The international taxation of capital when assets are imperfect substitutes

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Roadmap

- Motivation

- A simple two country / two period model

- A quantitative dynamic model

Motivation

‘...We haven’t gone far enough in harmonizing the taxes on businesses and economic activities subject to competition.

The result is that States are allowed to indulge in destructive competition on tax to attract businesses to their countries by cutting corporate tax, sometimes to zero.

Tax dumping, which is prospering under the unanimity rule isn’t acceptable inside the EU...’

Nicolas Sarkozy, 2007

Motivation

Consensus view among academics and policy makers: uncoordinated fiscal policy regarding capital taxation should lead to a race-to-the bottom of capital taxes if capital is mobile internationally.

Why? Financial globalization implies equalization of rates of return across countries $\Rightarrow$ the supply of capital becomes infinitely elastic to capital tax rates

But data for G7 countries on corporate tax rates do not suggest such a race-to-the bottom despite a wave of financial globalization over the last 25 years.

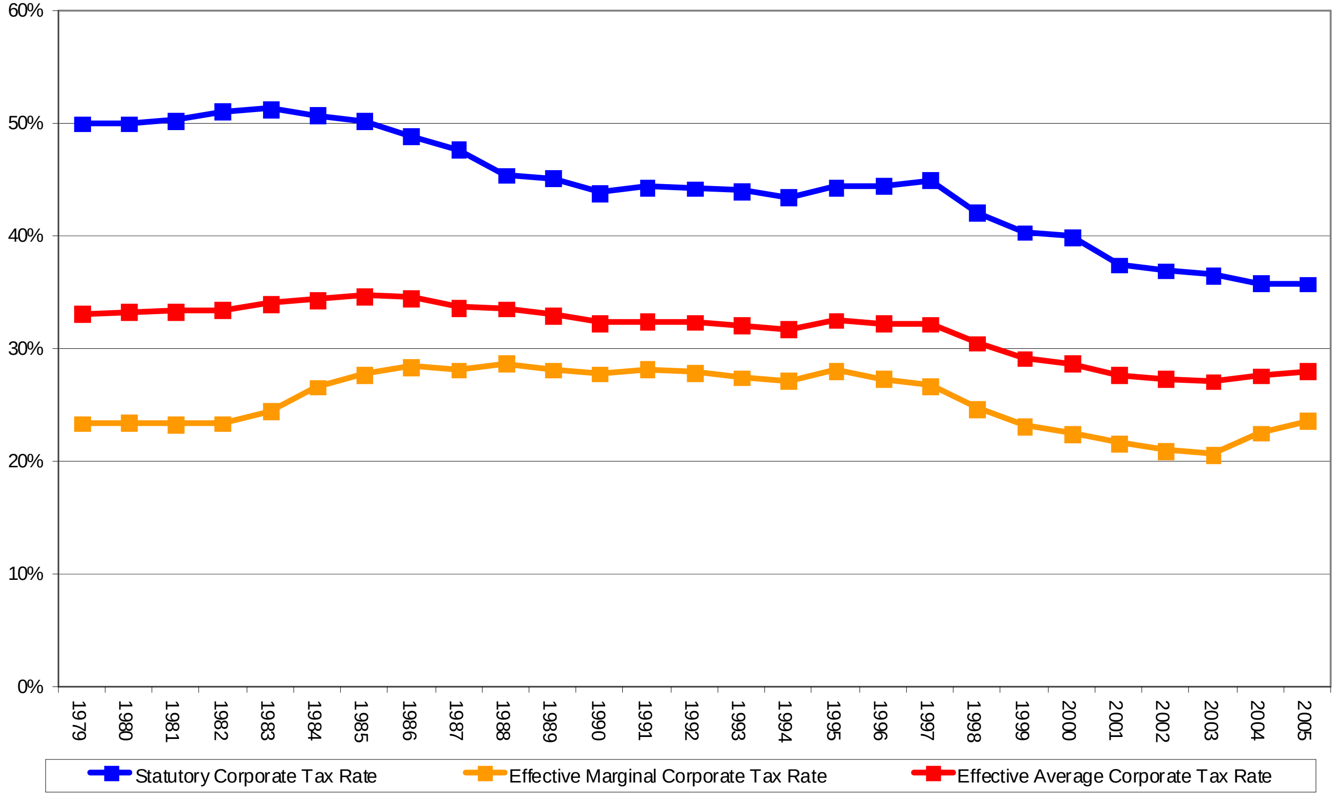

Figure 1: Corporate tax rates in G7 countries. Average values over the G7 countries. Source: OECD and Devereux et al.

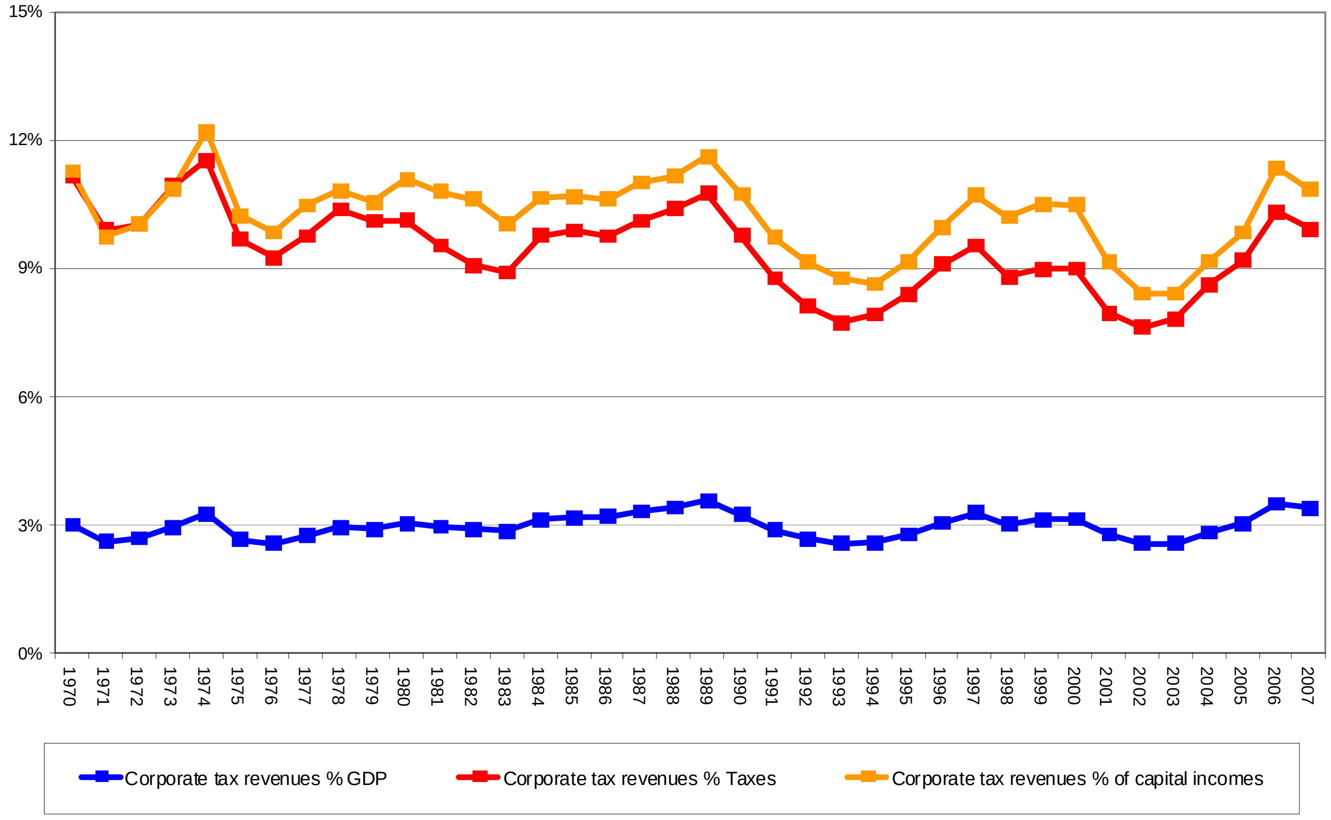

Figure 2: Corporate tax revenues in G7 countries. Average over G7 countries. Source: OECD

Motivation

What this paper does?

Challenges this consensus view in a world where assets are *imperfect substitutes* (due to aggregate risk in each country)

Main findings: with assets imperfect substitutes, strictly *positive* capital tax rates in the long-run if governments do not coordinate their fiscal policy. Thus even in an environment where optimal capital taxes are zero (Chamley-Judd)

Motivation

Intuition: Aggregate risk breaks down the equalization of rate of returns across countries $\Rightarrow$ Finite elasticity of the supply of capital to tax rates

Governments trade-off the benefits of imposing some of the burden of their spending on foreign capital holders with the costs of deterring capital accumulation

By-product: financial globalization does not necessarily lead to race-to-the-bottom. Two offsetting forces

(i) stronger competition for capital $\Rightarrow \downarrow$ capital taxes

(ii) foreigners hold a larger share of the capital stock $\Rightarrow \uparrow$ capital taxes

Related literature

Theory: Zero capital tax rates literature: Chamley (1986), Judd (1985) and Atkeson et al. (1999)

Capital taxation in open economies: Gordon (1986, 1992), Frenkel et al. (1991), Razin and Sadka (1995), Mendoza and Tesar (1998 and 2005), Gordon and Hines (2002).

Optimal tariffs and terms-of-trade manipulation: Krugman and Obstfeld (1997), Bagwell and Staiger (1999) among others

Empirics: Devereux, Griffith and Klemm (2002) Slemrod (2004), Devereux, Lockwood and Redoano (2008)...

A simple two country / two period model

Two symmetric countries Home (H) and Foreign.(F) with a representative household who lives two periods $t = 0, 1$.

Timing

$t = 0$: household of country i consumes and saves a share of its endowment y_0; allocates his savings between Home capital and Foreign capital. Country i savings invested in country $j = \{H, F\}$ denoted k_j^i

$t = 1$: household of country i consumes the returns of his investment decisions and his period $t = 1$ labor incomes w_1. Inelastic labor supply

Stochastic structure

Wages non-stochastic. At $t = 1$, one unit of capital invested in country i pays $R_i = \overline{R} + \varepsilon_i$ with ε_i stochastic: $\varepsilon_i \sim N(0; \sigma^2)$. $\rho =$ correlation between Home and Foreign capital returns.

Government and fiscal policy

Government of country i must finance spendings g in period $t = 1$. Commits to a fiscal policy $T_i = \left\{T_i^k, T_i^l\right\}$ at $t = 0$, where T_i^k (resp. T_i^l) denotes the taxation rate on capital (resp. labor). Budget constraint at $t = 1$:

$$g_i = T_i^l w_1 + T_i^k \left[k_i^i + k_i^j\right]$$

Capital tax is a like a fixed rate on the capital stock. Can be re-expressed as a state dependent tax rate τ_i^k on capital return where $\tau_i^k = \frac{T_i^k}{R_i}$.

Household utility and budget constraints

Households in country i derive utility from consumption at $t = 0, 1$:

$$U_i = c_{0,i} - \frac{\theta}{2} c_{0,i}^2 + \beta \left[c_{i,1} - \frac{\gamma}{2} E_0 \left(c_{i,1} - E(c_{i,1}) \right)^2 \right]$$

Non-standard quadratic utility function for tractability: $0 < \theta < \frac{1}{y_{i,0}}$ (but arbitrary small) to have some curvature in the period 0 utility function, otherwise no intertemporal distortions.

$$\begin{aligned} c_{0,i} &= y_0 - \left(k_i^i + k_j^i \right) && t = 0 \\ c_{i,1} &= \left[R_i - T_i^k \right] k_i^i + \left[R_j - T_j^k \right] k_j^i + \left(1 - T_i^l \right) w_1 && t = 1 \end{aligned}$$

Financial autarky

Inelastic labor supply.

Easy to show that optimal fiscal policy implies zero capital taxation.

$$T_i^k = 0; T_i^l = \frac{g}{w_1}$$

Integrated economy and coordinated fiscal policy

Same reasoning applies. Zero capital taxation is optimal

Integrated economy and uncoordinated fiscal policy

Household maximization

$$\max_{\left\{c_{0,i},c_{i,1},k_i^i;k_j^i\right\}} U_i \text{ subject to budget constraints}$$

Capital allocation in country i (similar expressions hold for country j):

$$k_j^i(T_i,T_j) = \frac{\gamma(\theta y_0 - 1)\sigma^2(1-\rho) + (\theta+\gamma\beta\sigma^2)\left[\overline{R} - T_j^k\right] - (\theta+\gamma\beta\rho\sigma^2)\left[\overline{R} - T_i^k\right]}{\gamma\sigma^2(1-\rho)\left[2\theta+\gamma\beta\sigma^2(1+\rho)\right]}$$

$$k_i^i(T_i,T_j) = \frac{\gamma(\theta y_0 - 1)\sigma^2(1-\rho) + (\theta+\gamma\beta\sigma^2)\left[\overline{R} - T_i^k\right] - (\theta+\gamma\beta\rho\sigma^2)\left[\overline{R} - T_j^k\right]}{\gamma\sigma^2(1-\rho)\left[2\theta+\gamma\beta\sigma^2(1+\rho)\right]}$$

Risk-return trade off:

Investment in country i is $\uparrow$ with expected return net of taxes $\left[\overline{R} - T_i^k\right]$ and decreasing with $\gamma\sigma^2(1-\rho)$.

Due to the presence of risk and imperfectly correlated returns $\left(\sigma^2(1-\rho) > 0\right)$ and $\gamma > 0$, the response of investment in domestic capital to changes in the tax rates is finite.

$\Rightarrow$ Domestic and foreign capital can have different net of taxes expected returns in equilibrium

Note: when $\gamma\sigma^2(1-\rho) \longrightarrow 0$, $\overline{R} - T_i^k = \overline{R} - T_j^k$.

Equilibrium fiscal policy

Solution strategy

(i) Solves for optimal T_i given T_j and given optimal decisions of households $(k_i^i(T_i,T_j); k_j^i(T_i,T_j); k_i^j(T_i,T_j); k_j^j(T_i,T_j))$ and government budget constraint

$\Rightarrow$ Gives best response function of each government

(ii) Solves for the Nash-Game between governments

Equilibrium fiscal policy

$$\max_{T_i} \left[U_i(k_i^i(T_i, T_j); k_j^i(T_i, T_j)) \right]$$

$$\text{s.t: } g_i = T_i^k (k_i^i(T_i, T_j) + k_i^j(T_i, T_j)) + T_i^l w_{i,1}$$

$\widetilde{T}_i(T_j)$ the optimal fiscal policy that solves the maximization program given country j fiscal policy T_j.

Uncoordinated fiscal policy in equilibrium $\left\{T_i^*; T_j^*\right\}$ satisfies:

$$T_i^* = \widetilde{T}_i(T_j^*) \text{ and } T_j^* = \widetilde{T}_j(T_i^*)$$

Equilibrium fiscal policy: best response function

$$\widetilde{T}_i(T_j^k) = \frac{(\theta + \gamma\beta\rho\sigma^2)T_j^k + \gamma(\theta y_0 - 1 + \beta R)\sigma^2(1-\rho)}{3(\theta + \gamma\beta\sigma^2)}$$

Strategic interactions between governments imply (for the realistic case of $\rho > 0$):

$$\frac{\partial T_i^k}{\partial T_j^k} = \frac{(\theta + \gamma\beta\rho\sigma^2)}{3(\theta + \gamma\beta\sigma^2)} > 0$$

Lower foreign taxes make domestic governments to lower their taxes (competition effect). The higher is the substitutability between assets (higher ρ) the stronger is the competition effect.

Equilibrium fiscal policy: Nash Equilibrium

$$\left(T^k\right)^* = \frac{(\theta y_0 - 1 + \beta R)\gamma\sigma^2(1-\rho)}{2\theta + \gamma\beta\sigma^2(1-\rho)}$$

Non-zero capital tax rates! Governments want to raise capital taxes to finance part of their spending at the expense of foreign holders of domestic capital. Doing so, domestic capital moves out of the country but with a finite elasticity (portfolio diversification). Gives incentives to the foreign government to raise taxes as well. Equilibrium capital tax reflects the trade-off faced by governments between attracting capital at home and having foreign shareholders financing domestic spending.

$\left(T^k\right)^*$ is raising with $\gamma\sigma^2(1-\rho)$. When assets are perfect substitutes ($\sigma^2(1-\rho) \to 0$), optimal capital tax rate $\left(T^k\right)^*$ is zero.

A quantitative dynamic model

Two countries Home (H) and Foreign.(F). One single tradable good.

One representative household in each country.

Technologies and firms

$$\begin{aligned} y_{i,t} &= \theta_i (k_{i,t})^{\alpha} (l_i)^{1-\alpha} \\ k_{i,t+1} &= (1-\delta_{i,t}) k_{i,t} + I_{i,t} \end{aligned}$$

$0 < \delta_{i,t} < 1$ is the stochastic depreciation rate of capital $\Rightarrow$ assets imperfect substitutes

$$\delta_{i,t} = \overline{\delta} + s\varepsilon_{i,t},\ \varepsilon_{i,t} \sim N(0,1)$$

with $corr(\varepsilon_{H,t}, \varepsilon_{F,t}) = \rho$.

Inelastic labour supply $l_i = 1$

Factor payments

$$w_{i,t} = (1-\alpha)y_{i,t}\ ; \quad (r_{i,t}-\delta_{i,t})k_{i,t} = \alpha y_{i,t} - \delta_{i,t}k_{i,t}$$

Fiscal Policy

Labor and capital taxes ($\left\{T_{i,t}\right\}_{t\geq 0} = \left[\tau^l_{i,t}, \tau^k_i\right]_{t\geq 0}$)

$$\begin{aligned} \tau^l_{i,t}w_{i,t} &= \tau^l_{i,t}(1-\alpha)y_{i,t} \\ \tau^k_i(r_{i,t}-\delta_{i,t})k_{i,t} &= \tau^k_i\left(\alpha y_{i,t} - \delta_{i,t}k_{i,t}\right) \end{aligned}$$

Note: constant capital tax for simplicity

Balanced budget

$$g_i = \tau^l_{i,t}(1-\alpha)y_{i,t} + \tau^k_i(\alpha y_{i,t} - \delta_{i,t}k_{i,t})$$

Government <u>commits</u> to such a policy ex-ante.

Asset structure

Two assets (no bonds for simplicity): $k^i_{j,t}$ holdings of capital in country $j = H, F$ by agents in country $i = H, F$

$$k^i_{i,t} + k^j_{i,t} = k_{i,t}$$

Gross return to capital $R_{i,t}$ net of taxes in country i are defined as follows:

$$R_{i,t} = 1 + (1 - \tau^k_i)(r_{i,t} - \delta_{i,t})$$

Transaction costs and portfolio adjustment costs

'Iceberg' transaction costs τ when repatriating capital incomes from country $j \neq i$.

Gross return to capital $R^i_{j,t}$ per unit of capital held in country $j \neq i$ for household i

$$R^j_{i,t} = 1 + (1-\tau)\,(1-\tau^k_i)(r_{i,t} - \delta_{i,t})$$

Portfolio rebalancing costs proportional to the average world capital.

Let α_t denote the share of wealth invested in country H's capital, then each period the investor must pay transaction costs given by:

$$TC_t = |\alpha_t - \alpha_{t-1}| * \widetilde{\tau} * (\overline{K}^H + \overline{K}^F)/2$$

Households

Maximizes liftetime utility in $\{c_{i,t}; k^i_{i,t}; k^i_{j,t}\}_{t\geq 0}$

$$U_{i,0} = E_0 \sum_{t=0}^{\infty} \beta^t \frac{c_{i,t}^{1-\sigma}}{1-\sigma}$$

s.t

$$c_{i,t} + k^i_{i,t+1} + k^i_{j,t+1} + TC_t = (1-\tau^l_{i,t}) w_{i,t} l_{i,t} + R_{i,t} k^i_{i,t} + R^i_{j,t} k^i_{j,t}, \quad j \neq i,$$

Gives portfolio decisions at any given date as a function of tax policies.

Equilibrium fiscal policy

Nash equilibrium

(i) Solves for $\left\{T_{i,t}\right\}_{t\geq 0} = \left[\tau^{l}_{i,t}, \tau^{k}_{i}\right]_{t\geq 0}$ given $\left\{T_{j,t}\right\}_{t\geq 0}$ that maximizes household i utility $U_{i,0}$, given optimal decisions of households, market clearing conditions and government budget constraint

$\Rightarrow$ Gives best response function of each government

(ii) Solves for the Nash-Game between governments

Solution method

1) For every combination of τ_i^k and τ_j^k, guess laws of motion for K_{t+1}^H, K_{t+1}^F as a function of the aggregate states: $\{K_t^H,\, K_t^F,\, \delta_{H,t},\, \delta_{F,t}\}$

Labor taxes redundant due to government balanced budget

3) Solve each individual agent's optimization problem given those law of motions, using value function iteration.

4) Simulate the economy for 10000 periods (plus 1000 burn in), clearing markets and computing the labor tax rates that balance the budgets of each government in every period.

5) Use the equilibrium series for the capital stocks to update the laws of motion in (1) and repeat the process until convergence.

Calibration

Preference parameters: $\sigma = 5$, $\beta = 0.97$

Technology: $\alpha = 0.34$, $\overline{\delta} = 0.08$, $s = 0.05$, $\rho = 0.5$

Transaction costs: $\tau = 0.1$, $\widetilde{\tau} = 0.05$

(Very) preliminary results

- Best responses imply a strictly positive capital tax rate $\left(\tau^k\right)^*$ (equal across countries due to symmetry)

- Very sparse grid for capital tax rates so far but we get $10\% < \left(\tau^k\right)^* < 20\%$.

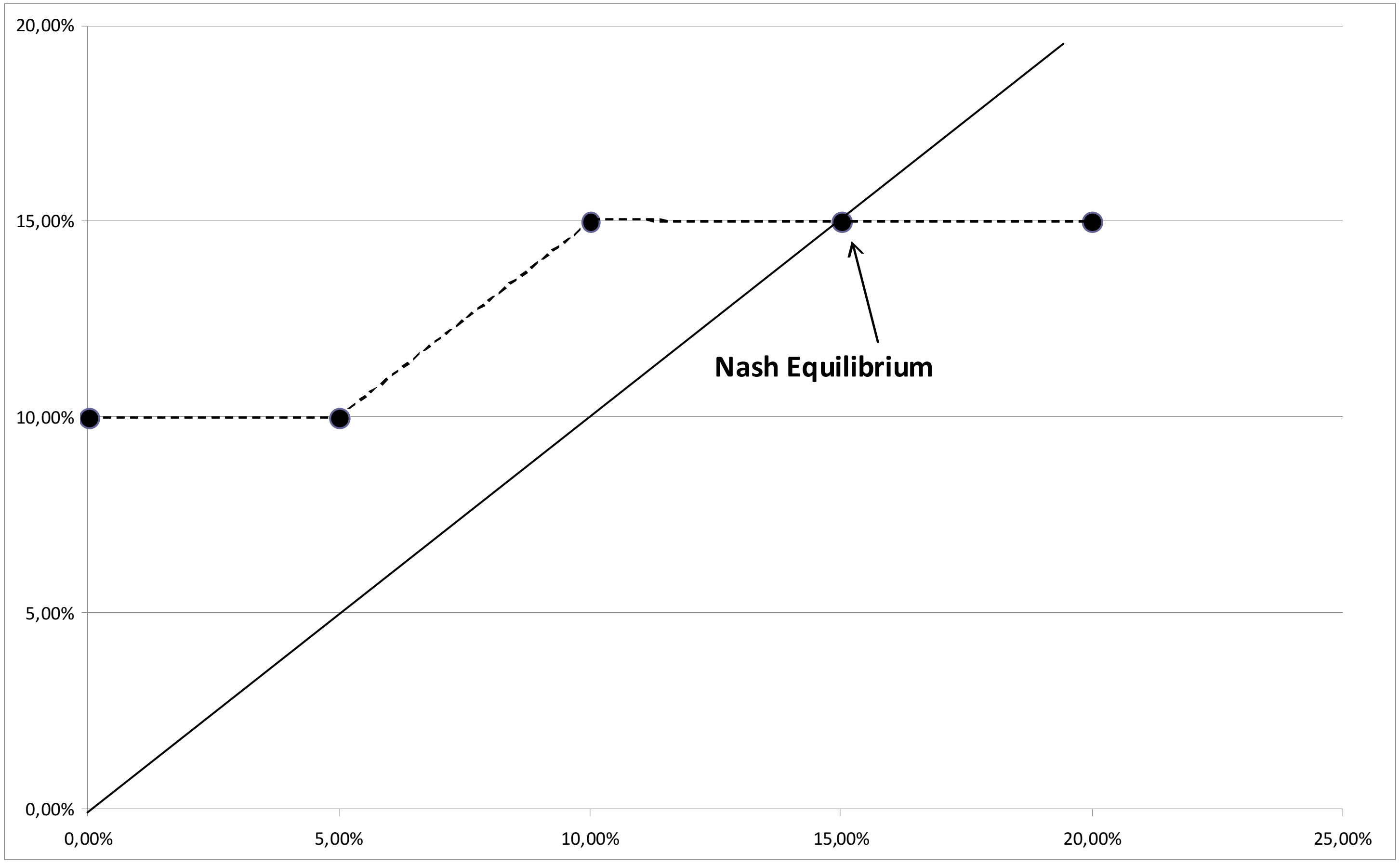

Figure 3: Best-response of country j to capital taxes set in $i \neq j$. Sparse grid $\{0; 5\%; 10\%...; 25\%\}$

Conclusion

We solve for optimal capital taxation in a world with capital mobility where assets are imperfect substitutes. Find positive tax rates in the long-run if governments do not coordinate. This holds despite optimality (under coordination) requires zero capital taxes. Challenges the consensus view that capital mobility should trigger a fall in capital taxes.

Extensions

- Heterogeneous countries (size, asset quality, level of spending). Could guide empirical work.

- Residence-based capital taxation.