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Risky Investment, Tax Competition, and Wealth Inequality

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Risky Investment, Tax Competition, and Wealth Inequality

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Abstract

This paper examines how investment risks affect tax competition, economic growth, and wealth distribution. We develop a perpetual-youth overlapping-generations model with accidental bequests and idiosyncratic investment risks in which residents allocate wealth across regions. Investment risks influence portfolio choices and, therefore, the mobility of capital. Higher risks weaken capital outflows by reducing the sensitivity of portfolio allocation to capital taxation. When investment risks differ across destinations and domestic investment risk is moderate, the equilibrium capital tax rate responds non-monotonically to outward investment risk, generating heterogeneous policy responses to rising wealth inequality and a non-monotonic relationship between growth and inequality.

Keywords: Economic growth; Tax competition; Wealth distribution
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1. Introduction

Wealth concentration has been observed over the last four decades, while average capital tax rates have declined during the same period. Piketty and Zucman (2015) and Saez and Zucman (2020) document a substantial expansion of wealth inequality since the 1980s. At the same time, the decline in corporate tax rates has been widely interpreted as evidence of international tax competition.[1] However, the relationship between wealth inequality and capital taxation varies across countries. Figure 1 illustrates the evolution of wealth inequality and corporate tax rate (as a proxy for capital taxation) in the European Union (EU) and G7 countries. Several countries raised capital tax rates as inequality increased, while others reduced them. These heterogeneous responses suggest a potentially nonmonotonic relationship between wealth inequality and capital taxation.

In recent years, several theoretical studies have attempted to clarify the relationship between tax competition and income distribution (Traub and Yang, 2020; Tamai, 2025). Using a two-country majority-voting model with heterogeneously populated countries, Traub and Yang (2020) examine the effects of tax competition on within-country and between-country income inequality. Tamai (2025) extends their model by introducing a triangular distribution of human wealth and analyzing inequality using the Gini coefficient. They theoretically clarify how tax competition affects income inequality. However, their frameworks abstract from capital accumulation and the dynamic evolution of wealth distribution.

This paper analyzes how investment risks affect tax competition, economic growth, and wealth distribution when investment returns are heterogeneously risky for residents and investment destinations. To address this issue, we adopt a perpetual-youth overlapping generations (OLG) model with accidental bequests, idiosyncratic investment risks, and multiple regions. Combined with incomplete annuity markets (i.e., accidental bequests), idiosyncratic investment risks generate endogenous dispersion in portfolio choices, which in turn affects both capital mobility and the distribution of wealth.[2]

Naturally, numerous researchers have examined the relationship between capital tax competition and capital accumulation in an endogenous growth model with infinitely lived consumers. The literature has incorporated distortion factors such as imperfect market integration, capital mobility, Leviathan government, and others (e.g., Lejour and Verbon, 1997; Rauscher, 2005). Köthenbürger and Lockwood (2010) ingeniously characterize moderate capital mobility across regions by combining investment in each region with its risk. Apart from their outstanding study, this paper contributes to three strands of literature: tax competition, economic growth, and wealth distribution.

Our main findings are summarized as follows, focusing on idiosyncratic investment risks. First,

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[1] Devereux et al. (2008) reported a decline in the average statutory corporate income tax rate. Moreover, Overesch and Rincke (2011) found that countries compete over statutory corporate tax rates.

[2] Idiosyncratic investment risks and a stochastic birth–death process generate a double-Pareto distribution to replicate a realistic wealth distribution (Benhabib et al., 2016). Without idiosyncratic risks, the wealth distribution converges to a Pareto distribution.

the idiosyncratic risks generate dispersion in portfolio choices. The risks affect portfolio responses to changes in tax rates, even though idiosyncratic risks cancel out at the aggregate level. Specifically, higher idiosyncratic risk weakens capital outflows due to increased taxes on capital in the home region. Therefore, the presence of idiosyncratic investment risks reduces tax-cut incentives of governments to prevent erosion of the tax base.

Second, the equilibrium tax rates are differentially responsive to the heterogeneous investment risks across destinations. Capital taxation negatively impacts economic growth, while the foreign investment risk inhibits tax base erosion by weakening the capital flow effect of capital taxation. Furthermore, the presence of life expectancy shortens the lifespan of individuals affected by the negative growth effects of capital taxation. Then, governments raise equilibrium tax rates in response to a worldwide increase in idiosyncratic risks. In contrast, increased risk of foreign investment reduces capital flight from the home region, strengthening the negative effect of capital taxation on economic growth. Therefore, the foreign investment risk nonmonotonically influences the equilibrium tax rate.

Finally, wealth inequality influences tax competition and economic growth. Higher idiosyncratic investment risk widens wealth inequality by increasing portfolio dispersion. An increased tax impedes economic growth. Focusing on the foreign investment risk, the equilibrium capital taxes nonmonotonically affect equilibrium growth rates, depending on domestic investment risk. Therefore, expanding the wealth inequality caused by increased risk of foreign investment is nonmonotonically linked to economic growth through the responses of capital taxes to the risks.

The remainder of this paper is organized as follows. The next section reviews the related literature. Section 3 explains our theoretical framework. Section 4 analyzes the dynamic equilibrium of symmetric regions with all aspects. Section 5 examines the effects of heterogeneous investment risks on the dynamic equilibrium, focusing on the two-region model. Finally, Section 6 delivers the conclusion of this paper.

2. Literature review

This paper relates to the three strands of literature: economic growth and inequality, tax competition and inequality, and tax competition and economic growth. This section provides a brief review of the related literature.

Inequality and economic growth

Income and wealth inequality have long been examined in the literature on economic growth and development. In the last decade, one of the workhorse models is a perpetual-youth OLG model presented by Yaari (1965) and Blanchard (1985). Under a stochastic birth-death process, incomplete annuity markets and idiosyncratic risks generate dynamics in wealth distribution, leading to unequal wealth even if individuals are identical (Benhabib et al., 2016; Kasa and Lai, 2018). In the long-run, the wealth dynamics replicate a double-Pareto wealth distribution, consistent with empirical evidence on wealth distribution in developed countries (Benhabib and Bisin, 2018).

Moreover, several empirical studies found that individual returns exhibit substantial heterogeneity, are positively correlated with wealth, and are strongly persistent over time and across generations (Bach et al., 2020; Fagereng et al., 2020). These findings imply that factors such as idiosyncratic risk are key drivers of wealth inequality. Indeed, a perpetual-youth OLG model with stochastic disturbances generates intragenerational heterogeneity in realized returns, even among ex-ante identical individuals, leading to a thick upper tail in the wealth distribution. We employ this mechanism to explain wealth inequality under real economic circumstances.

Tax competition and inequality

The tax competition model with multiple regions was pioneeringly formulated by Wilson (1986) and Zodrow and Mieszkowski (1986), so-called as the WZM model.[3] By incorporating regional heterogeneity into the WZM model, numerous studies have examined asymmetric tax competition (e.g., Bucovetsky, 1991; Wilson, 1991; Haufler, 1997). Heterogeneity of regions involves income inequality at least between regions. Therefore, the previous studies shed light on some aspects of the relationship between tax competition and income inequality. However, the inequality is not the central concern of these studies.

Traub and Yang (2020) address capital tax competition and income distribution by incorporating differences in population size into a two-country model. They reveal that the tax competition expands between-country income inequality, while it ambiguously affects within-country inequality. Extending Traub and Yang (2020) with a specific wealth distribution, Tamai (2025) shows that tax competition deepens both international and domestic inequality. Our study contributes to bridging the gap between capital formation and wealth distribution by endogenizing idiosyncratic investment risks across regions.

Tax competition and economic growth

The analysis of tax competition and economic growth was pioneered by Lejour and Verbon (1997), who developed it using an endogenous growth model with infinitely lived consumers.[4] Apart from the WZM model, this literature has focused on imperfect capital mobility and redistribution (Lejour and Verbon, 1997), Leviathan governments (Rauscher, 2005), and the effect of decentralization on economic growth (Thornton, 2007).

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[3] See Agrawal et al. (2022) for a general review of local public finance issues, including tax competition.

[4] Within a neoclassical growth model, Gross et al. (2020) examine resident-based and source-based capital taxation.

Becker and Rauscher (2013) formulate an endogenous growth model with imperfect capital mobility, knowledge spillovers, and investment adjustment costs. They illustrate the relationship between capital mobility and economic growth via capital taxation. Numerous studies adopt similar approaches by introducing externalities such as productive public goods, knowledge spillovers, and monopolistically competitive intermediate firms (Hatfield, 2015; Miyazawa et al., 2019; Tamai, 2022; Maebayashi and Morimoto, 2024).[5]

Capital taxation negatively affects economic growth by slowing capital accumulation. Hence, capital tax competition as a tax cut may enhance economic growth. Incorporating additional factors such as the redistribution, productive public expenditure, and externalities, the effects of tax competition on economic growth and welfare are more complicated; there might be a non-monotonic relationship. Previous studies have contributed to clarifying the various mechanisms. On the other hand, the dynamics of wealth distribution under tax competition remain an underexplored topic in the literature.

The most related study is developed by Köthenbürger and Lockwood (2010). A key feature of their study is an investment in each region as a portfolio choice. We extend their model by incorporating a stochastic birth–death process and incomplete markets with idiosyncratic investment risks. Therefore, this paper bridges these three strands of literature by introducing endogenous wealth distribution into a tax competition model of endogenous growth.

3. The model

We consider a multi-region growth model with a perpetual-youth OLG. Individuals (residents) face stochastic mortality (Yaari, 1965; Blanchard, 1985) and idiosyncratic investment risks (Benhabib et al., 2016), and allocate their wealth across regions (Köthenbürger and Lockwood, 2010). Regional governments levy taxes on capital, which are mobile across regions (Wilson, 1986; Zodrow and Mieszkowski, 1986; Köthenbürger and Lockwood, 2010).

The stochastic event of death follows a Poisson process with Poisson rate, λ ($\lambda > 0$). Assuming that the individual dies and new individual is born at the same moment, the measure of individuals of the cohort born at a time $s < t$ is $\lambda e^{\lambda(t-s)}$. Considering incomplete annuity markets, the individuals die with accidental bequests. Following Kasa and Lei (2018), we assume that newborns receive identical initial endowments.[6]

The expected lifetime utility function at time t for the individual born at time s is specified as

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[5] Baskaran et al. (2016) review theoretical and empirical studies on fiscal decentralization and economic growth using a meta-analysis of this empirical literature. They conclude that it is necessary to more deeply examine the theoretical transmission and to build consensus on how to measure decentralization.

[6] Redistribution of inheritance tax revenues equalizes the inheritance tax, and inheritance taxation partly counteracts the equalizing effect of inheritance (Elinder et al., 2018).

$$EU_i = \int_s^{\infty} [\log c_i(t,s) + \beta \log G_i(t)] e^{-(\rho+\lambda)(t-s)} dt, \tag{1}$$

where $c_i(t,s)$ is the consumption at time t of the individual born at time s in region i, $G_i(t)$ is the public good consumption at time t in region i, β is the preference parameter for public good consumption ($\beta > 0$), and ρ is the subjective discount rate ($\rho > 0$).

Following Köthenbürger and Lockwood (2010), we introduce a stochastic disturbance of investment returns. In contrast with their study, we assume that a Brownian motion $B_{ij}(t,s)$ with the drift parameter ξ ($\xi > 0$) and the volatility parameter σ_{ij} ($\sigma_{ij} > 0$), which are proportional to asset j, determines the return on the private investment in region j at time t for an individual born at time s and residing in region i. Hence, this stochastic process is representing the idiosyncratic shock to the return on asset j experienced by i.

We also assume that these geometric Brownian motions are mutually independent across investment destinations j and birth cohorts s. This assumption of independence captures the idiosyncratic nature of investment risks such as project-specific failures or information frictions. Moreover, the law of large numbers ensures that aggregate variables evolve deterministically. Hence, the production technology of region i becomes $dY_i(t) = \xi K_i(t)dt$, where $dY_i(t)$ is the region i's output, $K_i(t)$ is the capital input employed in region i, and ξ is the productivity parameter.

The region i's government taxes on capital at the rate τ_i. Let $a_i(t,s)$ be the total personal asset held by the individual in region i. Then, the budget constraint of the individual is

$$da_i(t,s) = [r_i(t,s)a_i(t,s) - c_i(t,s)]dt + \sum_{j=1}^{N} \sigma_{ij} n_{ij}(t,s) a_i(t,s)\, dB_{ij}(t,s), \tag{2}$$

where $n_{ij}(t,s)$ is the share of a risky asset j to the total amount of personal asset held by the region i's individual, and

$$r_i(t,s) \equiv \sum_{j=1}^{N} (\xi - \tau_j) n_{ij}(t,s).$$

Each individual maximizes Eq. (1) subject to Eq. (2) with their initial wealth for given vector $\boldsymbol{\tau} = (\tau_1, \cdots, \tau_N)$. The optimality conditions yield the following policy functions (See Appendix A for the derivation of Eqs. (3a) and (3b)):

$$c_i(t,s) = (\rho + \lambda) a_i(t,s), \tag{3a}$$

$$\tau_j - \tau_i = \left(1 - \sum_{i \neq j} n_{ij}\right) \sigma_{ii}^2 - \sigma_{ij}^2 n_{ij}, \tag{3b}$$

where $i, j = 1, \cdots, N$ ($i \neq j$). Using Eq. (3a), Eq. (2) can be written as

$$da_i(t,s) = \gamma_i a_i(t,s)dt + \sum_{j=1}^{N} \sigma_{ij} n_{ij}^* \, a_i(t,s) dB_{ij}(t,s), \tag{4}$$

with $\gamma_i \equiv r_i^* - \rho - \lambda$ and $r_i^* \equiv \sum_{j=1}^{N} (\xi - \tau_j) n_{ij}^*$.

Since the public goods expenditure is financed by capital tax revenue, the budget constraint of the regional government is

$$G_i(t) = \tau_i K_i(t). \tag{5}$$

Aggregate variables at the regional level are defined as

$$C_i(t) \equiv \int_{-\infty}^{t} E_s c_i(t,s) \, \lambda e^{\lambda(s-t)} ds,$$

$$A_i(t) \equiv \int_{-\infty}^{t} E_s a_i(t,s) \, \lambda e^{\lambda(s-t)} ds,$$

$$K_i(t) \equiv \sum_{j=1}^{N} n_{ji}^* A_j(t).$$

Similarly, aggregate variables at the whole economy level are

$$C(t) \equiv \sum_{i=1}^{N} C_i(t)\,, A(t) \equiv \sum_{i=1}^{N} A_i(t)\,, K(t) \equiv \sum_{i=1}^{N} K_i(t).$$

Since the expected value of the asset held by the individual is $E_s a_i(t,s) = E_s a_i(s,s) e^{\gamma_i(t-s)}$, by the definition of $A_i(t)$, the dynamics of $A_i(t)$ satisfies

$$dA_i(t) = (\gamma_i - \lambda) A_i(t) + \lambda E_t a_i(t,t). \tag{6}$$

Given that δ is the rate of inheritance ($0 < \delta < 1$), the total inheritance for the region i's individuals born at time t is $\lambda E_t a_i(t,t) = \lambda \delta A_i(t)$. Then, Eq. (6) becomes

$$dA_i(t) = g_i A_i(t), \tag{7a}$$

$$dA(t) = \left[\sum_{i=1}^{N} \gamma_i \frac{A_i(t)}{A(t)} - (1-\delta)\lambda \right] A(t), \tag{7b}$$

where $g_i \equiv \gamma_i - (1-\delta)\lambda$. By the definition, g_i stands for the equilibrium growth rate of region i's gross income.

We respectively define the ratio of the asset held by region i's individual to the region i's total asset and the ratio of the asset held by region i's individual to aggregate asset by

$$x_i(t,s) \equiv \frac{a_i(t,s)}{A_i(t)}, X_i(t,s) \equiv \frac{a_i(t,s)}{A(t)}.$$

Applying Ito's Lemma to $x_i(t,s)$ and $X_i(t,s)$, we obtain

$$dx_i(t,s) = (1-\delta)\lambda x_i(t,s) dt + \sum_{j=1}^{N} \sigma_{ij} n_{ij}^* \, x_i(t,s) dB_{ij}(t,s), \tag{8a}$$

$$dX_i(t,s) = \left[(1-\delta)\lambda + \gamma_i - \sum_{i=1}^{N} \gamma_i \frac{A_i(t)}{A(t)}\right] X_i(t,s)dt + \sum_{j=1}^{N} \sigma_{ij} n_{ij}^* X_i(t,s) dB_{ij}(t,s). \tag{8b}$$

Within region wealth distribution, Eq. (8a) derives a double-Pareto distribution (Benhabib et al., 2016), by the presence of idiosyncratic investment risks. Eq. (8b) governs the wealth dynamics of the region i's individual positioning on the whole economy. If regional heterogeneity of mean growth rate exists, Eq. (8b) leads to a wealth distribution different from Eq. (8a).

4. Dynamic equilibrium

This section characterizes the equilibrium policy and the dynamic equilibrium within a general framework. After that, we consider the symmetric equilibrium, where all the regions are identical in all aspects. In the symmetric equilibrium, the dynamic effects of tax competition on economic growth and wealth inequality will be clarified by focusing on the number of regions and the idiosyncratic investment risks.

4.1. Equilibrium policy

We begin our analysis by deriving the effects of a rise in the tax rate on the mean return and volatility of asset dynamics, given by Eq. (4). Then, one can verify

$$\frac{\partial \gamma_i}{\partial \tau_i} = \frac{\partial r_i^*}{\partial \tau_i} = -n_{ii}^* + \sum_{j=1}^{N} (\xi - \tau_j) \frac{\partial n_{ij}^*}{\partial \tau_i}, \tag{9}$$

$$\frac{\partial}{\partial \tau_i} \sum_{j=1}^{N} \sigma_{ij} n_{ij}^* = \sum_{j=1}^{N} \sigma_{ij} \frac{\partial n_{ij}^*}{\partial \tau_i}. \tag{10}$$

In Eq. (9), on one hand, a rise in the tax rate directly decreases the mean return due to an increase in the tax burden. On the other hand, portfolio rebalancing can indirectly increase the mean return. Eq. (10) indicates that the volatility term depends on the portfolio rebalancing.

We consider benevolent regional governments, which seek to maximize the following regional welfare function:

$$W_i = \int_{-\infty}^{t} EU_i \, \lambda e^{\lambda(s-t)} ds.$$

Inserting Eqs. (3a)–(5), the regional welfare function becomes the following equation (see Appendix B for the derivation of Eq. (11)):

$$W_i = \Lambda_i + \phi_i + \Omega_i, \tag{11}$$

where

$$\Lambda_i \equiv \frac{1}{\rho+\lambda}\int_{-\infty}^{t} \log a_i(t,s)\, \lambda e^{\lambda(s-t)} ds\,,$$

$$\phi_i \equiv \frac{1}{(\rho+\lambda)^2}\left[\gamma_i - \sum_{j=1}^{N} \frac{\sigma_{ij}^2 n_{ij}^2}{2} + \frac{\log(\rho+\lambda)}{\rho+\lambda}\right],$$

$$\Omega_i \equiv \frac{\beta}{\rho}\left[\log \tau_i + \frac{\gamma_i - (1-\delta)\lambda}{\rho}\right] + \int_{t}^{\infty} \log\left[n_{ii}^{*} A_i(t) + \sum_{j\neq i} n_{ji}^{*} g_{ji}(v) A_j(t)\right] e^{-\rho(v-t)} dv\,,$$

$$g_{ji}(v) \equiv e^{(\gamma_j - \gamma_i)(v-t)}.$$

In Eq. (11), the first term of the right-hand side Λ_i corresponds to the benefit from initial private consumption. The second term ϕ_i represents the present value of cumulative benefits from growth effects. The last term $\Omega_i(v)$ is the benefits from public goods provision, including growth effects. Note that the growth rates of the other regions influence the benefits from public good provision.

Specifically, the region i's government chooses τ_i to maximize Eq. (11) subject to Eqs. (3a), (3b), (4), (5), and (7a) for a given vector $\boldsymbol{\tau}_{-i}$, where is a vector, $\boldsymbol{\tau}$, excluding its i-th element τ_i. Hence, solving the regional governments' optimization problems simultaneously, we will obtain the equilibrium tax policy, satisfying $\tau_i^* = \arg\max W_i$. To obtain explicit solutions, we focus on several specified cases in the next sections.

4.2. Symmetric equilibrium

In this section, we consider symmetric regions in all aspects as our theoretical benchmark. This case implies that idiosyncratic investment risks are indifferent across investment destinations. Under the condition of symmetric regions, Eq. (3b) leads to the following equations (see Appendix C for the derivation of Eqs. (12a) and (12b)):

$$n_{ii}^{*} = \frac{1}{N} + \frac{(N-1)\left(\tau_j - \tau_i\right)}{\sigma^2 N}, \tag{12a}$$

$$n_{ij}^{*} = \frac{1}{N} - \frac{\tau_j - \tau_i}{\sigma^2 N}. \tag{12b}$$

Comparative statics regarding the coefficients of Eq. (4) and Eqs. (12a) and (12b) derive the following result (see Appendix C for the proof of Lemma 1):

Lemma 1. *For $i, j = 1, \cdots, N$ and $i \neq j$, the partial derivatives of the portfolio, mean growth rate, and volatility of resident's asset with respect to τ_i are*

$$(i)\ \frac{\partial n_{ii}^{*}}{\partial \tau_i} = -\frac{N-1}{\sigma^2 N} < 0, \qquad \frac{\partial n_{ij}^{*}}{\partial \tau_i} = \frac{1}{\sigma^2 N} > 0;$$

$$(ii)\ \frac{\partial \gamma_i}{\partial \tau_i} = \frac{\partial \gamma_j}{\partial \tau_i} = -\frac{1}{N} < 0;$$

$$(iii)\ \frac{\partial}{\partial \tau_i}\sum_{j=1}^{N} \sigma_{ij} n_{ij}^{*} = \sigma \sum_{j=1}^{N} \frac{\partial n_{ij}^{*}}{\partial \tau_i} = 0.$$

Lemma 1 captures the nature of the tax competition equilibrium. For the same level of σ, a rise in the tax rate in region i reduces the net return of asset i (i.e., investment to region i). As a result, the individuals switch their investments from region i to the others (Lemma 1 (i)). These portfolio-rebalancing effects offset each other because all regions are symmetric. Hence, net volatility of asset returns, $\sum_{j=1}^{N} \sigma_{ij} n_{ij}^{*}$, is independent of τ_i (Lemma 1 (iii)). On the other hand, the mean of asset growth rate is negatively affected by the tax rate because the increased tax burden equals to the asset share of a_i, corresponding to the inverse of the number of regions $1/N$ (Lemma 1 (ii)).

An increase in risk weakens the capital outflow/inflow effect of increased tax. In contrast, increasing the number of regions intensifies capital outflows driven by higher taxes. This is because having many regions implies having many investment destinations to hedge risks. It reveals that a larger N weakens the negative effect of increased tax on the mean growth rate of individual assets.

Using Lemma 1, we obtain the following result (see Appendix C for the proof of Lemma 2):

Lemma 2. *The partial derivatives of welfare components with respect to* τ_i *are*

$$(i)\ \frac{\partial \phi_i}{\partial \tau_i} = -\frac{1}{(\rho + \lambda)^2 N} < 0;$$

$$(ii)\ \frac{\partial \Omega_i}{\partial \tau_i} = \frac{\beta}{\rho}\left[\frac{1}{\tau_i} - \frac{1}{\rho N} - \frac{2}{\rho \sigma^2}\left(\frac{N-1}{N}\right)\right] \gtreqless 0 \Leftrightarrow \tau_i \lesseqgtr \frac{\rho \sigma^2 N}{\sigma^2 + 2(N-1)} \equiv \hat{\tau}_i.$$

Since the mean growth rate of individual's assets decreases as τ_i increases (Lemma 1 (ii)), a rise in the tax rate has a negative cumulative effect on welfare (Lemma 2 (i)). Increased tax revenue raises the supply of public goods at the moment. However, the negative effect of increased taxes on the mean growth rate reduces the growth of public good supply. Hence, the present value of net benefit from public goods is increasing in τ_i for $\tau_i < \hat{\tau}_i$, while it is decreasing in τ_i for $\tau_i > \hat{\tau}_i$ (Lemma 2 (ii)).

Using Lemma 2, the effect of a rise in the tax rate on regional welfare is

$$\frac{\partial W_i}{\partial \tau_i} = \underbrace{\frac{\partial \phi_i}{\partial \tau_i}}_{(-)} + \underbrace{\frac{\partial \Omega_i}{\partial \tau_i}}_{(+/-)}. \tag{13}$$

The first term is the welfare cost of the tax burden, reflecting the negative growth effect of a distortionary tax. The second term captures the welfare effect of public goods provision, which can be either positive or negative.

Each regional government seeks to maximize its regional welfare, taking the other governments' tax rates as given. As all regions are symmetric in all aspects, we obtain the equilibrium tax policy (see Appendix C for the proof of Proposition 1):

Proposition 1. *There exists a regional welfare-maximizing tax rate, satisfying* $\tau_i^* < \hat{\tau}_i$,

$$\frac{\partial \tau_i^*}{\partial N} \gtreqless 0 \Leftrightarrow \frac{\sigma^2}{2} \gtreqless \frac{\beta(\rho+\lambda)^2}{\rho^2+(\rho+\lambda)^2}; \frac{\partial \tau_i^*}{\partial \sigma^2} > 0; \frac{\partial \tau_i^*}{\partial \lambda} > 0; \frac{\partial \tau_i^*}{\partial \beta} > 0.$$

The intuition of Proposition 1 is explained as follows. Larger number of regions weakens a negative effect of a rise in the tax rate on economic growth because net return on only one asset i decreases by increased tax of region i keeping the others constant. On the other hand, an increase in N strengthens capital outflow caused by a rise in τ, which is decreasing in σ^2. Increasing capital outflow raises the welfare cost of increased taxes by decreasing the tax base. Therefore, a positive (negative) relationship exists between the equilibrium tax rate and number of regions when σ^2 is sufficiently large (small). This result suggests that intense tax competition, as a race to the bottom, arises with more competitors when the risks are sufficiently small, whereas it may be eased when the risks are sufficiently large through risk diversification and weakening tax base erosion.

In contrast, increasing each of σ^2, λ, and β has a monotonic effect on the equilibrium tax rate. An increase in σ^2 reduces the capital outflow caused by a rise in the tax rate (see Lemma 1 (i)). It mitigates a decrease in the tax base. Increasing λ shortens the residents' expected lifetime. Since increased taxes have a negative effect on welfare (see Lemma 2(i)), shorter lifetimes weaken that effect. Larger β implies stronger preference for public goods, leading to an increase in marginal benefit from public goods relative to its marginal cost (see Lemma 2 (ii)). The marginal cost of a rise in the tax rate decreases as σ^2 increases. Hence, the equilibrium tax rate is increasing in each of σ^2, λ, and β.

Inserting $\tau_i = \tau_i^*$, the equilibrium growth rate is given by g_i^* because all the regions are symmetric. Using Proposition 1, we can identify the growth effects of changes in key parameters (see Appendix C for the proof of Proposition 2):

Proposition 2. *The equilibrium growth rate* g_i^* *decreases as each of* σ^2, λ, *and* β *increases, while* N *positively (negatively) affects* g_i^* *if* σ^2 *is sufficiently small (large).*

A rise in the tax rate decreases the equilibrium growth rate by impeding capital accumulation, as shown in standard AK growth models without *productive* public goods. Hence, the mechanisms presented in Proposition 1 shape the nexus between growth and key parameters, excluding a change in λ. An increase in λ reduces the individual's saving/investment because the increased death rate incentivizes the individuals to consume private goods; this negatively affects the equilibrium growth rate. According to Propositions 1 and 2, economic growth is stimulated by tax competition caused by increased competitors with low investment risks (i.e., economic decentralization or economic divorce) or decreased competitors with high investment risks (i.e., economic centralization or economic integration).

As all regions are symmetric, the wealth inequality dynamics in each region follows the same dynamic equation given by Eq. (8a). Then, the wealth inequality depends on the mean term $(1-\delta)\lambda$ and volatility term $\sum_{j=1}^{N}\sigma_{ij}n_{ij}^{*}$ $(=\sigma)$ in Eq. (8a). A rise in σ^2 increases the volatility of asset dynamics, leading to an expansion of individual's portfolio heterogeneity. As a result, the wealth distribution after the shock is wider than before. Focusing on the effect of σ^2 on wealth inequality measured by the Gini coefficient, we have the following result (see Appendix D for the proof of Lemma 3):

Lemma 3. *The Gini coefficient is increasing in* σ^2*, while it is independent of* N *and* β*.*

Since economic growth depends negatively on the equilibrium tax rate (Lemma 1, Proposition 2) and wealth inequality depends positively on σ^2 (Lemma 3), changes in σ^2 generate a systematic relationship between growth and wealth inequality. Naturally, Proposition 2 and Lemma 3 derive the relationship between economic growth and wealth inequality through the effect of σ^2 on the equilibrium tax rate:

Proposition 3. *With a rise in* σ^2*, a negative relationship between economic growth and wealth inequality exists.*

Proposition 3 is consistent with empirical evidence that wealth inequality has a significant negative effect on economic growth (Bagchi and Svejnar, 2015; Berg et al., 2018), and it characterizes the dynamic effects of tax competition on economic growth and wealth inequality. With an increase in σ^2, individual's portfolio heterogeneity is increased and therefore, the wealth inequality is naturally expanded. Then, the equilibrium growth decreases due to the redistribution through public goods provision. This result implies that a rise in wealth inequality, driven by increased personal uncertainty, eases tax competition.

Summarizing all the results, Proposition 3 implies that a rise of wealth inequality and economic expansion may arise under tax competition with a low σ^2 and its moderate increase as well as increased competitors. On the other hand, the same situation may occur if a high σ^2 and its moderate increase as well as decreased competitors. Hence, an increase in potential competitors yields different equilibrium outcomes, depending on investment risk.

5. Heterogeneous destination risks of investment

In reality, residents as investors face higher risks when they invest abroad. This phenomenon is commonly referred to as home-country bias. To capture this feature, we extend the model by allowing investment risks to differ across regions. Based on this view, the region i's residents who wish to invest to the region j ($i \neq j$) face the investment risks that are $\sigma_{ij} > \sigma_{ii}$. Specifically, we consider the situation where $\sigma_{ii} = \sigma$ and

$$\sigma_{ij} = \sigma_{ji} = (1+\varepsilon)\sigma. \tag{14}$$

To identify on the region-specific heterogeneous investment risks, we focus on a two-region economy ($N = 2$).

Solving the individual's optimization problem under a new setting, the individual's portfolio becomes

$$n_{ii} = \frac{(1+\varepsilon)^2\sigma^2 - \tau_i + \tau_j}{[1+(1+\varepsilon)^2]\sigma^2}, \tag{15a}$$

$$n_{ij} = \frac{\sigma^2 + \tau_i - \tau_j}{[1+(1+\varepsilon)^2]\sigma^2}. \tag{15b}$$

Comparative statics of the portfolio and the mean of asset return with respect to τ_i yield the following lemma (see Appendix E for the proof of Lemma 4):

Lemma 4. *For* $i, j = 1,2$ *(*$i \neq j$*), the partial derivatives of the portfolio and mean growth rate of resident's asset with respect to* τ_i *are*

$$(i)\ \frac{\partial n_{ii}}{\partial \tau_i} = -\frac{1}{[1+(1+\varepsilon)^2]\sigma^2} < 0, \qquad \frac{\partial n_{ij}}{\partial \tau_i} = \frac{1}{[1+(1+\varepsilon)^2]\sigma^2} > 0;$$

$$(ii)\ \frac{\partial \gamma_i}{\partial \tau_i} = -\frac{(1+\varepsilon)^2}{1+(1+\varepsilon)^2} < 0, \qquad \frac{\partial \gamma_j}{\partial \tau_i} = -\frac{1}{1+(1+\varepsilon)^2} < 0;$$

$$(iii)\ \frac{\partial}{\partial \tau_i}\sum_{j=1}^{2} \sigma_{ij} n_{ij}^{*} = \frac{\varepsilon}{[1+(1+\varepsilon)^2]\sigma} > 0.$$

The qualitative results in Lemma 4 are the same as those of Lemma 1, except for (iii). The outflow of investment from home region to the other, caused by a rise in the tax rate, increases the risk by purchasing the asset j which has a larger risk than asset i. Therefore, under the region-specific heterogeneous risks, a rise in the tax rate increases the net volatility of asset dynamics.

Since an increase in ε increases the risk of outward investment, capital outflow from home region to another decreases for a rise in the tax rate of home region; the residents have more assets of home region for a larger ε. Hence, a rise in the tax rate of home region more negatively affects the equilibrium growth rate of home region when ε is large. Moreover, a larger ε produces a larger effect of a rise in the tax rate of home region on the resident's net investment risk.

Lemma 4 derives the following result (see Appendix E for the proof of Lemma 5):

Lemma 5. *The partial derivatives of welfare components with respect to* τ_i *are*

$$(i)\ \frac{\partial \phi_i}{\partial \tau_i} = -\frac{(1+\varepsilon)^2}{[1+(1+\varepsilon)^2](\rho+\lambda)^2} < 0,$$

$$(ii)\ \frac{\partial \Omega_i}{\partial \tau_i} = \frac{\beta}{\rho}\left\{\frac{1}{\tau_i} - \frac{(1+\varepsilon)^2}{[1+(1+\varepsilon)^2]\rho} - \frac{1}{1+(1+\varepsilon)^2}\left[\frac{2}{\sigma^2} - \frac{(1+\varepsilon)^2-1}{\rho[1+(1+\varepsilon)^2]}\right]\right\}.$$

The basic mechanisms behind Lemma 5 are essentially the same as those of Lemma 2. Hence, we note here how the heterogeneity of investment risks affects the results. For large ε, the home region's asset share held by the residents in home region is large; the tax change of the home region strongly affects the residents' investment. Therefore, an increase in outward investment risk strengthens the negative effect of a rise in the home region's tax rate on economic growth.

Regarding the effect of ε on public goods, it has a large negative impact on public goods provision through negative growth effect. At the same time, larger ε weakens the capital outflow from home region to the other, which is caused by a rise in the home region's tax rate. The latter effect mitigates the negative impact of increased taxes on public goods provision.

Using Eq. (13) and Lemma 5, we obtain the equilibrium tax rate as follows (see Appendix E for the proof of Proposition 4):

Proposition 4. *There exists an equilibrium tax rate,* τ_i^* $(i = 1,2)$*. (i) The equilibrium tax rate is increasing in* ε *if*

$$\frac{\sigma^2}{2} < \frac{\beta(\rho+\lambda)^2}{\rho^2 + 2\beta(\rho+\lambda)^2}.$$

(ii) The inverted U-shaped relationship exists between ε *and* τ_i^* *if*

$$\frac{\beta(\rho+\lambda)^2}{\rho^2 + 2\beta(\rho+\lambda)^2} < \frac{\sigma^2}{2} < \frac{\beta(\rho+\lambda)^2}{\rho}.$$

(iii) The equilibrium tax rate is decreasing in ε *if*

$$\frac{\sigma^2}{2} > \frac{\beta(\rho+\lambda)^2}{\rho}.$$

When σ^2 is extremely small, it strengthens the capital-outflow effect of a rise in home region (Lemma 4 (i)). However, negative growth effect of a rise in home region's tax rate is independent of

σ^2 becuase σ^2 is a common scale factor of idiosyncratic investment risk (or domestic investment risk) (Lemma 4 (ii)). A larger risk of the other region, ε, weakens the capital-outflow effect, preventing decreased tax base. Since an increase in ε more increases the tax revenue at the present than cumulative effect of decreasing tax base, the equilibrium tax rate is increasing in ε. In contrast, by operating the opposing mechanism, τ_i^* decreases as ε increases when σ^2 is extremely large.

For the intermediate value of σ^2, the relationship between τ_i^* and ε is non-monotonic. Especially, if there is no large difference in the region-specific investment risks (i.e., small ε), the equilibrium tax rate is increasing in ε because current tax revenue increase dominates cumulative negative effect on tax base. However, if there is a large risk of outward investment, the cumulative negative effect on the tax base outweighs the current increase in tax revenue. Hence, the equilibrium tax rate is decreasing in ε. Proposition 4 theoretically explains the background mechanism underlying heterogeneous responses to tax policy across wealth inequality levels, as shown in Figure 1.

In contrast to Proposition 2, Proposition 4 implies that the region-specific investment risks have different effects on the equilibrium tax rates, depending on the domestic investment risk. Using Lemma 4, Proposition 4 leads to the following proposition about the relationship between economic growth and outward investment risk:

Proposition 5. *(i) The equilibrium growth rate decreases as* ε *increases if*

$$\frac{\sigma^2}{2} < \frac{\beta(\rho+\lambda)^2}{\rho^2 + 2\beta(\rho+\lambda)^2}.$$

(ii) The U-shaped relationship exists between the equilibrium growth rate and ε *if*

$$\frac{\beta(\rho+\lambda)^2}{\rho^2 + 2\beta(\rho+\lambda)^2} < \frac{\sigma^2}{2} < \frac{\beta(\rho+\lambda)^2}{\rho}.$$

(iii) The equilibrium growth rate increases as ε *increases if*

$$\frac{\sigma^2}{2} > \frac{\beta(\rho+\lambda)^2}{\rho}.$$

The relationship between economic growth and tax competition is complicated by regional-specific investment risks. In particular, the equilibrium tax rate cannot be monotonically associated with the equilibrium growth rate. This result indicates the importance of considering asymmetric regions. On the other hand, tax competition as tax cut enhances economic growth even though the equilibrium tax rate non-monotonically depends on ε.

A rise in ε corresponds to a rise in σ in the previous section. Hence, Lemma 5 still holds even if ε increases instead of σ. Formally, we have the following lemma:

Lemma 6. *The Gini coeffect is increasing in* ε*.*

Finally, Proposition 5 and Lemma 6 yield the following result of the growth-inequality nexus:

Proposition 6. *(i) The negative relationship exists between economic growth and wealth inequality as* ε *increases if*

$$\frac{\sigma^2}{2} < \frac{\beta(\rho+\lambda)^2}{\rho^2 + 2\beta(\rho+\lambda)^2}.$$

(ii) The U-shaped relationship exists between economic growth and wealth inequality as ε *increases if*

$$\frac{\beta(\rho+\lambda)^2}{\rho^2 + 2\beta(\rho+\lambda)^2} < \frac{\sigma^2}{2} < \frac{\beta(\rho+\lambda)^2}{\rho}.$$

(iii) The positive relationship exists between economic growth and wealth inequality as ε *increases if*

$$\frac{\sigma^2}{2} > \frac{\beta(\rho+\lambda)^2}{\rho}.$$

Propositions 4–6 highlight the role of heterogeneous destination risks in shaping the dynamic outcomes of capital tax policy, economic growth, and wealth inequality. When the outward investment risk increases, two opposing mechanisms arise. First, higher outward investment risk reduces capital outflows, mitigating tax base erosion and allowing governments to raise capital taxes. Second, larger outward investment risk amplifies the negative effect of capital taxation on economic growth by increasing the share of home-region assets. These opposing effects generate non-monotonic responses of tax policy to the outward investment risk, leading to complex relationships between economic growth and wealth inequality. These results theoretically explain why tax policies may respond differently to rising inequality across regions (Figure 1).

6. Conclusion

This paper examined the effects of tax competition on economic growth and wealth distribution when residents face heterogeneous investment risks across regions. A perpetual-youth OLG model with accidental bequests characterizes the endogenous determination of both capital mobility and wealth distribution by linking to the idiosyncratic investment risks. A key feature is that capital taxation affects capital mobility through individuals' portfolio choices, depending on risk levels.

The analysis reveals how the idiosyncratic investment risks affect tax competition, economic growth, and wealth distribution. In particular, the equilibrium tax rate is nonmonotonically associated with the foreign investment risk at a moderate level of domestic investment risk. In other words, the inverted U-shaped relationship exists between the equilibrium tax rate and the foreign investment risk.

Therefore, it exhibits a U-shaped relationship between economic growth and wealth inequality through the response of the equilibrium tax rate to foreign investment risk.

The future direction of this research should incorporate factors such as knowledge spillover and public input. Since productive government expenditure as public inputs stimulates economy-wide productivity (e.g., Barro, 1990), regional governments have an incentive to raise tax rates to attract capital. In addition, knowledge spillover moderates the knife-edge mobility of capital. Such extensions of our basic model will provide new insights into the relationship among tax competition, economic growth, and wealth inequality.

Appendix

A. Individual's optimization problem

The optimization problem is formulated as

$$\max_{c_i,n_{ij}}\left\{\log c_i-(\rho+\lambda)V(a_i)+(r_ia_i-c_i)V'(a_i)+\sum_{j=1}^{N}\sigma_{ij}^2n_{ij}^2\frac{a_i^2V''(a_i)}{2}\right\}.$$

The first-order condition with respect to c_i is

$$c_i^{-1}=V'(a). \tag{A1}$$

We guess that the value function takes the form of

$$V(a_i)=\frac{\log a_i}{\rho+\lambda}+\phi_i. \tag{A2}$$

Eqs. (A1) and (A2) lead to

$$c_i=(\rho+\lambda)a_i.$$

Regarding to the choice of n_{ij}, we have

$$\sum_{j=1}^{N}(1-\tau_j)dn_{ij}-\sum_{j=1}^{N}\sigma_{ij}^2n_{ij}dn_{ij}=0. \tag{A3}$$

Total differentiation of $\sum_{j=1}^{N}n_{ij}=1$ provides

$$\sum_{j=1}^{N}dn_{ij}=0\Leftrightarrow dn_{ii}=-\sum_{i\neq j}dn_{ij}\,. \tag{A4}$$

Suppose that $dn_{ij}=0$ for $j\neq k$. Then, $dn_{ii}=-dn_{ik}$. Applying this into (Eq. (A4), we obtain

$$(\xi-\tau_i)dn_{ii}-(\xi-\tau_k)dn_{ii}-\sigma_{ii}^2n_{ii}dn_{ii}+\sigma_{ik}^2n_{ik}dn_{ii}=0. \tag{A5}$$

Substituting k in Eq. (A5) by j, we arrive at

$$\tau_j-\tau_i=\left(1-\sum_{j\neq i}n_{ij}\right)\sigma_{ii}^2-\sigma_{ij}^2n_{ij}.$$

We now consider ϕ. The value function must satisfy

$$(\rho+\lambda)V=\log(\rho+\lambda)a_i+[r_ia_i-(\rho+\lambda)a_i]V'(a)+\sum_{j=1}^{N}\sigma_{ij}^2n_{ij}^2\frac{a_i^2V''(a)}{2}. \tag{A6}$$

Inserting Eqs. (3a) and (A2) into Eq. (A6) yields

$$0=\log(\rho+\lambda)-(\rho+\lambda)\phi_i+\frac{\gamma_i}{\rho+\lambda}-\frac{1}{\rho+\lambda}\sum_{j=1}^{N}\frac{\sigma_{ij}^2n_{ij}^2}{2}. \tag{A7}$$

Solving Eq. (A7) with respect to ϕ_i, we obtain

$$\phi_i = \frac{1}{(\rho+\lambda)^2}\left[\gamma_i - \sum_{j=1}^{N}\frac{\sigma_{ij}^2 n_{ij}^2}{2} + \frac{\log(\rho+\lambda)}{\rho+\lambda}\right].$$

B. Regional welfare function

Using the market equilibrium conditions, Eq. (5) can be rewritten as

$$G_i(t) = \tau_i K_i(t) = \tau_i \sum_{j=1}^{N} n_{ji}^{*} A_j(t)\,. \tag{B1}$$

Integrating Eq (7a) with respect to time from s to v, we have

$$A_j(v) = A_j(s) e^{[\gamma_j-(1-\delta)\lambda](v-s)}. \tag{B2}$$

Using Eqs. (3a), (3b), (B1) and (B2), the maximization of problem of Eq. (12) becomes

$$\max_{\tau_i}\left\{\int_{-\infty}^{t}\frac{\log a_i(t,s)}{\rho+\lambda}\lambda e^{\lambda(s-t)}ds + \phi_i + \frac{\beta\log\tau_i}{\rho} + \frac{\beta[\gamma_i-(1-\delta)\lambda]}{\rho^2}\right.$$

$$\left. + \beta\int_{t}^{\infty}\log\left(n_{ii}^{*}A_i(t) + \sum_{j\neq i} n_{ji}^{*} g_{ji}(v) A_j(t)\right)e^{-\rho(v-t)}dv\right\}.$$

C. Regional government’s optimization problem in symmetric equilibrium

In symmetric equilibrium, Eq. (3b) becomes

$$\tau_j - \tau_i = \left(1 - \sum_{j\neq i} n_{ij}\right)\sigma_{ii}^2 - \sigma_{ij}^2 n_{ij} = \{[1-(N-1)n_{ij}] - n_{ij}\}\sigma^2. \tag{C1}$$

$$\tau_i - \tau_j = \left(1 - \sum_{i\neq j} n_{ji}\right)\sigma_{jj}^2 - \sigma_{ji}^2 n_{ji} = \{[1-(N-1)n_{ji}] - n_{ji}\}\sigma^2. \tag{C2}$$

Solving Eq. (C1) and (C2) with respect to n_{ij} and n_{ji} respectively, we obtain

$$n_{ij}^{*} = \frac{1}{N} - \frac{\tau_j - \tau_i}{\sigma^2 N}, \tag{C3}$$

$$n_{ji}^{*} = \frac{1}{N} - \frac{\tau_i - \tau_j}{\sigma^2 N}. \tag{C4}$$

Using Eq. (C3)

$$n_{ii}^* = n_{ij}^* + \frac{\tau_j - \tau_i}{\sigma^2} = \frac{1}{N} - \frac{\tau_j - \tau_i}{\sigma^2 N} + \frac{\tau_j - \tau_i}{\sigma^2} = \frac{1}{N} + \frac{(N-1)\left(\tau_j - \tau_i\right)}{\sigma^2 N}. \tag{C5}$$

Proof of Lemma 1.

We can easily derive the partial differentiation of Eqs. (C3)–(C5) with respect to τ_i. Furthermore, utilizing Eqs. (10), (11), and the market equilibrium conditions, we have

$$\frac{\partial \gamma_i}{\partial \tau_i} = -n_{ii}^* + \sum_{j=1}^{N} (\xi - \tau_k) \frac{\partial n_{ij}^*}{\partial \tau_i} = -\frac{1}{N},$$

$$\frac{\partial \gamma_j}{\partial \tau_i} = -n_{ji}^* + \sum_{k=1}^{N} (\xi - \tau_k) \frac{\partial n_{jk}^*}{\partial \tau_i} = -\frac{1}{N},$$

$$\sum_{j=1}^{N} \sigma_{ij} n_{ij}^* = \sigma \sum_{j=1}^{N} n_{ij}^* = \sigma,$$

$$\frac{\partial}{\partial \tau_i} \sum_{j=1}^{N} \sigma_{ij} n_{ij}^* = \sigma \sum_{j=1}^{N} \frac{\partial n_{ij}^*}{\partial \tau_i} = 0,$$

$$\sum_{j=1}^{N} n_{ij}^* \frac{\partial n_{ij}^*}{\partial \tau_i} = n_{ii}^* \frac{\partial n_{ii}^*}{\partial \tau_i} + (N-1) n_{ij}^* \frac{\partial n_{ij}^*}{\partial \tau_i} = 0.$$

Proof of Lemma 2.

Combined these equations with the partial derivatives of welfare components with respect to τ_i,

$$\frac{\partial \chi_i}{\partial \tau_i} = \frac{1}{\lambda} \left(\frac{\partial \gamma_i}{\partial \tau_i} - \sigma^2 \sum_{j=1}^{N} n_{ij}^* \frac{\partial n_{ij}^*}{\partial \tau_i} \right) = -\frac{1}{\lambda N},$$

$$\frac{\partial \phi_i}{\partial \tau_i} = \frac{1}{(\rho + \lambda)^2} \left(\frac{\partial \gamma_i}{\partial \tau_i} - \sigma^2 \sum_{j=1}^{N} n_{ij}^* \frac{\partial n_{ij}^*}{\partial \tau_i} \right) = \frac{1}{(\rho + \lambda)^2} \frac{\partial \gamma_i}{\partial \tau_i} = -\frac{1}{(\rho + \lambda)^2 N},$$

$$\frac{\partial}{\partial \tau_i} \left(n_{ii}^* A_i(t) + \sum_{j \neq i} n_{ji}^* g_{ji}(v) A_j(t) \right) = \frac{\partial n_{ii}^*}{\partial \tau_i} A_i(t) + \sum_{j \neq i} \left[\frac{\partial n_{ji}^*}{\partial \tau_i} g_{ji}(v) + n_{ji}^* \frac{\partial g_{ji}(v)}{\partial \tau_i} \right] A_j(t)$$

$$= -2 \left(\frac{N-1}{N} \right) \frac{A_i(t)}{\sigma^2},$$

where $g_{ji}(v) = e^{(\gamma_j - \gamma_i)(v-t)} = 1$ and

$$\frac{\partial g_{ji}(v)}{\partial \tau_i} = \left(\frac{\partial \gamma_j}{\partial \tau_i} - \frac{\partial \gamma_i}{\partial \tau_i} \right) (v - t) e^{(\gamma_j - \gamma_i)(v-t)} = 0.$$

Note that $n_{ii}^{*}A_i(t)+\sum_{j\neq i}n_{ji}^{*}g_{ji}(v)A_j(t)=A_i(t)$ holds in equilibrium. Using the equation mentioned above,

$$\frac{\partial\Omega_i}{\partial\tau_i}=\frac{\beta}{\rho}\left(\frac{1}{\tau_i}+\frac{1}{\rho}\frac{\partial\gamma_i}{\partial\tau_i}+\frac{1}{A_i(t)}\sum_{j=1}^{N}\frac{\partial n_{ji}^{*}}{\partial\tau_i}A_j(t)\right)=\frac{\beta}{\rho}\left[\frac{1}{\tau_i}-\frac{1}{\rho N}-\frac{2}{\rho\sigma^2}\left(\frac{N-1}{N}\right)\right]\gtreqless 0\Leftrightarrow\tau_i\lesseqgtr\hat{\tau}_i.$$

Proof of Proposition 1.

Using Lemmas 1 and 2, Eq. (13) becomes

$$\frac{\partial W_i}{\partial\tau_i}=-\frac{1}{(\rho+\lambda)^2N}+\frac{\beta}{\rho}\left[\frac{1}{\tau_i}-\frac{1}{\rho N}-\frac{2}{\rho\sigma^2}\left(\frac{N-1}{N}\right)\right].\tag{C6}$$

The second-order derivative is given by

$$\frac{\partial^2W_i}{\partial\tau_i^2}=-\frac{\beta}{\rho\tau_i^2}<0.\tag{C7}$$

Using Eq. (C6), we have

$$\lim_{\tau_i\to0}\frac{\partial W_i}{\partial\tau_i}=+\infty,\tag{C8}$$

$$\lim_{\tau_i\to\hat{\tau}_i}\frac{\partial W_i}{\partial\tau_i}=-\frac{1}{(\rho+\lambda)^2N}<0.\tag{C9}$$

Therefore, Eqs. (C6)–(C9) show that a welfare-maximizing tax rate exists in $\tau\in(0,\hat{\tau}_i)$.

For, total differentiation of Eq. (6) yields

$$\frac{\partial\tau_i^{*}}{\partial N}=-\frac{\dfrac{1}{(\rho+\lambda)^2N^2}+\dfrac{\beta}{\rho^2N^2}\left(1-\dfrac{2\rho}{\sigma^2}\right)}{\dfrac{\partial^2W_i}{\partial\tau_i^2}}\gtreqless 0\Leftrightarrow\frac{\sigma^2}{2}\gtreqless\frac{\beta\rho(\rho+\lambda)^2}{\rho^2+\beta(\rho+\lambda)^2},$$

$$\frac{\partial\tau_i^{*}}{\partial\sigma^2}=-\frac{\dfrac{2\beta}{\rho\sigma^4}\left(\dfrac{N-1}{N}\right)}{\dfrac{\partial^2W_i}{\partial\tau_i^2}}>0,$$

$$\frac{\partial\tau_i}{\partial\lambda}=-\frac{\dfrac{2}{(\rho+\lambda)^3N}}{\dfrac{\partial^2W_i}{\partial\tau_i^2}}>0,$$

$$\frac{\partial\tau_i^{*}}{\partial\beta}=-\frac{\dfrac{1}{\rho}\left[\dfrac{1}{\tau_i}-\dfrac{1}{\rho N}-\dfrac{2}{\sigma^2}\left(\dfrac{N-1}{N}\right)\right]}{\dfrac{\partial^2W_i}{\partial\tau_i^2}}>0.$$

Proof of Proposition 2.

The partial derivatives of g_i^{*} are

$$\frac{\partial g_i^{*}}{\partial N}=-\frac{\partial\tau_i^{*}}{\partial N}\lesseqgtr 0\Leftrightarrow\frac{\sigma^2}{2}\gtreqless\frac{\beta\rho(\rho+\lambda)^2}{\rho^2+\beta(\rho+\lambda)^2},$$

$$\frac{\partial g_i^*}{\partial \sigma^2} = -\frac{\partial \tau_i^*}{\partial \sigma^2} < 0, \frac{\partial g_i^*}{\partial \lambda} = -\frac{\partial \tau_i^*}{\partial \lambda} - (2-\delta) < 0, \frac{\partial g_i^*}{\partial \beta} = -\frac{\partial \tau_i^*}{\partial \beta} < 0.$$

D. Proof of Lemma 3

The probability density function of Eq. (8a) satisfies

$$\frac{\partial f(x,t)}{\partial t} = -\frac{\partial}{\partial x}\left(\mu_x x f(x,t)\right) + \frac{1}{2}\frac{\partial^2}{\partial x^2}\left(\sigma_x^2 x^2 f(x,t)\right) - \lambda f(x,t), \tag{D1}$$

where $\mu_x \equiv (1-\delta)\lambda$ and $\sigma_x \equiv \sum_{j=1}^{N} \sigma_{ij} n_{ij}^*$. Note that the subscript i is dropped here and $\sigma_x = \sigma$ holds. Suppose that the stationary probability density function as $f(x) = bx^{-q-1}$. Eq. (D1) can be rewritten as

$$P(q) \equiv \sigma_x^2 q^2 + (2\mu_x - \sigma_x^2)q - 2\lambda = 0. \tag{D2}$$

We have $P(-1) = 2\sigma_x^2 - 2\lambda(2-\delta) < 0$ and $P(1) = -2\delta\lambda < 0$. Therefore, the roots of Eq. (D2) are derived as

$$q_1 = \frac{-2\mu_x + \sigma_x^2 - \Delta}{2\sigma_x^2} \equiv -\zeta_L < -1, \tag{D3}$$

$$q_2 = \frac{-2\mu_x + \sigma_x^2 + \Delta}{2\sigma_x^2} \equiv \zeta_R > 1, \tag{D4}$$

where $\Delta \equiv \sqrt{(2\mu_x - \sigma_x^2)^2 + 8\lambda\sigma_x^2}$. With q_1 and q_2, we obtain

$$b = -\frac{q_1 q_2}{(q_2 - q_1)\delta} = \frac{\zeta_L \zeta_R}{(\zeta_L + \zeta_R)\delta} = \frac{2\lambda}{\delta\Delta}.$$

Hence, the probability density function is given by

$$f(x) = \begin{cases} b\left(\frac{x}{\delta}\right)^{-q_1-1} & \text{for } x < \delta, \\ b\left(\frac{x}{\delta}\right)^{-q_2-1} & \text{for } x > \delta. \end{cases}$$

The probability distribution function satisfies

$$F(x; x \le \delta) = \int_0^x f(z)\,dz = \frac{\zeta_R}{\zeta_L + \zeta_R}\delta^{-\zeta_L} x^{\zeta_L},$$

$$F(x; x > \delta) = -\frac{\psi\delta}{q_1} + \int_\delta^x f(z)\,dz = 1 - \frac{\zeta_L}{\zeta_L + \zeta_R}\delta^{\zeta_R} x^{-\zeta_R}.$$

By the definition of the Gini coefficient, the Gini coefficients for bottom and top groups are

$$\int_0^\delta F(x)[1 - F(x)]\,dx = \frac{\delta\zeta_L\zeta_R(2\zeta_L + \zeta_R + 1)}{(\zeta_L + 1)(2\zeta_L + 1)(\zeta_L + \zeta_R)^2}, \tag{D5}$$

$$\int_\delta^\infty F(x)[1 - F(x)]\,dx = \frac{\delta\zeta_L\zeta_R(\zeta_L + 2\zeta_R - 1)}{(\zeta_R - 1)(2\zeta_R - 1)(\zeta_L + \zeta_R)^2}. \tag{D6}$$

Using Eqs. (D5) and (D6) derives

$$GI = \int_0^\infty F(x)[1-F(x)]\,dx = \frac{\delta\zeta_L\zeta_R[\zeta_L(2\zeta_L+1)+\zeta_R(2\zeta_R-1)+2\zeta_L\zeta_R]}{(\zeta_L+1)(2\zeta_L+1)(\zeta_R-1)(2\zeta_R-1)(\zeta_L+\zeta_R)}. \tag{D7}$$

The partial derivatives of Eqs. (D3) and (D4) with respect to σ_x^2 lead to

$$\frac{\partial\zeta_L}{\partial\sigma_x^2} = -\frac{2\lambda[1+(1-\delta)\xi_L]}{\sigma_x^2\Delta} < 0, \tag{D8}$$

$$\frac{\partial\zeta_R}{\partial\sigma_x^2} = -\frac{2\lambda[1-(1-\delta)\xi_R]}{\sigma_x^2\Delta} < 0, \tag{D9}$$

where $(1-\delta)\zeta_R < 1$ due to $P((1-\delta)^{-1}) > 0$. Using Eqs. (D8) and (D9), the partial derivative of Eq. (D7) with respect to σ_x^2 is given by

$$\frac{\partial GI}{\partial\sigma_x^2} = \frac{16\delta\lambda^2[8\mu_x^2+12(1+\delta)\lambda\sigma_x^2+3\sigma_x^4]}{[4(1+\delta)\lambda+\sigma_x^2]^2\Delta^3} > 0.$$

E. Asymmetric heterogeneous risks

Proof of Lemma 4.

By the similar way in Appendix C, we have

$$n_{ii}^* = \frac{(1+\varepsilon)^2\sigma^2-(\tau_i-\tau_j)}{[1+(1+\varepsilon)^2]\sigma^2} = \frac{(1+\varepsilon)^2}{1+(1+\varepsilon)^2},$$

$$n_{ij}^* = \frac{\sigma^2+\tau_i-\tau_j}{[1+(1+\varepsilon)^2]\sigma^2} = \frac{1}{1+(1+\varepsilon)^2}.$$

The partial derivatives of n_{ii}^* and n_{ij}^* with respect to τ_i are

$$\frac{\partial n_{ii}^*}{\partial\tau_i} = -\frac{1}{[1+(1+\varepsilon)^2]\sigma^2} < 0, \tag{E1}$$

$$\frac{\partial n_{ij}^*}{\partial\tau_i} = \frac{1}{[1+(1+\varepsilon)^2]\sigma^2} > 0. \tag{E2}$$

Using Eqs. (E1) and (E2), we obtain

$$\sigma_{ii}\frac{\partial n_{ii}}{\partial\tau_i} + \sigma_{ij}\frac{\partial n_{ij}}{\partial\tau_i} = -\frac{1}{[1+(1+\varepsilon)^2]\sigma} + \frac{1+\varepsilon}{[1+(1+\varepsilon)^2]\sigma} = \frac{\varepsilon}{[1+(1+\varepsilon)^2]\sigma}.$$

The mean growth rate of asset becomes

$$\gamma_i = (\xi-\tau_i)n_{ii}^* + (\xi-\tau_j)n_{ij}^* - \rho - \lambda.$$

The partial derivative of γ_i with respect to τ_i is

$$\frac{\partial\gamma_i}{\partial\tau_i} = -n_{ii}^* + (\xi-\tau_i)\frac{\partial n_{ii}^*}{\partial\tau_i} + (\xi-\tau_j)\frac{\partial n_{ij}^*}{\partial\tau_i} = -\frac{(1+\varepsilon)^2}{1+(1+\varepsilon)^2}.$$

Similarly, we arrive at

$$\frac{\partial\gamma_j}{\partial\tau_i} = -n_{ji}^* + (\xi-\tau_i)\frac{\partial n_{ji}^*}{\partial\tau_i} + (\xi-\tau_j)\frac{\partial n_{jj}^*}{\partial\tau_i} = -\frac{1}{1+(1+\varepsilon)^2}.$$

Proof of Lemma 5.

Using Lemma 4, the partial derivative of ϕ_i with respect to τ_i becomes

$$\frac{\partial \phi_i}{\partial \tau_i} = \frac{1}{(\rho+\lambda)^2}\left[\frac{\partial \gamma_i}{\partial \tau_i} - \sigma^2 n_{ii}^* \frac{\partial n_{ii}^*}{\partial \tau_i} - (1+\varepsilon)^2 \sigma^2 n_{ij}^* \frac{\partial n_{ij}^*}{\partial \tau_i}\right] = -\frac{(1+\varepsilon)^2}{[1+(1+\varepsilon)^2](\rho+\lambda)^2} < 0,$$

with

$$\sum_{j=1}^{2} \sigma_{ij}^2 n_{ij}^* \frac{\partial n_{ij}^*}{\partial \tau_i} = \sigma^2 n_{ii}^* \frac{\partial n_{ii}^*}{\partial \tau_i} + (1+\varepsilon)^2 \sigma^2 n_{ij}^* \frac{\partial n_{ij}^*}{\partial \tau_i} = 0.$$

We have

$$\begin{aligned}\frac{\partial}{\partial \tau_i}\left(n_{ii}^* A_i(t) + n_{ji}^* g_{ji}(v) A_j(t)\right) &= A_i(t)\frac{\partial n_{ii}^*}{\partial \tau_i} + g_{ji}(v) A_j(t) \frac{\partial n_{ji}^*}{\partial \tau_i} + n_{ji}^* A_j(t) \frac{\partial g_{ji}(v)}{\partial \tau_i} \\ &= -\frac{2}{[1+(1+\varepsilon)^2]\sigma^2}\left\{1 - \left[\frac{(1+\varepsilon)^2 - 1}{1+(1+\varepsilon)^2}\right]\frac{\sigma^2}{2}(v-t)\right\} A_i(t),\end{aligned}$$

where $g_{ji}(v) = e^{(\gamma_j - \gamma_i)(v-t)} = 1$, and

$$\frac{\partial g_{ji}(v)}{\partial \tau_i} = \left(\frac{\partial \gamma_j}{\partial \tau_i} - \frac{\partial \gamma_i}{\partial \tau_i}\right)(v-t) e^{(\gamma_j-\gamma_i)(v-t)} = \left[\frac{(1+\varepsilon)^2 - 1}{1+(1+\varepsilon)^2}\right](v-t).$$

Hence, we arrive at

$$\frac{\partial \Omega_i}{\partial \tau_i} = \frac{\beta}{\rho}\left\{\frac{1}{\tau_i} - \frac{(1+\varepsilon)^2}{[1+(1+\varepsilon)^2]\rho} - \frac{1}{1+(1+\varepsilon)^2}\left[\frac{2}{\sigma^2} - \frac{(1+\varepsilon)^2 - 1}{\rho[1+(1+\varepsilon)^2]}\right]\right\}.$$

Proof of Proposition 5.

The first-order condition of the regional welfare function with respect to the tax rate is

$$\begin{aligned}\frac{\partial W_i}{\partial \tau_i} = &-\frac{1}{(\rho+\lambda)^2}\left[\frac{(1+\varepsilon)^2}{1+(1+\varepsilon)^2} + \frac{(\tau_i - \tau_j)}{[1+(1+\varepsilon)^2]\sigma^2}\right] \\ &+ \frac{\beta}{\rho}\left\{\frac{1}{\tau_i} - \frac{(1+\varepsilon)^2}{[1+(1+\varepsilon)^2]\rho}\right. \\ &\left. - \frac{2}{[1+(1+\varepsilon)^2]\sigma^2}\left[1 - \frac{1}{2}\left(\frac{\sigma^2 + \tau_i - \tau_j}{\rho}\right)\left[\frac{(1+\varepsilon)^2 - 1}{1+(1+\varepsilon)^2}\right]\right]\right\} = 0.\end{aligned}$$

In equilibrium, we have

$$\frac{\partial W_i}{\partial \tau_i} = -\frac{(1+\varepsilon)^2}{[1+(1+\varepsilon)^2](\rho+\lambda)^2} + \frac{\beta}{\rho}\left\{\frac{1}{\tau_i} - \frac{1+(1+\varepsilon)^4}{[1+(1+\varepsilon)^2]^2\rho} - \frac{2}{[1+(1+\varepsilon)^2]\sigma^2}\right\} = 0. \qquad \text{(E3)}$$

Then the second order condition becomes

$$\frac{\partial^2 W_i}{\partial \tau_i^2} = -\frac{\beta}{\rho \tau_i^2} < 0.$$

Total differentiation of Eq. (E3) engenders

$$\frac{\partial \tau_i}{\partial \varepsilon} = \frac{\dfrac{\beta}{\rho\sigma^2} - \dfrac{1}{2(\rho+\lambda)^2} - \dfrac{(1+\varepsilon)^2 - 1}{[1+(1+\varepsilon)^2]}\dfrac{\beta}{\rho^2}}{-\dfrac{\partial^2 W_i}{\partial \tau_i^2}} \frac{1+\varepsilon}{[1+(1+\varepsilon)^2]^2}. \tag{E4}$$

Note that the denominator of Eq. (E4) is decreasing in ε. Eq. (E4) yields

$$\left.\frac{\partial \tau_i}{\partial \varepsilon}\right|_{\varepsilon\to 0} = \frac{\dfrac{\beta}{\rho\sigma^2} - \dfrac{1}{2(\rho+\lambda)^2}}{-\dfrac{\partial^2 W_i}{\partial \tau_i^2}},$$

$$\left.\frac{\partial \tau_i}{\partial \varepsilon}\right|_{\varepsilon\to \infty} = \frac{\dfrac{\beta}{\rho^2\sigma^2} - \dfrac{1}{2(\rho+\lambda)^2} - \dfrac{\beta}{\rho^2}}{-\dfrac{\partial^2 W_i}{\partial \tau_i^2}} \lim_{\varepsilon\to\infty} \frac{1+\varepsilon}{[1+(1+\varepsilon)^2]^2}.$$

We now have

$$\left.\frac{\partial \tau_i}{\partial \varepsilon}\right|_{\varepsilon\to 0} < \left.\frac{\partial \tau_i}{\partial \varepsilon}\right|_{\varepsilon\to \infty} < 0 \text{ for } \frac{\sigma^2}{2} > \frac{\beta(\rho+\lambda)^2}{\rho} \Rightarrow \frac{\partial \tau_i}{\partial \varepsilon} < 0 \text{ for } \frac{\sigma^2}{2} > \frac{\beta(\rho+\lambda)^2}{\rho}.$$

However, we obtain

$$\left.\frac{\partial \tau_i}{\partial \varepsilon}\right|_{\varepsilon\to 0} > 0\,, \left.\frac{\partial \tau_i}{\partial \varepsilon}\right|_{\varepsilon\to \infty} \gtrless 0 \text{ for } \frac{\sigma^2}{2} < \frac{\beta(\rho+\lambda)^2}{\rho}. \tag{E5}$$

More precisely, we have

$$\left.\frac{\partial \tau_i}{\partial \varepsilon}\right|_{\varepsilon\to \infty} \gtreqless 0 \Leftrightarrow \frac{\sigma^2}{2} \lesseqgtr \frac{\beta(\rho+\lambda)^2}{\rho^2 + 2\beta(\rho+\lambda)^2}. \tag{E6}$$

Eqs. (E5) and (E6),

$$\left.\frac{\partial \tau_i}{\partial \varepsilon}\right|_{\varepsilon\to 0} > 0 > \left.\frac{\partial \tau_i}{\partial \varepsilon}\right|_{\varepsilon\to \infty} \text{ for } \frac{\beta(\rho+\lambda)^2}{\rho^2 + 2\beta(\rho+\lambda)^2} < \frac{\sigma^2}{2} < \frac{\beta(\rho+\lambda)^2}{\rho}, \tag{E7}$$

and

$$\left.\frac{\partial \tau_i}{\partial \varepsilon}\right|_{\varepsilon\to 0} > \left.\frac{\partial \tau_i}{\partial \varepsilon}\right|_{\varepsilon\to \infty} > 0 \text{ for } \frac{\sigma^2}{2} < \frac{\beta(\rho+\lambda)^2}{\rho^2 + 2\beta(\rho+\lambda)^2} \Rightarrow \frac{\partial \tau_i}{\partial \varepsilon} < 0 \text{ for } \frac{\sigma^2}{2} < \frac{\beta(\rho+\lambda)^2}{\rho^2 + 2\beta(\rho+\lambda)^2}.$$

In case of Eq. (E7), we arrive at

$$\frac{\partial \tau_i}{\partial \varepsilon} \gtreqless 0 \Leftrightarrow \varepsilon \lesseqgtr \hat{\varepsilon},$$

where

$$\left.\frac{\partial \tau_i}{\partial \varepsilon}\right|_{\varepsilon=\hat{\varepsilon}} = 0.$$

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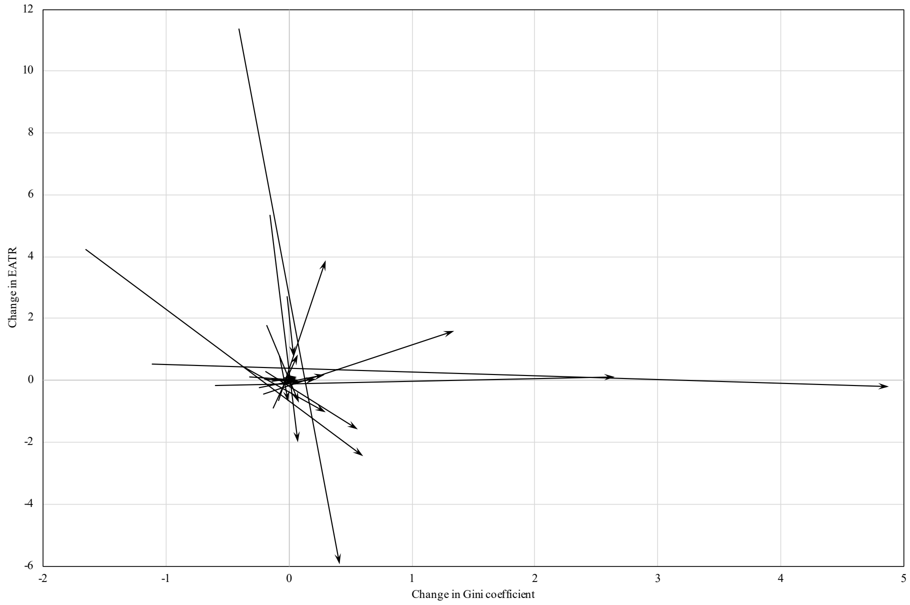
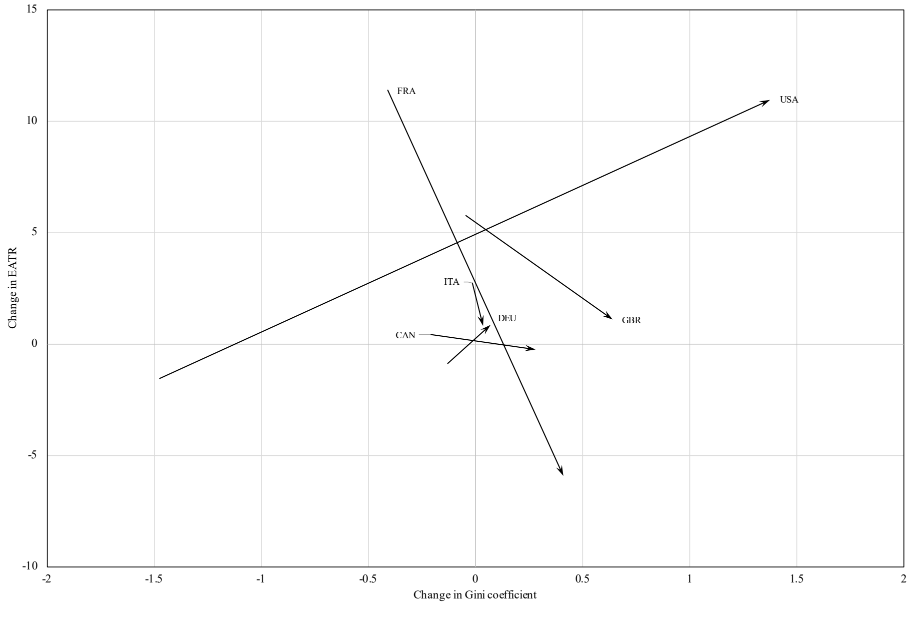
Figures



(a) EU countries



(b) G7 countries

Figure 1: Changes in EATRs and Gini coefficients

Data: EATRs from Corporate Tax Statistics, OECD; Gini coefficients of personal wealth (all ages, equal-split, adults) from WID database.

Note: Data period is 2017–2023. EATRs and Gini coefficients are normalized to the difference from average level over the data period. The arrows align the direction of increasing Gini coefficients. The countries are excluded because there is no change of EATRs or Gini coefficients.