since the steady state conditions also depend on the policy rule, $\Psi$, we cannot separate between the steady-state variables

and the determination of the policy rules. The solution to the set of equations which define the steady state and the decision rule are computed numericaly[9].

# 7    References

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