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Dynamic fiscal competition: a political economy theory

Abstract

I develop a political economy theory of dynamic fiscal competition via public spending and debt. With internationally mobile capital, strategic policies generate two cross-border externalities that voters in each country fail to internalize: (1) an increase in public spending that bolsters capital accumulation but also (2) a race to the top in public debt which crowds out capital. The relative size of these two externalities varies with the number of financially integrated countries and interacts with the domestic political conflict between young and old voters. Despite residence based taxation, capital tax rates are lower under strategic policies than under coordination. Furthermore, they may decline with financial integration. Strategic policies lead to lower long run output and welfare relative to coordination but are preferred by subsequent generations of voters if the number of financially integrated countries is low or the political weight of the young is high.

JEL-Codes: H200, H400, H600.

Keywords: political economy, public spending, public debt, economic integration.

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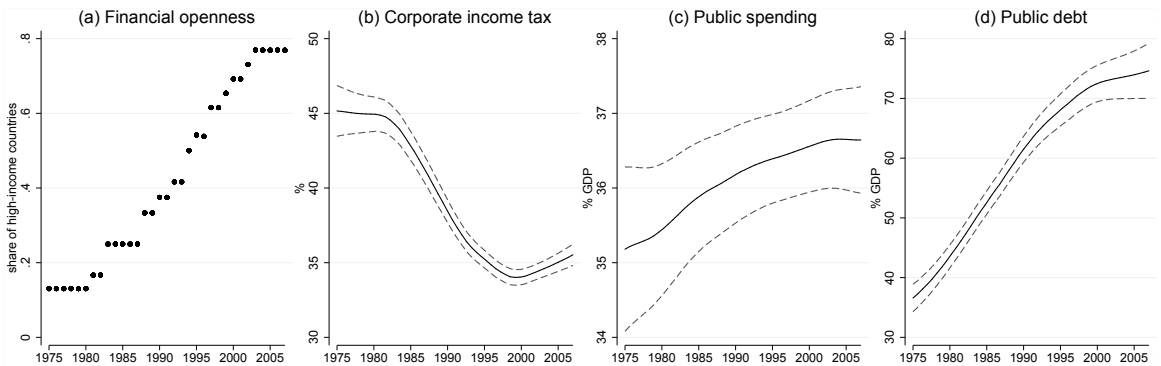
1 Introduction

The process of financial liberalization spreading across high income democracies during the last decades (Figure $1-a$) has far reaching yet not fully understood implications for public finance: How does international capital mobility change the political economy of domestic fiscal policies? What is the scope for international policy coordination given electorally motivated, short-termist governments? What are the effects of fiscal cross-border externalities on welfare and growth?

Figure 1: Financial liberalization and public finance



Panel (a) displays the share of high income economies (IMF classification) reaching a maximum Chinn-Ito index of financial liberalization in any given year. See Chinn-Ito (2006) for details. Panel (b) shows the average statutory corporate tax rate in high income countries. The solid line represents the local mean smoothed series, weighted by real PPP GDP and dashed lines represent 95% confidence intervals. Similar statistics are shown in panel (c) for the government primary expenditure share in GDP, sourced from Mauro et al. (2013) and in panel (d) for the general government debt share in GDP, sourced from Abbas et al. (2010). See Appendix A for coverage and summary statistics.

The significant decline in statutory capital tax rates (Figure $1-b$) is a well known correlate of financial liberalization. Moreover, recent empirical research (e.g. Devereux and Griffith (1998), Redoano (2003), Bénassy-Quéré et al. (2007)) has shown that international capital flows respond not only to tax rate differentials but also to public spending outlays, such as infrastructure investments, research and development or public services. While recent literature (e.g. (Rodrik, 1997, 1998), Epifani and Gancia (2009)) has traced the overall increase in public spending in open economies (Figure $1-c$) back to strategic trade and redistribution considerations, it has left the issue of fiscal competition for mobile factors largely out of focus. Finally, in this context, the simultaneous build-up of public debt in developed countries (Figure $1-d$), suggests strategic fiscal policies may also have important welfare effects via the intertemporal government budget constraint.

Although these stylized facts point to the importance of considering multidimensional and dynamic fiscal competition, the theoretical literature, building on the seminal work of Zodrow and Mieszkowski (1986) and Wilson (1986), has so far devoted little attention to the strategic use of multiple fiscal policy variables and their political economy in a dynamic setting.

The paper contributes to the literature by providing a tractable framework to study strategic fiscal policies chosen by subsequent generations of voters through repeated elections in a world where capital is internationally mobile.[1] Specifically, I build a multi-country dynamic general equilibrium model with productive public spending and debt and study the interactions between countries that share an integrated capital market but retain independence of their policies. Countries are assumed to be large, i.e., they take into account their effect on the interest rate. Each country is inhabited by overlapping generations of two-period lived agents. Current generations in each country elect every period a government that sets productive public spending and its financing through debt, labor and capital taxes to maximize the voters' lifetime welfare.

Capital mobility generates two distinct externalities. First, seeking to attract mobile private capital, countries use public spending as an instrument of fiscal competition.[2] In this context, I study a novel channel whereby higher public spending not only raises the marginal productivity of private capital as in the previous literature, but leads to the production of new varieties and thus creates a positive industry level externality that increases with the number of competing countries. Second, deficit spending yields a negative pecuniary externality (an increase in the interest rate) as national governments ignore the crowding out effect in other countries. This leads to higher public debt everywhere. To focus on the role of deficit financed public spending, in the benchmark model I assume residence based capital taxation.[3] Both externalities arise from the common capital market inducing "beggar-thy-neighbor" behavior, hence they do not depend qualitatively on the government's finite time horizon.

Importantly, the net effect of these cross-border fiscal externalities, shaped by the domestic political conflict between young and old generations, becomes crucial for

[1] I use the notion of strategic fiscal policies to refer to the corss-border externalities induced by mobile capital. Nonetheless, as explained later on, elected governments also behave strategically in an intertemporal sense, by steering the policy of future domestic governments.

[2] See Romp (2005) for an overview on the role of public capital on productivity and growth.

[3] In general, capital income may be taxed in the country where the income is earned (source based taxation), or in the country of residence of the person who receives it (residence based taxation). As shown in the supplementary appendix IV, introducing source based taxation and thus direct tax competition does not alter the main results.

the prospects of international policy coordination.

In this framework I derive analytic policy rules describing strategic fiscal policies implemented by elected governments and contrast them, both in the short run (i.e. conditional on previous period capital stock and debt) and the steady state, against policies implemented under the assumption that short-termist governments can credibly coordinate to maximize the joint lifetime welfare of current generations. I then analyze how fiscal externalities and equilibrium policies depend on the scope of financial integration, proxied by the number of countries participating in the common capital market. Finally, I compare the output and welfare associated with strategic and coordinated policies and study under what conditions currently living generations are made better off by international policy coordination of their respective short-termist governments.

First, for a given number of financially integrated countries, fiscal competition in public spending leads in the short run to lower capital tax rates relative to coordinated policies. The mechanism is new to the fiscal competition literature. While capital taxation is residence based hence there is no direct incentive to lower tax rates to attract new capital, governments substitute current tax revenues with debt in order to fund public spending. In turn, this increases the tax base both by attracting more capital and making it more productive. Therefore, lower tax rates under fiscal competition do not translate necessarily into lower welfare in the short run, another major difference with respect to the standard tax competition framework. In contrast to the short run results, *steady state* capital tax rates are higher and public spending is lower under strategic policies since capital accumulation is hampered by excessive public debt.

Second, following an increase in the scope of financial integration, proxied by the number of integrated countries, fiscal competition becomes more intense and both public spending and debt go up. Capital and labor taxes decline if the weight of the young in the political process is large. This response of taxation to an increase in the scope of financial integration sheds new light on the interaction between cross border externalities and the domestic political conflict between generations. Young agents prefer low labor taxes, high capital taxes, high public spending that increases their productivity. The current old agents would like to minimize capital tax rates by spreading the cost of public spending into the future through public debt. In contrast, the current young foresee the negative effect of debt for their old age income and hence prefer lower levels. While similar inter-generational trade-offs were studied in the literature, here however public debt is determined, together with the interest rate, as an equilibrium outcome of multiple strategic policies in an integrated capital

market. In particular, at low initial levels, public debt increases faster with the scope of financial integration. Thus, when the political weight of the young is large, an increase in the scope of financial integration reduces the need for current tax revenues and tax rates decline.

Finally, relative to coordinated policies, fiscal competition is optimal in the short run from the point of view of the current generations of voters only if the number of financially integrated economies is below some threshold.[4] In this case, the positive effect of public spending on current output dominates the crowding out effect of debt on the next period capital stock. Moreover, as explained before, the young generation has an interest to limit public debt. Thus, the better represented they are in the political process, the higher the threshold number of countries at which indebtedness is large enough to justify coordinated policies. In the steady state however, the crowding out effect of debt is always larger than the positive effect of public spending which makes coordination welfare superior.

The next section discusses the related literature. Section 2 introduces the model. Section 3 defines and computes the equilibrium allocations under strategic and coordinated policies and section 4 compares these allocations both in the short run and the steady state. Section 5 looks at the effects of an increase in the scope of financial liberalization. Section 6 calculates and compares welfare levels attained under the two policy regimes. The final section concludes. Proofs are relegated to the appendix. A supplementary appendix provides additional derivations, extensions and robustness checks.[5]

2 Related literature

The paper adds to the literature on international policy coordination, fiscal competition and the political economy of public debt.

Kehoe (1989) shows policy coordination is undesirable in the steady state when policy makers cannot commit and capital flight is possible since tax competition prevents confiscatory capital taxation. The analysis excludes externalities from productive public spending and debt which are central to this paper. In particular, here fiscal competition may be preferred in the short run when the positive effects of the former outweigh the negative effects of the latter.

[4] Coordination can be viewed as an alternative set of fiscal institutions (e.g. budget rules) whose adoption depends on the cost-benefit analysis of the current voters. See Alesina and Passalacqua (2016) for a survey of the literature on the political economy of public debt.

[5] See http://profesores.esade.edu/calinarcalean/DFCPE_online.pdf

Chang (1990) studies public debt under capital mobility and concludes that the debt externality is increasing in the number of countries and that policy coordination is welfare improving. The analysis focuses on the steady state and abstracts from issues of capital accumulation. It also eschews political frictions and fiscal competition, understood as bidding for mobile factors. In the current paper, these features give rise to new externalities and, as explained above, to important differences between the short run and the steady state effects of coordination on welfare.

Moreover, the paper shares a concern for dynamics with some recent work on fiscal competition, such as Wildasin (2003), Koethenbuerger and Lockwood (2010), Makris (2005), Batina (2009), Becker and Rauscher (2013), Gross (2014), Klein and Makris (2014). Different from all these contributions, which consider direct intertemporal tax externalities and their effects on welfare and growth, the focus here is on the simultaneous (and strategic) choice of public debt and productive public spending.[6] Also, while many of these contributions analyze infinitely lived planners and steady state outcomes, the current paper looks at policies set by myopic governments driven by political economy concerns, both in the short run and steady state. Moreover, the paper studies how policies and welfare change with the number of financially integrated countries and compares coordinated and strategic policies.

Within the tax competition literature, a few contributions have focused on the role of debt. Jensen and Toma (1991) study a two-period two-jurisdiction model of tax competition with public debt and no capital accumulation. While issuing public debt initially alleviates the underprovision of public goods, it worsens it during the second period when repayment occurs. In Arcalean (2017) tax competition leads to lower capital taxation and boosts capital accumulation. Under the assumption that the earnings of the median voter do not benefit from tax competition, higher capital mobility leads to higher public debt as an instrument of bringing forward the redistribution through capital taxation. Janeba and Todtenhaupt (2016) show that when the option of default constrains borrowing, tax competition pushes highly indebted countries to lower both public spending and tax rates. Complementary to these papers, the current analysis relies on a general equilibrium model to clearly distinguish between short and long run and a tractable political economy setup to endogenize policies. In particular, while spending and debt externalities support either strategic or coordinated policies depending on the number of countries, capital accumulation magnifies the effect of debt such that coordination is unambiguously

[6] Bucovetsky and Wilson (1991) and Braid (2000) study fiscal competition with multiple tax instruments while Hauptmeier et al. (2012) study competition in business taxes and productive public spending.

optimal in the long run.

Wildasin (2003) and Wildasin (2011) study price taking jurisdictions and emphasize how factor complementarity and mobility costs shape the dynamics of tax competition as well as the tradeoff between redistribution and efficiency. In this paper jurisdictions are large, capital moves costlessly and dynamics are driven by neoclassical capital accumulation subject to fiscal externalities. Nonetheless, a similar tradeoff arises due to the different time horizons of the current young and old agents. Whereas the latter would like to maximize the amount of public debt, the former group partly internalizes the crowding out of private capital and thus, the higher their share in the social welfare function, the higher the capital tax rates but also capital accumulation.

Finally, the paper also contributes to the political economy literature on government debt. Complementing studies of closed economies (Cukierman and Meltzer (1989)), or small open economies (Song et al. (2012)), the framework presented here focuses on countries that are large enough to behave strategically. Azzimonti et al. (2014) consider the political economy of strategic public debt in an environment with neither capital accumulation nor fiscal competition. Different from this literature, here the intergenerational (domestic) political conflict leads to drastically different outcomes, in terms of welfare and growth, depending on the scope of international financial integration.

3 The model economy

I consider an infinite horizon economy that consists of n countries, indexed by i, with identical technologies and initial conditions. Countries are populated by identical, immobile, two-period lived agents. In each country, population is stationary and normalized to one. Capital is perfectly mobile across the n countries. Each country has a government that taxes capital and labor and issues bonds to fund a productive public good. Competitive firms produce a unique, homogenous and costlessly tradable good whose price is normalized to one. This final good combines an endogenously determined variety of intermediate goods produced by monopolistically competitive firms using capital, labor and services stemming from the public good.

Households. When young, individuals supply labor inelastically, consume and save for the old age. An individual born at time t in country i maximizes the lifetime

utility

$$\max_{c^y_{i,t},c^o_{i,t+1}} \ln c^y_{i,t} + \beta \ln c^o_{i,t+1} \tag{1}$$
$$\text{s.t. } c^y_{i,t} = (w_{i,t} - s_{i,t})(1 - \tau^L_{i,t}) \text{ and } c^o_{i,t+1} = s_{i,t} R_{t+1}(1 - \tau^K_{i,t+1}),$$

where $c^y_{i,t}$, $c^o_{i,t+1}$ denote consumption flows, $s_{i,t}$ are the savings of a young individual, $w_{i,t}$ is the wage rate and $\tau^L_{i,t}$ and $\tau^K_{i,t+1}$ are the tax rates on labor and capital income, respectively.

Savings are tax deductible in the young age and the gross return R_{t+1} is taxed in the old age. The tax deduction simplifies the analysis without loss of generality. Denote the marginal product of capital with q_{t+1} and the gross return on capital with $R_{t+1} = 1 - \delta^K + q_{t+1}$ where δ^K is the depreciation rate of capital. Assuming $\delta^K = 1$, i.e. capital depreciates fully in one period, implies $R_{t+1} = q_{t+1}$.

Given policies, households' optimal allocations are:

$$c^y_{i,t} = \frac{1}{1+\beta} w_{i,t}(1 - \tau^L_{i,t}),\ s_{i,t} = \frac{\beta}{1+\beta} w_{i,t},\ c^o_{i,t+1} = \frac{\beta}{1+\beta} w_{i,t}(1 - \tau^K_{i,t+1}) R_{t+1}. \tag{2}$$

Production. Competitive firms in country i produce the final good using an endogenously determined range of intermediate goods $x_{j,i,t}$, $j \in (0, v_t)$:

$$Y_{i,t} = \left(\int_0^{v_{i,t}} x^{1-\sigma}_{j,i,t} dj \right)^{1/(1-\sigma)} \tag{3}$$

where $\sigma \in [0, 1]$ is the inverse of substitution elasticity between intermediate goods. The intermediate goods $x_{j,i,t}$ are produced in a monopolistically competitive sector by firms that pay a fixed cost f every period to operate. They hire capital $k_{j,i,t}$, labor $l_{j,i,t}$ and use services stemming from a public good, provided at no cost by the government:

$$x_{j,i,t} = G^\delta_{i,t} k^\alpha_{j,i,t} l^{1-\alpha}_{j,i,t},\ 0 < \delta \leqslant \alpha < 1. \tag{4}$$

The public good, enhancing total factor productivity, can be broadly thought of as public education, infrastructure, R&D services or law and order.[7]

Denoting $z = (\sigma/f)^{\frac{\sigma}{1-2\sigma}}$, $\eta = \delta(1-\sigma)/(1-2\sigma)$, $\phi = \alpha(1-\sigma)/(1-2\sigma)$, standard derivations detailed in appendix A lead to aggregate output:

$$Y_{i,t} = z G^\eta_{i,t} K^\phi_{i,t}. \tag{5}$$

[7] As shown in the supplementary appendix III, including the public goods in the utility does not provide additional insights.

Factor prices are thus given by:

$$w_{i,t} = (1-\sigma)(1-\alpha)Y_{i,t} \text{ and } q_{i,t} = (1-\sigma)\alpha Y_{i,t}/K_{i,t}. \tag{6}$$

Assumption 1. $\eta + \phi < 1$.

Assumption 1 implies overall decreasing returns to scale in reproducible inputs.[8] Substituting the expressions for η and ϕ, it implies $\sigma < (1-\alpha-\delta)/(2-\alpha-\delta) < 1/2$, which also ensures the number of intermediate goods increases with the stock of capital. Note that in equilibrium the aggregate output elasticity with respect to public spending is higher than the firm level counterpart ($\eta > \delta$). This is due to the indirect effect of the public spending on the entry in the intermediate goods sector and hence on the variety of such goods produced in equilibrium.[9] As I explain later, this distinction is important from the point of view of fiscal competition.

Government. In each country, the government finances public spending using a tax on labor, a tax on capital and one period bonds, issued in the common capital market. Governments can commit to repay outstanding debt[10]. Importantly, residence based capital taxation is feasible. Thus, irrespective of where they invest their savings, the immobile households pay capital taxes only in the country of residence.

The budget constraint in period t is:

$$B_{i,t+1} + \tau^L_{i,t} w_{i,t} + \tau^K_{i,t} R_t s_{i,t-1} = G_{i,t} + R_{i,t} B_{i,t}, \text{ with } B_{i,0}, G_{i,0} \text{ and } s_{i,-1} \text{ given}, \tag{7}$$

where $B_{i,t}$ is the outstanding debt at the beginning of period t. Solvency is ensured by the transversality condition $\lim_{T\to\infty} \left(\prod_{t=t_0}^{T} R_t\right)^{-1} B_{i,T} = 0$, $\forall t_0 > 0$.

Political Economy. Policies are selected in repeated elections where the current living generations vote. While old agents care only about their current consumption, young voters are rational and forward looking but because of repeated elections they cannot directly decide future fiscal policy. However, they can affect it through the current policy choices which in turn determine the future stock of capital and public debt.

[8] Estimates on the elasticity of aggregate output with respect to public capital are generally below 0.20 (see De Haan et al. (2008) and Ligthart and Suárez (2011)). Given $\phi \approx 0.4$, decreasing returns are likely to obtain even with a broader notion of public spending, as used here.

[9] See Chakraborty and Dabla-Norris (2011) for a more detailed discussion about the difference between the macro and the micro level output elasticity with respect to public spending.

[10] Relaxing this assumption would imply that, in equilibrium, governments are able to borrow less. However, as long as debt remains positive, introducing symmetric commitment limits does not remove the cross border externalities underlying the main results.

In line with recent literature on the political economy of fiscal policy, I model electoral competition in a probabilistic voting setup à la Lindbeck and Weibull (1987). The mechanism is standard in the literature so here I describe it briefly.[11] Probabilistic voting assumes the existence of a separate "ideology" dimension, orthogonal to the policy variables. With two political parties maximizing their expected vote share, the probability that a vote is cast in favor of one party is a continuous, increasing function of the relative appeal of that party's platform. Assuming an equilibrium in pure strategies exists, proposed policies are identical and maximize a weighted sum of agents' welfare.[12] In the context of this model, fiscal policy allocations are chosen every period to maximize:

$$U_{i,t} = \chi u^y_{i,t} + (1-\chi) u^o_{i,t}, \tag{8}$$

where $u^y_{i,t} = \ln c^y_{i,t} + \beta \ln c^o_{i,t+1}$ is the lifetime utility of the currently young agents and $u^o_{i,t} = \ln c^o_{i,t}$ is the utility of currently old agents. $\chi \in (0,1)$ and $1-\chi$ denote the weight of the young and old generation respectively. The old-age welfare of agents who are young in period t enters the aggregate welfare function both in period t and period $t+1$, the first occurrence being due to the forward looking behavior of young agents.

The integrated capital market. The n countries share a common capital market accessible to both firms and governments. Denote aggregate variables as $X_t = \sum_{i=1}^{n} X_{i,t}$, for $X = \{Y, K, G, c^y, c^o, s, B\}$. Every period, the common capital market clearing condition reads:

$$K_t = S_{t-1} - B_t. \tag{9}$$

The fiscal externalities. The integrated capital market yields two distinct externalities arising through: (1) government debt and (2) public spending.

The public debt externality is straightforward. In a closed economy, higher public debt crowds out capital and increases the interest rate. Since young agents care about their old age welfare, the cost of debt is partially internalized, even by the myopic governments described above. When borrowing in an international market, however,

[11] The supplementary appendix describes the model in more detail. See also Persson and Tabellini (2002) for a detailed exposition of probabilistic voting models. Applications to fiscal policy in dynamic settings include Dixit and Londregan (1998), Strömberg (2004), Hassler et al. (2005), Gonzalez-Eiras and Niepelt (2008). Song et al. (2012) provide details on the application of probabilistic voting to a model with public debt.

[12] See Laussel and Breton (2002) for a more detailed analysis on the equilibrium properties under probabilistic voting.

these governments ignore the fact that an increase in the interest rate crowds out private capital and lowers output in all other countries. Thus, independently set fiscal policies rely too much on borrowing. Importantly, this cross-border pecuniary debt externality occurs independently from the governments' finite life-spans.[13]

The second cross-border externality arises through public spending. In a closed economy public spending already generates a positive externality by increasing productivity and entry in the intermediate goods sectors. In the following I explain how this externality plays out in open economies.

While capital flows freely across countries, the owners are immobile. In order to focus on the interplay between public spending competition and debt, I further assume the capital taxation is residence based, so that the direct, intraperiod, tax competition channel is shut down.[14] Thus, capital mobility requires the marginal product of capital before tax to be equal across countries, i.e.:

$$G_{i,t}^{\eta}/K_{i,t}^{1-\phi} = G_{j,t}^{\eta}/K_{j,t}^{1-\phi}, \forall i \neq j. \tag{10}$$

Competitive capital markets and full depreciation further imply the return on assets is equal to the international marginal product of capital, $R_t = q_t$. The presence of a publicly provided input in the production implies that the marginal product of capital can be affected by fiscal policy and that governments choose $G_{i,t}$ strategically to attract private capital, given the choices of other governments. Thus, when the income of the old agents is taxed in the country of origin and the pre-tax returns are equalized, rewriting (10) for all countries yields the following equilibrium condition:

$$K_{i,t} = g_{i,t}K_t, \text{ where } g_{i,t}\left(G_{i,t}, G_{j\neq i,t}\right) = G_{i,t}^{\frac{\eta}{1-\phi}}\left(\sum\nolimits_{j=1}^{n} G_{j,t}^{\frac{\eta}{1-\phi}}\right)^{-1}. \tag{11}$$

where K_t is the common market aggregate stock of capital.[15] Intuitively, the stock of physical capital that each country can attract depends on its share in total public spending and the total capital stock available in the integrated economy. This relationship summarizes the fiscal competition among countries in each period. Using (11), the production function in each country can now be expressed only in terms of

[13] Chang (1990) shows that uncoordinated benevolent governments representing current and future generations still issue excessive amounts of debt.

[14] In the supplementary appendix IV, I explore numerically the role of direct tax competition in a simplified version of the model.

[15] This condition is very similar to the payoff function postulated by Bucovetsky (2005) in a model of public input competition. Here, it arises naturally from the assumptions of strategic public investment and integrated capital markets.

the public spending *in all countries* and the aggregate capital stock:

$$Y_{i,t} = zG_{i,t}^{\eta}(g_{i,t}\left(G_{i,t}, G_{j\neq i,t}\right)K_t)^{\phi}. \tag{12}$$

Given fixed costs related to entry of σY_t, the aggregate resource constraint of the n-country economy is

$$(1-\sigma)Y_t = C_t^y + C_t^o + K_{t+1} + G_t. \tag{13}$$

4 Policy regimes and equilibrium allocations

Let $\Theta_{i,t}(s_{j,t-1}, B_{jt}),\ j \in \{1, 2, ...n\}$ denote the policy vector $(\tau_{i,t}^L, \tau_{i,t}^K, G_{i,t}, B_{i,t+1})$ set by the government in country i at time t. as functions of the the vector of saving and public debt allocations that characterize all countries at the beginning of period t. These state variables define the world supply of capital K_t through (9).

First, given public policies, $\Theta_{i,t}$ the private sector economic equilibrium is given by household allocations (2), firms' hiring rules (6) and the equalization of before tax returns to capital (10) implied by international capital mobility.

Second, to specify how policies $\Theta_{i,t}$ are chosen, I study two policy regimes. Under the first regime, termed "strategic policies", governments choose every period national policies independently in order to maximize the utility of domestic voters given other countries' policies. Under the second, termed "coordinated policies", fiscal policies are set jointly to maximize the welfare of currently living generations in all countries subject to all public budget constraints.

Before defining and characterizing equilibrium under each of these policy regimes, it is important to emphasize the nature of strategic policy making in this model. On the one hand, the time t government in country i behaves strategically in a "cross-border" sense, i.e. vis-a-vis the other governments in power at time t. On the other hand, the same government behaves strategically in an "inter-temporal" sense, i.e. relative to the country i's next government. In particular, while governments only hold office for one period and cannot commit to future policies, they can strategically use current fiscal policy to manipulate the decisions of future policy makers by determining the amount of public debt and private saving available to their successors. As detailed below, strategic policies incorporate both the cross-border and the inter-temporal margins while coordinated policies bypass the cross-border rivalry but remain strategic in the inter-temporal sense due to the underlying demographic and political structure of the economy.

4.1 Strategic policies

In analyzing strategic fiscal policies, denoted by superscript s, I focus on symmetric and stationary Markov perfect equilibria (MPE) in pure strategies.[16] The payoff relevant state variables are $s_{j,t-1}, B_{jt}$, $j \in \{1, 2, ...n\}$.

As explained above, when setting policies, governments take into account households' and firms' optimal decisions rules on consumption, saving and hiring.[17] Furthermore, each government at t anticipates its effects on the domestic government at $t+1$, i.e. recognizes the functional dependence $\Theta_{i,t+1}(\Theta_{i,t})$.[18] At the same time, current fiscal policies in other countries, $\Theta_{j,t}, j \neq i$, are taken as given.

Finally, recall that welfare in country i depends on policies in the rest of the world through the capital market: the share of private capital a country can attract depends on the public investment in all countries while the interest rate also depends on their public debt.

Definition 1. *Consider the case of strategic policies with n symmetric countries characterized by $\mathbf{x}_0 = \{s_{i,-1}, B_{i,0}\}, i \in \{1, 2, ...n\}$. Let $\Theta^s_{i,t}(\mathbf{x}_t)$ denote the vector of policy rules $\tau^L_{i,t}(\mathbf{x}_t), \tau^K_{i,t}(\mathbf{x}_t), G_{i,t}(\mathbf{x}_t), B_{i,t+1}(\mathbf{x}_t)$ set by government i at time t. A symmetric MPE path of this economy is a n-tuple of rules' sequences $\left\langle \left\{\Theta^s_{i,l}(\mathbf{x}_l)\right\}^{\infty}_{l=0} \right\rangle$ for all i such that, $\forall t \geqslant 0$, government i chooses $\Theta^s_{i,t}$ to solve:*

$$V^s_{i,t} = \max_{\Theta_{i,t}} \left\{ \chi u^y_{i,t} + (1-\chi) u^o_{i,t} \right\}, \tag{14}$$

$$\text{subject to } B_{i,t+1} + \tau^L_{i,t} w_{i,t} + \tau^K_{i,t} R_t s_{i,t-1} = G_{i,t} + R_t B_{i,t}, \tag{15}$$

as well as:

i) the capital mobility condition (10),

ii) the optimal behavior of households (2) and firms (6),

iii) the functional dependence of domestic policies at $t+1$ on current domestic policies, $\Theta_{i,t+1}(\Theta_{i,t})$, and

iv) taking as given current and future policies in all other countries, $\Theta_{j,l}, j \neq i, l \geqslant t$.

In a MPE, policies depend only on current states $s_{i,t-1}, B_{i,t}$ $i \in \{1, 2, ...n\}$**.** More-

[16] The conjecture that a symmetric equilibrium exists in pure strategies is widespread in the literature and is instrumental for tractability. Moreover, as shown in the supplimentary appendix IV, numerical simulations seem to support such a conjecture.

[17] In contrast, private agents take prices and public policies as given.

[18] This dependence arises through the level of public debt $B_{i,t+1}$ and since next period saving is a function of current public spending $G_{i,t}$. Moreover, each government at t correctly anticipates the symmetric equilibrium at $t+1$.

over, with identical initial conditions, a symmetric equilibrium can be supported as public spending ultimately depends on the production function parameters, which are identical. Hence, *in equilibrium* public spending and the capital stock are equal across countries so $g_{i,t} = 1/n$ and $K_{i,t} = K_t/n$. Note that, while each government takes as given the other governments' policies, budget constraints hold automatically. This is because factor prices (6) adjust to maintain the common market general equilibrium.

With logarithmic utility and Cobb-Douglas production function, functional dependence on future policies can be analytically solved for. This enables a two step solution technique, similar to Klein et al. (2008) and Bonatti (2007). First, assuming a finite horizon problem, $t = 1, 2, ..., T$, the solution is found solving backwards assuming the government at t anticipates its effects on the symmetric policy rules followed by the *domestic* government at $t+1$. Second, iterating on this solution and letting $T \to \infty$ yields the time invariant policy rules for the infinite horizon case. Section I) of the supplementary appendix provides detailed derivations.

In equilibrium, given aggregate capital $K_t^s = S_{t-1} - B_t$, symmetry implies $K_{i,t}^s = K_t^s/n$. Strategic policy rules $\Theta_{i,t}^s$, next period capital stock $K_{i,t+1}^s$ and the public budget shadow price $\mu_{i,t}^s$ are given respectively, by:

$$\tau_{i,t}^{L,s} = 1 - \frac{(1+\beta)\chi}{z(1-\sigma)(1-\alpha)} D^s, \ \tau_{i,t}^{K,s} = 1 - \frac{(1-\chi)}{z(1-\sigma)\alpha} D^s \frac{s_{i,t-1} - B_{i,t}^s}{s_{i,t-1}}, \quad (16)$$

$$G_{i,t}^s = (c^s)^{\frac{1}{1-\eta}} \left(K_{i,t}^s\right)^{\frac{\phi}{1-\eta}}, \quad (17)$$

$$B_{i,t+1}^s = \frac{c^s + (1-\sigma)z\left(\frac{1-\alpha}{1+\beta}\left(\frac{(1-\eta)n}{\phi\chi} - 1\right) - \alpha\right)}{1 + \frac{1-\eta}{\beta\phi\chi}n} (c^s)^{\frac{\eta}{1-\eta}} \left(K_{i,t}^s\right)^{\frac{\phi}{1-\eta}}, \quad (18)$$

$$K_{i,t+1}^s = \frac{\chi\beta\phi}{1-\eta} \frac{D^s}{n} (c^s)^{\frac{\eta}{1-\eta}} \left(K_{i,t}^s\right)^{\frac{\phi}{1-\eta}}, \quad (19)$$

$$\mu_{i,t}^s = (D^s)^{-1} (c^s)^{-\frac{\eta}{1-\eta}} \left(K_{i,t}^s\right)^{-\frac{\phi}{1-\eta}}, \quad (20)$$

where c^s and D^s are constants given by:

$$c^s = (1-\sigma)z\eta\left(\frac{1-\alpha}{1-\phi}\left(1 - \frac{\phi}{n}\right) + \frac{\alpha}{n}\right) \text{ and } D^s = \frac{(1-\eta)\left(z(1-\sigma) - c^s\right)}{(1-\eta) + \chi\beta\phi/n}.$$

Assumption 1 ensures overall decreasing returns to scale and thus a unique and stable steady state, that can be solved for by setting $K_{i,t+1}^s = K_{i,t}^s$ in (19).

The steady state capital stock in country i under strategic policies is then:

$$K_{i,ss}^{s} = (c^{s})^{\frac{\eta}{1-\eta-\phi}} \left(\frac{\chi\beta\phi D^{s}}{n(1-\eta)} \right)^{\frac{1-\eta}{1-\eta-\phi}}. \tag{21}$$

The term c^s captures the externality stemming from competition in public spending. Note that the cross-border spending externality depends critically on different elasticities of public spending at firm and aggregate level ($\phi > \alpha \iff \eta > \delta$), i.e. on the entry enhancing effects of public spending. When $\phi = \alpha$, the effects of fiscal competition in public spending on labor and capital income cancel each other. In this case, $G_{i,t}^{s}$ depends on the output elasticity $\eta = \delta$ but not on n. When $\phi > \alpha$, the marginal effect of $G_{i,t}^{s}$ on the interest rate remains constant as capital adjusts costlessly while the marginal effect on wages becomes larger due to additional entry in the intermediate goods sector. Given the tax base $s_{i,t-1}$ is predetermined, these effects imply $G_{i,t}^{s}$ increases with n.

Moreover, the public spending externality does not depend on the relative political weight of the young χ, as the marginal utility of public spending is equalized across young and old agents via different tax rates. As expected, the higher χ, the lower the labor tax and the higher the capita tax rate.[19] Assumption 1 ensures D^s is positive. On the one hand, higher public spending increases the tax base today and thus reduces the shadow price of the public budget $\mu_{i,t}^{s}$. On the other hand, the overall cost of funding the public budget is captured by the inverse of the term D^s, which depends negatively on c^s since funding public spending is distortionary. Thus, a higher D^s lowers $\mu_{i,t}^{s}$ as well as the tax rates and increases the capital stock next period $K_{i,t+1}^{s}$. At a given level of public spending, D^s increases with n as the pecuniary interest rate externality lowers the cost of debt and thus reduces tax rates. Note however that future capital depends on D^s/n therefore the public debt externality also has a direct crowding out effect on capital accumulation. Thus, it is straightforward to show that the speed of capital accumulation $K_{i,t+1}^{s}/K_{i,t}^{s}$ increases with χ since the higher the political weight of the young, the lower the incentive to issue debt.

To better understand the role played by each externality in this economy, it is useful to first contrast strategic policies against those resulting from coordination among national governments.

[19] $\partial\tau_{i,t}^{L,s}/\partial\chi = \frac{n(1+\beta)(n-1)^2(n(1-(1-\alpha)\eta-\phi)+\eta(\phi-\alpha))}{(1-\alpha)(1-\phi)(n(1-\eta)+\beta\phi\chi)^2} < 0$ and $\partial\tau_{i,t}^{k,s}/\partial\chi = \frac{(1-\eta)(n(1-\eta)+\beta\phi)(n(1-(1-\alpha)\eta-\phi)+\eta(\phi-\alpha))}{\alpha(1-\phi)(n(1-\eta)+\beta\phi\chi)^2} \frac{s_{i,t-1}-B_{i,t}^{s}}{s_{i,t-1}} > 0$ under Assumption 1.

4.2 Coordinated policies

Coordinated policies, superscripted c, are chosen by a planner that takes into account the welfare of the voting agents in all countries as well as all public budget constraints. Given the short termism of domestic governments, retaliation in future periods cannot act as a credible enforcement mechanism. Thus, this policy regime implicitly assumes the existence of some formal enforcement mechanism that would prevent national governments to deviate.[20]

Note that here coordination is short-sighted, a consequence of the limited household life-span. Coordination takes into account the effects of both domestic public spending and public debt on the other countries in the economy. Coordination solves both the fiscal free-riding (through debt) and the fiscal competition (through public spending), but the long run effects of these policies are only partially internalized relative to an infinitely lived planner.

Definition 2. *Consider the case of coordinated policies with n symmetric countries characterized by $\mathbf{x}_0 = \{s_{i,-1}, B_{i,0}\}$. An equilibrium path of this economy is a n-tuple of public policy sequences $\left\langle \left\{\Theta^c_{j,v}(\mathbf{x}_v)\right\}_{v=0}^{\infty} \right\rangle$ for all $j = \{1, n\}$ such that $\forall t \geqslant 0$, allocations solve:*

$$V_t^c = \max_{\Theta_{j,t}} \sum\nolimits_{j=1}^{n} U_{j,t} \tag{22}$$

$$\text{subject to } B_{j,t+1} + \tau^L_{j,t} w_{j,t} + \tau^K_{j,t} R_t s_{j,t-1} - T_j = G_{j,t} + R_t B_{j,t},\ j = \{1, n\}, \tag{23}$$

as well as:

i) the capital mobility condition (10),

ii) the optimal behavior of households (2) and firms (6), and

iii) the functional dependence of policies at $t+1$ on current policies, $\Theta_{i,t+1}(\Theta_{j,t})$, $i = \{1, n\}$.

Solving for the coordinated policy sequences $\Theta^c_{i,t}$ (see the supplementary appendix for derivations) yields:

[20] A formal agreement would take the form of a pact (e.g. the European Union treaties) committing all governments to cooperate and setting explicit penalties for those who deviate.

$$\tau_{i,t}^{L,c} = 1 - \frac{(1+\beta)\chi}{z(1-\sigma)(1-\alpha)} D^c,\ \tau_{i,t}^{K,c} = 1 - \frac{(1-\chi)}{z(1-\sigma)\alpha} D^c \frac{s_{i,t-1} - B_{i,t}^c}{s_{i,t-1}}, \quad (24)$$

$$G_{i,t}^c = (c^c)^{\frac{1}{1-\eta}} \left(K_{i,t}^c\right)^{\frac{\phi}{1-\eta}}, \quad (25)$$

$$B_{i,t+1}^c = \frac{c^c + (1-\sigma)z\left(\frac{1-\alpha}{1+\beta}\left(\frac{(1-\eta)}{\phi\chi} - 1\right) - \alpha\right)}{1 + \frac{1-\eta}{\beta\phi\chi}} (c^c)^{\frac{\eta}{1-\eta}} \left(K_{i,t}^c\right)^{\frac{\phi}{1-\eta}}, \quad (26)$$

$$K_{i,t+1}^c = \frac{\chi\beta\phi}{1-\eta} D^c (c^c)^{\frac{\eta}{1-\eta}} \left(K_{i,t}^c\right)^{\frac{\phi}{1-\eta}}, \quad (27)$$

$$\mu_{i,t}^c = (D^c)^{-1} (c^c)^{-\frac{\eta}{1-\eta}} \left(K_{i,t}^c\right)^{-\frac{\phi}{1-\eta}}, \quad (28)$$

where

$$c^c = (1-\sigma)z\eta \text{ and } D^c = \frac{(1-\eta)\left(z(1-\sigma) - c^c\right)}{(1-\eta) + \chi\beta\phi}.$$

Again, Assumption 1 guarantees overall decreasing returns to scale and the existence of a unique and stable steady state. Under coordination, the steady state aggregate capital stock is:

$$K_{i,ss}^c = (c^c)^{\frac{\eta}{1-\eta-\phi}} \left(\frac{\chi\beta\phi D^c}{1-\eta}\right)^{\frac{1-\eta}{1-\eta-\phi}}. \quad (29)$$

Analyzing the coordinated allocations, it is clear that they do not depend on n, the scope of the capital market. In fact, coordinated policies can be obtained by setting $n = 1$ in the equations that describe strategic allocations. Thus, $c^c < c^s$ as the strategic motive behind public spending is removed. $D^c > D^s$, i.e. the overall distortion from funding the public budget is lower under coordination due to both reduced financing needs ($G_{i,t}^c < G_{i,t}^s$) and to internalizing crowding out effects. The next section proceeds to compare strategic and coordinated policies more in depth. In particular, I contrast the two sets of policies in the short run, i.e. conditional on the current capital stock, as well as in the steady state.

5 Strategic vs coordinated policies in the short run and steady state

Assuming the n-country economy is characterized at time t by $s_{i,t-1}, B_{it}$, $i \in \{1, 2, ...n\}$ equations (16)-(19) and (24)-(27) describe the short run strategic and respectively the coordinated policies. Comparing the two sets of allocations, the

following results can be established:

Proposition 1. ***Policy comparison in the short run.*** *Relative to coordinated policies, strategic policies imply:*

a) higher public spending and output: $G^s_{i,t} > G^c_{i,t}$ *and* $Y^s_{i,t} > Y^c_{i,t}$,

b) higher share of public debt in output: $B^s_{i,t+1}/Y^s_{i,t} > B^c_{i,t+1}/Y^c_{i,t}$,

c) lower tax rates on labor and capital: $\tau^{L,s}_{i,t} < \tau^{L,c}_{i,t}$ *and* $\tau^{K,s}_{i,t} < \tau^{K,c}_{i,t}$,

d) lower future capital stock: $K^s_{t+1} < K^c_{t+1}$.

Proof. See Appendix C. □

International capital mobility leads to overinvestment in public goods but also to a higher public debt share in output. Importantly, while the framework does not feature explicit tax competition, strategic tax rates are nonetheless lower than coordinated ones despite increased needs to fund public spending in order to attract capital. This arises since *i)* the higher level of productive public spending increases output and thus current tax base and *ii)* the perceived cost of public debt is too low (relative to coordination) and thus governments are willing to fund strategic public spending through public debt relative to taxation. While the public spending externality has a positive effect on capital accumulation, strategic public debt has a larger negative effect on capital hence $K^s_{t+1} < K^c_{t+1}$.

Given capital accumulation depends on the policy regime, comparing steady state outcomes becomes a natural next step. Assuming each respective policy regime lasts forever, steady state policies can be found by substituting steady state capital stocks (21) and (27) in equations (16)-(19) and (24)-(27) respectively. Comparing the two sets of policies, the following results can be established:

Proposition 2. ***Policy comparison in steady state.*** *Relative to coordinated policies, strategic policies imply:*

a) lower public spending: $G^s_{i,ss} < G^c_{i,ss}$,

b) higher share of public debt in output : $B^s_{i,ss}/Y^s_{i,ss} > B^c_{i,ss}/Y^c_{i,ss}$,

c) lower tax rates on labor, $\tau^{L,s}_{i,ss} < \tau^{L,c}_{i,ss}$*, but higher capital tax rates:* $\tau^{K,s}_{i,ss} > \tau^{K,c}_{i,ss}$,

d) lower capital stock $K^s_{ss} < K^c_{ss}$.

Proof. See Appendix C. □

Note that a) and d) above imply $Y^s_{ss} < Y^c_{ss}$. In stark contrast to Proposition 1, in the steady state, it is policy coordination that delivers the lower capital tax rates, as well as the higher level of public spending. Given fiscal competition under strategic policies occurs in the form of a "race to the top" in public spending, these outcomes

may seem puzzling at first. They can be easily understood once capital accumulation is taken into account. While fiscal competition delivers higher public spending in the short run, i.e. for a given capital stock, this is not enough to compensate for the larger crowding out of private capital due to public debt. As capital accumulation slows down, servicing public debt requires higher tax revenues and at the same time reduces the incentives to engage in public spending competition which further slows down capital accumulation. Steady state interest rates are higher under strategic policies, while wages are lower. This explains why in the steady state capital tax rates are higher and labor tax rates are lower under fiscal competition relative to coordinated policies.

Next, I study how strategic policies are shaped by changes in the scope of financial liberalization, i.e. the number of countries participating in the common capital market.

6 An increase in the scope of financial liberalization (n)

Recall that capital accumulation depends on n, the number of countries, only under strategic policies, reflecting the fiscal externalities which are the focus of the paper. Given the assumption of costlessly mobile capital across participating economies, n is a natural proxy for the scope or extent of global financial liberalization observed in the last decades. While in general changes in the scope of financial liberalization involve a transition towards a new steady state, I first focus on the short run, i.e. on the effects of an increase in n at the beginning of t, given $s_{i,t-1}, B_{it}$, $i \in \{1, 2, ...n\}$.

The higher the number of countries, the more intense the fiscal competition in public spending, i.e. $\partial G^s_{i,t}/\partial n > 0$. This follows from $\partial c^s/\partial n = z\eta(1-\sigma)(\phi - \alpha)/(n^2(1-\phi)) > 0$ and $\phi = \alpha(1-\sigma)/(1-2\sigma) > \alpha$. Thus, ceteris paribus, the larger the output and the capital stock next period. The effects on the term D^s are more involved. On the one hand, higher n increases D^s through the term in the denominator. This stems from the pecuniary interest rate externality that leads governments to underprice their debt. On the other hand, higher public spending lowers D^s and thus increases tax rates.[21]

Proposition 3. *Assuming strategic policies, in the short run, an increase in the*

[21] In contrast, in the absence of public debt, Hoyt (1991) finds in a static tax competition environment that an increase in the number of jurisdictions leads to lower (unproductive) public spending, tax rates and welfare.

Figure 2: Strategic policies at different levels of financial integration

The benchmark economy (circle symbol lines) has $n = 2$. The paths of public spending G_i, (first panel), debt share in output $B_{i,t+1}/Y_{i,t}$ (second panel), capital tax rate $\tau^K_{i,t}$ (third panel) and labor tax rate $\tau^L_{i,t}$ (fourth panel) are shown for different levels of financial integration n beginning with $t = 3$. The light solid lines depict policies when $n = 3$ and the dashed lines depict the case $n = 4$. The zoom-in of the leftmost panel focuses on relevant changes. As per (19) in the main text, public spending and capital follow similar bounded dynamics. The other parameters are set at $\alpha = 0.35$, $\delta = 0.2$, $\sigma = 0.1$, $\chi = 0.8$ and $\beta = 0.95$.

scope of financial integration (the number of countries n) leads to:

a) higher public spending $\partial G^s_{i,t}/\partial n > 0$,

b) higher share of public debt in output: $\partial(B^s_{i,t+1}/Y^s_{i,t})/\partial n > 0$,

c) lower tax rates: $\partial\tau^{L,s}_{i,t}/\partial n < 0$ *and* $\partial\tau^{K,s}_{i,t}/\partial n < 0$ *if* $\chi > \hat{\chi} = (1-\eta)\eta(\phi - \alpha)/(\beta\phi(1-\eta-\phi+\alpha\eta))$,

d) lower capital stock: $\partial K^s_{i,t+1}/\partial n < 0$.

Proof. See Appendix C. □

Figure 2 shows how strategic policies respond when the scope of financial integration changes from $n = 2$, assuming $\chi > \hat{\chi}$. More intense fiscal competition implies that even as they spend more, governments issue more debt and thus can set lower tax rates. The condition under which tax rates decline with n is related to the intergenerational conflict. The condition $\chi > \hat{\chi}$ implies national governments place a large weight on the lifetime welfare of the current young.

Young agents prefer low labor taxes and high current capital taxes. Moreover, similar to Song et al. (2012), while current old would like to minimize current capital tax rates by spreading the cost of public spending into the future via an increase in public debt, the current young foresee the negative effect of the public debt for their old age income and hence prefer lower debt levels. However, the lower the debt level, the more it increases with the scope of financial integration as countries ignore the

external effects on the interest rate. Thus, when the political weight of the young is high, i.e. $\chi > \hat{\chi}$, an increase in financial integration increases public debt more than public spending and reduces the need for current tax revenues hence both tax rates decline. In contrast, when the political weight of the young is low, $\chi \leqslant \hat{\chi}$, public debt and the interest rate are high. This implies debt is increasing less with financial integration and thus the tax rates have to increase in order to finance higher levels of public spending triggered by fiscal competition.

Since coordinated policies replicate the one country case, Proposition 2 can also be used to infer the steady state impact of an increase in n. As also shown in Figure 2, in the long run labor tax rates are lower, capital tax rates are higher, the debt output share is higher but public spending declines. As a result physical capital and output are lower too.

So far, I have compared strategic and coordinated policies taking each regime as given. In the following, I assume both regimes can be implemented at time t and study the choice of national governments by comparing the social welfare levels associated with each regime, both in the short run and in the steady state.

7 Welfare analysis

The welfare of the currently living generations in country i can be expressed for each policy regime $x = \{s, c\}$, in terms of the shadow prices associated with the government budget constraints at t and $t+1$:

$$V_{i,t}^{x} = (1-\chi)\ln\left(\frac{1-\chi}{\mu_{i,t}^{x}}\right) + \chi\ln\left(\frac{(1+\beta)\chi}{\mu_{i,t}^{x}}\right) + \beta\chi\ln\left(\frac{1-\chi}{\mu_{i,t+1}^{x}}\right), \tag{30}$$

where χ is the weight of the young generation in the social welfare function.

Let $\Omega_t = V_{i,t}^{s} - V_{i,t}^{c}$ denote the welfare gap between strategic and coordinated policies:

$$\Omega_t = \ln\left(\frac{\mu_{i,t}^{c}}{\mu_{i,t}^{s}}\right)\left(\frac{\mu_{i,t+1}^{c}}{\mu_{i,t+1}^{s}}\right)^{\chi\beta}. \tag{31}$$

Note that while $\mu_{i,t}^{x}$, $x = \{s, c\}$ depend on the initial stock of capital at date t, $\mu_{i,t+1}^{x}$, $x = \{s, c\}$ depend on the endogenous - and regime dependent - capital stock at $t+1$. Intuitively, expression (31) links the welfare difference to the relative cost (across the two policy regimes) of funding the public budget today (this affects both young and old agents, so it has a weight of one), and tomorrow (this affects only the currently young agents, so it has a discounted weight of $\beta\chi$). Assuming

each policy regime lasts indefinitely and using the steady state capital stocks (21) and (29) in the expressions for $\mu^s_{i,t}$ and $\mu^c_{i,t}$, (20) and (28) respectively, yields the steady state shadow prices $\mu^s_{i,ss}$, $\mu^c_{i,ss}$ and the corresponding steady state welfare gap $\Omega_{ss} = \ln\left(\mu^c_{i,ss}/\mu^s_{i,ss}\right)^{1+\chi\beta}$.

Signing the welfare differences during transition (Ω_t) and in the steady state (Ω_{ss}) yields the following results:

Proposition 4. *In the short run, coordinated policies yield higher welfare for the currently living generations relative to strategic policies only if the number of countries is higher than some threshold. A sufficient condition for $\Omega^s_t > \Omega^c_t$ is $n > \widetilde{n} = (1+\chi\beta\phi/(1-\eta))^{1+(1-\eta)(1+\beta\chi)/(\phi\chi\beta)}$. However, in the steady state, coordinated fiscal policies deliver the highest welfare, i.e. $\Omega^s_{ss} > \Omega^c_{ss}, \forall n > 1$.*

Proof. See Appendix C. □

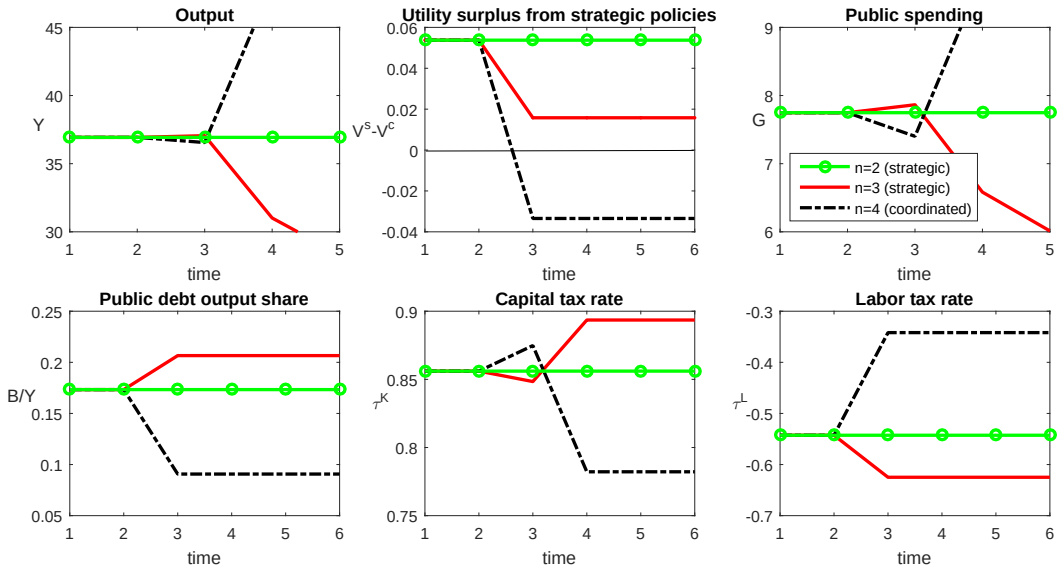
The proposition summarizes an important result: in a world where short lived governments use deficit funded public spending to compete for mobile capital, policy coordination can be inferior in the short run and thus unenforceable despite being optimal in the steady state. In particular, given some stock of capital and public debt, if $n < \widetilde{n}$ voters prefer strategic policies while they prefer coordinated policies for $n > \widetilde{n}$.

The *top middle* panel of Figure 3 displays $\Omega_t = V^s_{i,t} - V^c_{i,t}$ for the benchmark case of $n = 2$ (circle symbol line) as well as for unanticipated changes to $n = 3$ (light solid line) and $n = 4$ (dark solid line) at $t = 3$. The remaining panels display policy paths that maximize the lifetime utility of current generations at each t and n.

For the benchmark case of $n = 2$, strategic policies emerge in equilibrium. Upon the increase in the scope of financial integration to $n = 3$ tax rates drop and the public debt share in output increases. While higher debt slows down capital accumulation and lowers output in the long run, strategic policies continue to deliver higher utility to successive generations of voters relative to coordination. If $n = 4$ the debt channel is strong enough (see the dashed line in Figure 1) for strategic policies to generate a utility loss even for current generations. Thus, provided an enforceable pact to coordinate policies can be formulated, such policies (depicted by dash-dot lines for $n = 4$) would be supported by current generations and would lead to higher current tax rates and lower public debt. Private capital crowd in would lead to higher output growth during transition.

So why does fiscal competition prevail if the scope of the global capital market is low? Recall that while both public spending and debt have external effects, their

Figure 3: Fiscal policies that maximize the lifetime welfare of current voters at different levels of financial integration



The top middle panel shows the difference in lifetime utility of generations living at t between strategic and coordinated policies $V^s_{i,t} - V^c_{i,t}$ for different n. Strategic policies dominate for the benchmark $n = 2$ (circle symbol lines) and $n = 3$ (light solid lines) but yield lower welfare at $n = 3$ (dark solid lines). Thus, coordinated policies are chosen for $n = 4$ (dash-dot lines). The other panels depict the paths of output $Y_{i,t}$ (top left), public spending $G_{i,}$ (top right), debt share in output $B_{i,t+1}/Y_{i,t}$ (bottom left), capital tax rate $\tau^K_{i,t}$ (bottom middle) and labor tax rate $\tau^L_{i,t}$ (bottom right). The zoom-in of the top left and middle panels focuses on relevant changes. As per (19) in the main text, public spending, capital and output follow similar bounded dynamics. The other parameters are set at $\alpha = 0.35$, $\delta = 0.2$, $\sigma = 0.1$, $\chi = 0.8$ and $\beta = 0.95$.

magnitudes change at different rates with the number of countries. The externality from productive public spending leads to higher current incomes and thus welfare. While this externality dominates initially, uncoordinated public debt increases faster with n. Eventually, crowding out of private capital becomes large enough to warrant a switch to coordinated policies even by short-lived governments.

Finally, it can be shown that $\widetilde{n}$ increases in χ. Intuitively, if young voters prefer low public debt, the higher their political weight, the lower the associated negative externality from capital mobility and since the positive spending externality is independent of χ, the higher the scope of financial integration needed to justify coordinated policies. Thus, setting aside other considerations, such as the price of capital, to the extent population aging lowers χ, it makes coordination worthwhile with a smaller number of countries. Conversely, with a given number of countries, a uniform increase in the size of the young generation, for example due to international migration, could imply a switch from coordination to strategic policies.

8 Concluding remarks

The paper develops a tractable dynamic politico-economic theory of fiscal competition via productive public spending and debt.

In this framework, while residence based taxation is feasible, fiscal competition lowers capital tax rates relative to coordination in the short run. The result is driven by the preference of the current voters to increase the tax base by funding productive public spending with debt. However, steady state capital tax rates are higher under fiscal competition as high debt levels set the world economy on a path of lower capital accumulation which in turn increases the relative cost of public debt.

Following an increase in the scope of financial liberalization, modelled as an increase in the number of countries that participate in the common capital market, capital tax rates can decline as public debt rises in all countries disproportionately. The result is relevant in the context of the long-standing policy debate on harmful tax competition. Recent agreements on automatic tax data sharing between OECD/G20 countries[22] may be seen as an attempt to restore the principle of residence based taxation with the expectation they will moderate if not revert the "race to the bottom" in capital tax rates. In contrast to conventional wisdom, this paper shows capital tax rates may continue to decline with financial liberalization as countries engage in deficit spending in order to compete more for mobile capital via public spending.

As illustrated by the recent evolution of the European integration project, the potential tension between *scope* and *depth* in the process of economic integration remains a highly relevant policy issue. The paper sheds some light in this direction by emphasizing how the interaction of multiple externalities affects the incentives for policy coordination.

The paper points to a new link between the domestic politico-economic choice of fiscal policies and the characteristics of the global capital market. In particular, it suggests the scope of financial integration is an important determinant of long run growth and welfare. Specifically, while an increase in the scope of financial integration may induce myopic voters to select fiscal policies that are optimal in the long run, a sufficiently large decrease in the number of participating countries can generate an enduring switch to a path of low output growth. Furthermore, assuming strategic policies are initially supported in the short run, reducing membership to the common capital market will induce lower indebtedness and higher output. Importantly, the critical number of countries that would induce coordinate policies depends on how

[22]The Standard for Automatic Exchange of Financial Account Information in Tax Matters, released by OECD in July 2014 has been endorsed by 51 countries.

different generations are represented in the political process. This suggests, for example, that population aging could be a driver for international coordination of fiscal policies while at the same time lowering capital tax rates. Finally, while a higher political weight of the young generation lowers public debt given the policy regime, this "disciplined children" effect may lead, paradoxically, to higher equilibrium debt levels, as strategic policies remain appealing over a larger number of countries.

To keep the analysis tractable, the model has been simplified along a number of dimensions. While numerical exercises provide some indication that introducing direct tax competition does not alter results qualitatively, more work is needed to understand, theoretically and empirically, strategic interactions with multiple instruments in a dynamic setup. Recently Chirinko and Wilson (2017) have emphasized the importance of correctly specifying the dynamic effects of fiscal competition in empirical work. Following their suggestion, dynamic models such as the one developed here could here could help identify generalized response functions.

Also, considering the incentives to coordinate across heterogenous countries is of clear interest. Kanbur and Keen (1993) find in a static model that despite added inefficiencies from size differences, tax harmonization may still be suboptimal. In the current setup, size differences would presumably lead to divergent equilibrium policies, e.g. larger countries supporting larger tax rates and thus lower public debt. While this is likely to reduce the appeal of coordination, alternative arrangements may still lower the negative externality stemming from excessive public debt.[23] Related concerns are the option to default on public debt or other restrictions, such as budget rules. To the extent the (endogenous) constraints on debt would first affect strategic policies, current results on the superiority of fiscal competition would be reinforced. On the other hand, a restricted policy space would eventually lead to lower welfare levels. Moreover, the model abstracts from other linkages, such as labor mobility, trade flows or monetary policy that may limit/amplify fiscal free riding and thus the benefits of coordination. All these extensions are left for future research.

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Appendix A Data coverage and sources

The trends in Figure 1 cover high income economies by the IMF classification: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States. The table below provides summary statistics.

Table 1: Summary statistics and data sources

Variable	Mean	Std. Dev.	Min.	Max.	N	Source
Chinn-Ito index of fin. liber.	0.67	0.34	0	1	905	Chinn and Ito (2006)
Corporate income tax (%)	36.14	9.60	3	56	859	World Tax Database
Gov. primary exp. (% GDP)	40.85	10.55	9.88	71.72	888	Mauro et al. (2013)
Gen. gov. debt (% GDP)	48.97	28.13	1.7	186.4	938	Abbas et al. (2010)

Appendix B Production of intermediate goods

Competitive firms in country i produce the final good using an endogenously determined range of intermediate goods $x_{j,i,t}$ where $j \in (0, v_t)$:

$$Y_{i,t} = \left(\int_0^{v_{i,t}} x_{j,i,t}^{1-\sigma} dj\right)^{1/(1-\sigma)} \tag{B.1}$$

where $\sigma \in [0,1]$ is the inverse of the elasticity of substitution between intermediate goods. Final good firms choose $x_{j,i,t}$ given prices $p_{j,i,t}$ to maximize profits $\Pi_{i,t} = Y_{i,t} - \int_0^{v_{i,t}} p_{j,i,t} x_{j,i,t} dj$. This yields demand functions $x_{j,i,t}(p_{j,i,t}) = p_{j,i,t}^{-1/\sigma} Y_{i,t}$.

The monopolists that produce the intermediate goods $x_{j,i,t}$ pay a fixed cost f every period to operate and hire capital $k_{j,i,t}$, labor $l_{j,i,t}$ and the services provided at no cost by the government, G_{it}:

$$x_{j,i,t} = G_{i,t}^{\delta} k_{j,i,t}^{\alpha} l_{j,i,t}^{1-\alpha}, \ 0 < \delta \leqslant \alpha < 1. \tag{B.2}$$

They hire private inputs at given prices $w_{i,t}$ and $q_{i,t}$ to maximize profits:

$$\max_{l_{j,i,t}, k_{j,i,t}} \pi_{i,t} = p_{j,i,t} x_{j,i,t}(p_{j,i,t}) - (w_{i,t} l_{j,i,t} + q_{i,t} k_{j,i,t}) - f \text{ s.t. (B.2).} \tag{B.3}$$

The associated first order conditions are:

$$w_{i,t} = (1-\sigma)(1-\alpha)\frac{p_{j,i,t} x_{j,i,t}}{l_{j,t}}, \ q_{i,t} = (1-\sigma)\alpha \frac{p_{j,i,t} x_{j,i,t}}{k_{j,i,t}}. \tag{B.4}$$

Substituting prices (B.4) back into the profit function (B.3) implies, together with the free entry condition,

$$f = \sigma p_{j,i,t} x_{j,i,t}. \tag{B.5}$$

In a symmetric equilibrium $x_{j,i,t} = x_{i,t}$, $p_{j,i,t} = p_{i,t}$, $\forall j \in (0, v_{i,t})$ and thus (3) becomes:

$$Y_{i,t} = v_{i,t}^{1/(1-\sigma)} x_{i,t}, \tag{B.6}$$

which, combined with (B.2), yields $p_{i,t} = v_{i,t}^{\sigma/(1-\sigma)}$. Combining this with (B.5) yields the equilibrium quantity of intermediate good $x_{i,t} = f v_{i,t}^{-\sigma/(1-\sigma)}/\sigma$. Using this in (B.6) I obtain the expression for final output $Y_{i,t} = f v_{i,t}/\sigma$.

Given aggregate labor supply has been normalized to unity, in a symmetric equilibrium $k_{j,i,t} = K_{i,t}/v_{i,t}$ and $l_{j,i,t} = 1/v_{i,t}$, where $K_{i,t}$ is the aggregate stock of capital in country i. Using these allocations in (4), the production function for $x_{i,t}$, and solving for $v_{i,t}$ yields the endogenous variety of intermediate goods

$v_{i,t} = \left(\sigma G_{i,t}^{\delta} K_{i,t}^{\alpha}/f\right)^{(1-\sigma)/(1-2\sigma)}$.

Thus, denoting $z = (\sigma/f)^{\frac{\sigma}{1-2\sigma}}$, $\eta = \delta(1-\sigma)/(1-2\sigma)$, $\phi = \alpha(1-\sigma)/(1-2\sigma)$:

$$Y_{i,t} = z G_{i,t}^{\eta} K_{i,t}^{\phi}, \tag{B.7}$$

and prices (B.4) are:

$$w_{i,t} = (1-\sigma)(1-\alpha) Y_{i,t} \text{ and } q_{i,t} = (1-\sigma)\alpha Y_{i,t}/K_{i,t}. \tag{B.8}$$

Appendix C Proofs

Proof of Proposition 1.

a) $c^s > c^c \Rightarrow G_{i,t}^s > G_{i,t}^c$ and $Y_{i,t}^s > Y_{i,t}^c, \forall n > 1$.

b) See part b) of Proposition 3. Note that $f^b(n) = B_{i,t+1}^s/Y_{i,t}^s$ and $f^b(1) = B_{i,t+1}^c/Y_{i,t}^c$. Thus, since $\partial f^b/\partial n > 0$, $\forall n > 1, B_{i,t+1}^s/Y_{i,t}^s > B_{i,t+1}^c/Y_{i,t}^c$.

c) Follows from $\frac{1-\tau_{i,t}^{L,s}}{1-\tau_{i,t}^{L,c}} = \frac{c^s - z(1-\sigma)}{c^c - z(1-\sigma)} \frac{1-\delta(1-\sigma)-2\sigma+\alpha\beta\chi(1-\sigma)}{1-\delta(1-\sigma)-2\sigma+\alpha\beta\chi(1-\sigma)/n} > 1$ for $n > 1$ and δ small, since $c^s > c^c$. Similarly, $\tau_{i,t}^{K,s} < \tau_{i,t}^{K,c}$.

d) The result follows from part d) of Proposition 3. Note that $f^k(1) = K_{t+1}^c$ and $g^k(1) = K_{ss}^c$.Conditional on current capital stock, $K_{ss}^s/K_{ss}^c < 1 \Rightarrow K_{t+1}^s/K_{t+1}^c < 1$.

Proof of Proposition 2.

a) Using the definitions of $G_{i,t}^s$ and $G_{i,t}^c$ together with those for the steady state capital stocks $K_{i,ss}^s$ and $K_{i,ss}^c$, for $G_{i,ss}^s/G_{i,ss}^c < 1$ it is sufficient to show:

$$\left(1 + \frac{(n-1)(\phi-\alpha)}{n(1-\phi)}\right)^{(1-\phi)/\phi} \left(1 - \frac{\eta(n-1)(\phi-\alpha)}{(1-\eta)n(1-\phi)}\right) \left(1 - \frac{(n-1)(1-\eta)}{n(1-\eta)+\beta\phi\chi}\right) < 1. \tag{C.1}$$

Then, for $0 < x < 1$ and $p > 0$, $h(x) = (1+x)^p(1-px) < 1$ since $\lim_{x\to 0} h(x) = 1$ and $\partial h/\partial x = -p(1+p)x(1+x)^{-1+p} < 0$. Use the previous result for $p = (1-\phi)/\phi$ and $x = (n-1)(\phi-\alpha)/n(1-\phi) < 1$. Finally, $1-(n-1)(1-\eta)/(n(1-\eta)+\beta\phi\chi) < 1$ holds for any $n > 1$.

b) Denote $f^b(n) = B_{i,t+1}^s/Y_{i,t}^s = \frac{c^s + (1-\sigma)z\left(\frac{1-\alpha}{1+\beta}\left(\frac{(1-\eta)n}{\phi\chi} - 1\right) - \alpha\right)}{z(1+(1-\eta)n/(\beta\phi\chi))}$. Then

$$\frac{\partial f^b}{\partial n} = \frac{\beta\phi\chi(1-\sigma)\left[n(1-\eta)\left(n(1-(1-\alpha)\eta-\phi) + 2\eta(\phi-\alpha)\right) + \beta\eta\phi\chi(\phi-\alpha)\right]}{n^2(1-\phi)\left(n(1-\eta)+\beta\phi\chi\right)^2} > 0$$

since $\phi + \eta < 1$ and $\alpha < 1 \Rightarrow 1-(1-\alpha)\eta - \phi > 0$ and $\phi = \alpha(1-\sigma)/(1-2\sigma) > \alpha$. Note that $f^b(n) = B_{i,t+1}^s/Y_{i,t}^s = B_{i,ss}^s/Y_{i,ss}^s$ and $f^b(1) = B_{i,t+1}^c/Y_{i,t}^c = B_{i,ss}^c/Y_{i,ss}^c$. Thus, since $\partial f^b/\partial n > 0$, $\forall n > 1, B_{i,ss}^s/Y_{i,ss}^s > B_{i,ss}^c/Y_{i,ss}^c$.

c) Labor taxes do not depend on the capital stock so part c) of Proposition 1 also implies $\tau_{i,ss}^{L,s} < \tau_{i,ss}^{L,c}$. On the other hand steady state capital taxes depend on capital stocks and saving levels. Setting equations (16) and (24) to the steady state implies,

after simplifications:

$$\frac{1-\tau_{i,ss}^{K,s}}{1-\tau_{i,ss}^{K,c}}=\left(1-\frac{\eta(n-1)(\phi-\alpha)}{n(1-\phi)(1-\eta)}\right)^2\left(1-\frac{(n-1)(1-\eta)}{n(1-\eta)+\beta\phi\chi}\right)^2\frac{1}{n}<1,$$

which holds $\forall n>1$ since all the terms in parentheses are positive and subunitary.

d) Follows from part d) of Proposition 3 with $g^k(1)=K_{ss}^c$.

Proof of Proposition 3.

a) Follows from $\partial c^s/\partial n=z\eta(1-\sigma)(\phi-\alpha)/(n^2(1-\phi))>0$ and $\phi=\alpha(1-\sigma)/(1-2\sigma)>\alpha$.

b) Denote $f^b(n)=B_{i,t+1}^s/Y_{i,t}^s=\frac{c^s+(1-\sigma)z\left(\frac{1-\alpha}{1+\beta}\left(\frac{(1-\eta)n}{\phi\chi}-1\right)-\alpha\right)}{z(1+(1-\eta)n/(\beta\phi\chi))}$. Then

$$\frac{\partial f^b}{\partial n}=\frac{\beta\phi\chi(1-\sigma)\left[n(1-\eta)\left(n(1-(1-\alpha)\eta-\phi)+2\eta(\phi-\alpha)\right)+\beta\eta\phi\chi(\phi-\alpha)\right]}{n^2(1-\phi)\left(n(1-\eta)+\beta\phi\chi\right)^2}>0$$

since $\phi+\eta<1$ and $\alpha<1\Rightarrow 1-(1-\alpha)\eta-\phi>0$ and $\phi=\alpha(1-\sigma)/(1-2\sigma)>\alpha$.

c) $\partial\tau_{i,t}^{K,s}/\partial n<0\Leftrightarrow\partial D^s/\partial n>0\Leftrightarrow\frac{z(1-\eta)(1-\sigma)(\beta\phi\chi(1-\eta-\phi+\alpha\eta)-(1-\eta)\eta(\phi-\alpha))}{(1-\phi)(n(1-\eta)+\beta\phi\chi)^2}>0$. The latter inequality yields the condition $\beta\chi>(1-\eta)\eta(\phi-\alpha)/(\phi(1-\eta-\phi+\alpha\eta))$. A similar condition can be derived for labor tax rates.

d) Denote $f^k(n)=K_{t+1}^s/n$ and $g^k(n)=K_{ss}^s/n$. Conditional on current capital stock, $g^k(n)<g^k(1)\Rightarrow f^k(n)<f^k(1),\forall n>1$. Thus, focusing on the former inequality, it is sufficient to show that:

$$\left(\frac{c^s}{c^c}\right)^{\eta/(1-\eta)}\frac{z(1-\sigma)-c^s}{z(1-\sigma)-c^s}\frac{1-\eta+\chi\beta\phi}{n(1-\eta)+\chi\beta\phi}<1. \tag{C.2}$$

Substituting the expressions for c^s and c^c in (C.2) and simplifying yields:

$$\left(1+\frac{(n-1)(\phi-\alpha)}{n(1-\phi)}\right)^{\eta/(1-\eta)}\left(1-\frac{\eta(n-1)(\phi-\alpha)}{(1-\eta)n(1-\phi)}\right)\left(1-\frac{(n-1)(1-\eta)}{n(1-\eta)+\beta\phi\chi}\right)<1.$$

Then, use the result from Proposition 2 a) above that $(1+x)^p(1-px)<1$ for $0<x<1$ and $p>0$ with $p=\eta/(1-\eta)$ and $x=(n-1)(\phi-\alpha)/n(1-\phi)<1$. Also, $1-(n-1)(1-\eta)/(n(1-\eta)+\beta\phi\chi)<1$, $\forall n>1$.

Proof of Proposition 4.

The welfare difference at t, $\Omega_t=V_{i,t}^s-V_{i,t}^c$ is rewritten as:

$$\Omega_t=\ln\left(\mu_{i,t}^c/\mu_{i,t}^s\right)\left(\mu_{i,t+1}^c/\mu_{i,t+1}^s\right)^{\chi\beta}, \tag{C.3}$$

where

$$\frac{\mu_{i,t+1}^c}{\mu_{i,t+1}^s}=\left(\mu_{i,t}^c/\mu_{i,t}^s\right)^{1+\frac{\phi}{1-\eta}}n^{-\frac{1-\eta}{\phi}}, \tag{C.4}$$

$$\frac{\mu_{i,t}^c}{\mu_{i,t}^s}=n\left(1+\frac{(n-1)(\phi-\alpha)}{n(1-\phi)}\right)^{\frac{\eta}{1-\eta}}\left(1-\frac{\eta(n-1)(\phi-\alpha)}{n(1-\phi)(1-\eta)}\right)\frac{1-\eta+\chi\beta\phi}{n(1-\eta)+\chi\beta\phi} \tag{C.5}$$

Substituting (C.4) together with (28) in (C.3) and simplifying implies $\Omega_t < 0$ is equivalent to:

$$(1+\chi\beta)\ln n + (1+\chi\beta\,(1+\phi/\,(1-\eta))) \times \tag{C.6}$$

$$\left[\frac{\eta}{1-\eta}\ln\left(1+\frac{n-1}{n}\frac{\phi-\alpha}{1-\phi}\right)+\ln\left(1-\frac{\eta}{1-\eta}\frac{n-1}{n}\frac{\phi-\alpha}{1-\phi}\right)- \tag{C.7}$$

$$\ln\left(\frac{n(1-\eta)+\chi\beta\phi}{1-\eta+\chi\beta\phi}\right)\right]<0. \tag{C.8}$$

Applying $x \gtrsim \ln(1+x)$ for small x to the terms on the second line above yields:

$$(1+\chi\beta)\ln n < \left(1+\chi\beta\left(1+\frac{\phi}{1-\eta}\right)\right)\ln\left(\frac{n(1-\eta)+\chi\beta\phi}{1-\eta+\chi\beta\phi}\right), \tag{C.9}$$

and using $\frac{n(1-\eta)+\chi\beta\phi}{1-\eta+\chi\beta\phi} > \frac{n(1-\eta)}{1-\eta+\chi\beta\phi}$ leads to the sufficient condition:

$$-\frac{\phi\chi\beta}{1-\eta}\ln n < \left(1+\chi\beta\left(1+\frac{\phi}{1-\eta}\right)\right)\ln\left(\frac{1-\eta}{1-\eta+\chi\beta\phi}\right). \tag{C.10}$$

This is satisfied for $n > \widetilde{n} = (1+\chi\beta\phi/(1-\eta))^{1+(1-\eta)(1+\beta\chi)/(\phi\chi\beta)}$.

Ranking of steady state welfare levels: Using capital stocks (21) and (29) in (20) and (28) respectively yields the steady state welfare difference $\Omega_{ss} = V^s_{i,ss} - V^c_{i,ss}$:

$$\begin{aligned}\Omega_{ss} &= \ln\left(\frac{\mu^c_{i,ss}}{\mu^s_{i,ss}}\right)^{1+\chi\beta} = \ln\left(n^{1+\chi\beta}\right)+\ln\left(1+\frac{(n-1)(\phi-\alpha)}{n(1-\phi)}\right)^{\frac{\eta(1-\eta)(1+\chi\beta)}{(1-\eta)(1-\eta-\phi)}}+\\ &+\ln\left[\left(1-\frac{\eta(n-1)(\phi-\alpha)}{(1-\eta)\,n(1-\phi)}\right)\frac{1-\eta+\chi\beta\phi}{n(1-\eta)+\chi\beta\phi}\right]^{\frac{(1-\eta)(1+\chi\beta)}{1-\eta-\phi}}.\end{aligned}$$

Coordinated policies yield higher steady state welfare if $\Omega_{ss} < 0$. Using the log approximation to cancel the first two parentheses, after some simplifications, the inequality is equivalent with:

$$\underbrace{n^{\frac{\phi}{1-\eta}}}_{LHS(n)} > \underbrace{\left(1-\eta+\frac{\chi\beta\phi}{n}\right)/\,(1-\eta+\chi\beta\phi).}_{RHS(n)}$$

While $LHS(1) = RHS(1) = 1$, $\partial LHS/\partial n > 0$ while $\partial RHS/\partial n < 0, \forall n > 1$. Thus $V^s_{i,ss} < V^c_{i,ss}$, $\forall n > 1$.