International tax competition with rising intangible capital and financial globalization

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Rising share of intangible capital

Share of intangible capital

- Measure I (Compustat including R&D)
- Measure II (Compustat including R&D and SG&A)
Rising ‘de-facto’ globalization: Cross-Country Foreign Direct Investment & Portfolio Equity Investment

Stock of FDI (% of GDP)

Stock of FDI (% Equity)

Stock of PEI (% of GDP)

Stock of PEI (% of Equity)
Questions

- What is the impact of the two trends on cross-country tax competition?

- What can we say about welfare?
How we address the questions

- Two-country model with capital mobility.

- Governments fund ‘exogenous’ spending with two types of taxes:
  - Profit taxes (*source principle*).
  - Income taxes (*residence principle*).

- Governments choose Taxes optimally every period without commitment (*time consistent policy*) and without coordination (*non-cooperative policy choice i.e. tax competition*).
Findings

• Rising intangible capital leads to lower capital income tax rates (via lower taxation of profits) and very small increase in income tax rates.

• Rising ‘de-facto’ globalization leads to higher capital tax rates (via higher taxation of profits).

• The combined changes over the last three decades caused
  
  • A net decline in profit tax rates of 20% (30% to 24%).

  • A welfare gain of 0.55% (Obviously starting from the same initial conditions).
What is special about intangible capital?

- Non-rivalry:
  - The same capital can be used in multiple locations (countries).

- Arbitrary geographical allocation of the cost of capital:
  - Multinationals have some ability to shift profits in countries with lower taxes.

**Implication**

- Higher prevalence of intangible capital increases tax competition
What is special about ‘de-facto’ globalization?

- Internationalization of profits:
  - Some of the profits earned in a country belong to foreigners.

- Taxation of profits earned by foreigners:
  - Source taxes allow governments to tax profits earned by foreigners in their country.

**Implication**

- Higher ‘de-facto’ globalization increases the incentive to tax profits.
MODEL
Model features

- There are two symmetric countries: ‘Home’ and ‘Foreign’

- In each country there is
  - Continuum of representative households;
  - Continuum of multinational firms headquartered there;
  - A government that taxes profits (source) and income (residence).
Households

- Standard Preferences
  \[
  \sum_{t=0}^{\infty} \beta^t \frac{c_{t}^{1-\sigma}}{1 - \sigma}.
  \]

- Supply one unit of labor inelastically.

- Hold a share \( \theta \) of domestic multinationals and a share \( 1 - \theta \) of foreign multinationals.

- Lend or borrow internationally with a one-period bond.
Multinational firms

- Produce intermediate inputs domestically and abroad

\[ m_t = z \left( x_t^\alpha k_t^{1-\alpha} \right)^\nu \ell_t^{1-\nu} \]
\[ \hat{m}_t = \hat{z} \left( x_t^\alpha \hat{k}_t^{1-\alpha} \right)^\nu \hat{\ell}_t^{1-\nu} \]

\( z, \hat{z} = \) Productivity at home and abroad (today \( z = \hat{z} \))

\( x = \) Intangible capital

\( k, \hat{k} = \) Tangible capital at home and abroad

\( \ell, \hat{\ell} = \) Labor at home and abroad

- Capital (intangible and tangible) depreciates at rate \( \delta \).
Final production and intermediate prices

- Final production with inputs produced by home and foreign multinationals

\[ y_t = m_t^\lambda (\hat{m}_t^*)^{1-\lambda} \]

- Intermediate prices are marginal productivities in final sector

\[
\begin{align*}
q_t &= \frac{\partial [m_t^\lambda (\hat{m}_t^*)^{1-\lambda}]}{\partial m_t}, \\
\hat{q}_t^* &= \frac{\partial [m_t^\lambda (\hat{m}_t^*)^{1-\lambda}]}{\partial \hat{m}_t^*}
\end{align*}
\]
Cross-country allocation of costs

- Recall that Intangible capital depreciates at rate $\delta$.

- However, multinationals have discretion in choosing country-specific depreciation—$\zeta_t$ at home and $\hat{\zeta}_t$ abroad—provided that

$$\zeta_t + \hat{\zeta}_t = \delta$$

- There is a cost though

$$\chi \cdot \left( \zeta_t - \lambda \delta \right)^2 \cdot x_t$$

$$\chi \cdot \left( \hat{\zeta}_t - (1 - \lambda) \delta \right)^2 \cdot x_t$$
Profits of Home Firms

\[
\pi_t = q_t F(x_t, k_t, l_t) - w_t l_t - \delta k_t - \zeta_t x_t - \chi \cdot \left( \zeta_t - \lambda \delta \right)^2 x_t \\
\hat{\pi}_t = \hat{q}_t \hat{F}(x_t, \hat{k}_t, \hat{l}_t) - w^*_t \hat{l}_t - \delta \hat{k}_t - (\delta - \zeta_t) x_t - \chi \cdot \left( \lambda \delta - \zeta_t \right)^2 x_t
\]
Government

- Fund exogenous spending $G + T$ with
  - Profit taxes at source, $\tau_t$
  - Income taxes based on residency, $\phi_t$

- Budget constraint

$$G_t + T_t = \tau_t (\pi_t + \hat{\pi}_t^*) + \phi_t \left[ \theta(1 - \tau_t)\pi_t + \theta(1 - \tau_t^*)\hat{\pi}_t + (1 - \theta)(1 - \tau_t)\hat{\pi}_t^* + (1 - \theta)(1 - \tau_t^*)\pi_t^* + w_t \right]$$
Write the Problem Recursively

- Aggregate State is

\[ s = \{X, K, \hat{K}, X^*, K^*, \hat{K}^*, B\} \]

- Individual States.
  - Home Firms
    \[ \{s, x, k, \hat{k}\} \]
  - Foreign Firms
    \[ \{s, x^*, k^*, \hat{k}^*\} \]
  - Home Households
    \[ \{s, b\} \]
  - Foreign Households
    \[ \{s, b^*\} \]
Home Firm Problem Given Policy $\Psi$: I Static Part

$$\max_{\zeta, \mathring{\zeta}, \ell, \mathring{\ell}} \left\{ (1 - \tau)\pi + (1 - \tau^*)\mathring{\pi} \right\},$$

s.t. $\zeta + \mathring{\zeta} = \delta.$

With FOC

$$\left[ 1 + \varphi_\zeta(\zeta) \right] (1 - \tau) = \left[ 1 + \mathring{\varphi}_\zeta(\mathring{\zeta}) \right] (1 - \tau^*),$$

$$q \ F_\ell(k, x, \ell) = w,$$

$$\mathring{q} \ \mathring{F}_\ell(k, x, \mathring{\ell}) = w^*,$$
Home Firm Problem Given Policy $\Psi$: II Dynamics

- Solves

$$V(s, x, k, \hat{k}; \Psi) = \max_{n, i, \hat{i}} \left\{ d + \hat{R}^{-1}(s) V(s'; x', k', \hat{k}'; \Psi) \right\}$$

s.t.

$$d = (1 - \bar{\phi}) \left[(1 - \tau)\pi + (1 - \hat{\tau})\hat{\pi}\right] - n - i - \hat{i},$$

$$x' = x + n, \quad k' = k + i, \quad \hat{k}' = \hat{k} + \hat{i},$$

$$(\tau, \tau^*, \phi, \phi^*) = \Psi(s), \quad s' = \gamma(s; \Psi) \quad \text{Equil object}$$

$$\bar{\phi} = \theta\phi + (1 - \theta)\phi^*, \quad d \text{ (Firms pay income taxes of its shareholders)}.$$

- FOC

$$R^{-1}(s) \left[1 + (1 - \bar{\phi}')(1 - \tau') \frac{\partial \pi'}{\partial x'} + (1 - \tau^*)' \frac{\partial \hat{\pi}'}{\partial x'} - \varphi(\zeta')\right] = 1,$$

$$R^{-1}(s) \left[1 + (1 - \bar{\phi}')(1 - \tau') \frac{\partial \pi'}{\partial k'}\right] = 1,$$

$$R^{-1}(s) \left[1 + (1 - \bar{\phi}')(1 - \tau^*)' \frac{\partial \hat{\pi}'}{\partial k'}\right] = 1.$$
Household Problem Given Policy $\Psi$

- Solves

$$\Omega(s, b; \Psi) = \max_{c, b'} \left\{ u(c) + \beta \Omega(s', b'; \Psi) \right\}$$

s.t.

$$c = (1 - \phi)w + \theta d + (1 - \theta)d^* + T + b - pb',$$

$$\phi = \Psi_\phi(s),$$

$$s' = \Upsilon(s; \Psi).$$

- FOC

$$u_c(c) p = \beta u_c(c'),$$

- This FOC Yields the discount factor for firm $R^{-1}(s)$
Equilibrium given $\Psi$

- It is just that decision rules of agents satisfy

- Representative Agent Conditions

- Consistency with $s' = \gamma(s; \Psi)$
Also Have to Consider deviations from $\Psi$

- Governments have to consider alternative taxation so
- A home firm would solve

$$
\tilde{V}(s, x, k, \hat{k}, \tau, \tau^*; \Psi) = \max_{\zeta, l, \ell, n, i, \hat{i}} \left\{ d + pV(s', x', k', \hat{k}'; \Psi) \right\} \text{s.t.}
$$

$$
d = (1 - \bar{\phi})(1 - \tau)\pi + (1 - \tau^*)\hat{\pi} - n - i - \hat{i},
$$

$$
x' = x + n,
$$

$$
k' = k + i,
$$

$$
\hat{k}' = \hat{k} + \hat{i},
$$

$$
(\phi, \phi^*) = \bar{B}(s; \tau, \tau^*)
$$

$$
\bar{\phi} = \theta \phi + (1 - \theta)\phi^*
$$

$$
s' = \bar{\gamma}(s, \tau, \tau^*; \Psi).
$$

- Same for other agents
Government objective and time-consistent policy

- Maximize welfare of residents by choosing \( \{\tau, \phi\} \), taking as given
  - \( \{\tau^*, \phi^*\} = \) Tax rate chosen by the other country
  - \( \Psi(s) = \) Policy rule determining future taxes
  - Equilibrium response from optimal decisions of households and firms

\[
\max_{\tau} \tilde{\Omega}(s, \tau, \tau^*; \psi)
\]

- A **Nash one-step equilibrium** is a policy function

\[
(\tau, \tau^*) = \psi(s; \Psi)
\]

that satisfies

\[
\tau = h(s, \tau^*; \Psi), \quad \text{and} \quad \tau^* = h^*(s, \tau; \Psi).
\]

- A **Time-consistent policy rule** satisfies

\[
\Psi(s) = \psi(s; \Psi).
\]
QUANTITATIVE ANALYSIS
Steps in the quantitative exercise

The goal is to quantify the impact of changes in intangible capital and ‘de-facto’ globalization during the last three decades. So

- We calibrate the model to early 1990s.

- We then changes the parameters $\alpha$, $\lambda$, $\theta$ so that the model replicates the share of intangible capital and globalization in 2020,

- We also Change TFP to ensure that same output is implied

- We quantify the macroeconomic and welfare implications.
## Calibration

### Steady state values

<table>
<thead>
<tr>
<th></th>
<th>Targets 1990</th>
<th>Implications 2020</th>
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</thead>
<tbody>
<tr>
<td>Profit tax rate</td>
<td>0.30</td>
<td>0.24</td>
</tr>
<tr>
<td>Income tax rate</td>
<td>0.35</td>
<td>0.35</td>
</tr>
<tr>
<td>Share Intangible Capital</td>
<td>0.30</td>
<td>0.70</td>
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<tr>
<td>Stock of FDI</td>
<td>0.15</td>
<td>0.50</td>
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<tr>
<td>Share of PEI</td>
<td>0.05</td>
<td>1.03</td>
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<tr>
<td>Public purchases-output ratio</td>
<td>0.20</td>
<td>0.19</td>
</tr>
<tr>
<td>Public transfers-output ratio</td>
<td>0.15</td>
<td>0.14</td>
</tr>
<tr>
<td>Stock of capital</td>
<td>2.29</td>
<td>2.49</td>
</tr>
<tr>
<td>Output</td>
<td>1.00</td>
<td>1.03</td>
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</tbody>
</table>

### Parameter values.

<table>
<thead>
<tr>
<th></th>
<th>1990</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount factor</td>
<td>$\beta$</td>
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<tr>
<td>Utility curvature</td>
<td>$\sigma$</td>
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<tr>
<td>Productivity</td>
<td>$\bar{z}$</td>
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<tr>
<td>Capital income share</td>
<td>$\nu$</td>
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<tr>
<td>Share intangible capital</td>
<td>$\alpha$</td>
<td>0.30</td>
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<tr>
<td>Share domestic production inputs</td>
<td>$\lambda$</td>
<td>0.93</td>
</tr>
<tr>
<td>Share domestic ownership of multinationals</td>
<td>$\theta$</td>
<td>0.98</td>
</tr>
<tr>
<td>Cost of tax shifting</td>
<td>$\chi$</td>
<td>0.81</td>
</tr>
<tr>
<td>Government purchases</td>
<td>$G$</td>
<td>0.20</td>
</tr>
<tr>
<td>Government transfers</td>
<td>$T$</td>
<td>0.15</td>
</tr>
</tbody>
</table>
Summary

- A net decline in profit tax rates of 20% (30% to 24%).

- Income Tax Rates barely Change (.346 to .349)
Sensitivities

(a) Tax sensitivity to intangible capital

Rate vs. Share of intangible capital

Profit tax rate vs. Income tax rate

(b) Macro sensitivity to intangible capital

Level vs. Share of intangible capital

Total capital vs. Output

(c) Tax sensitivity to foreign investment

Rate vs. FDI as fraction of output

Profit tax rate vs. Income tax rate

(d) Macro sensitivity to foreign investment

Level vs. FDI as fraction of output

Total capital vs. Output

(e) Tax sensitivity to foreign ownership

Rate vs. PEI as fraction of output

Profit tax rate vs. Income tax rate

(f) Macro sensitivity to foreign ownership

Level vs. PEI as fraction of output

Total capital vs. Output
What About Welfare?

- Steady State Comparisons say **nothing** about welfare.

- Need to Compute Transition

  - Starting from the initial steady state

  - An MIT permanent Shock that Changes the three parameters (increasing intangible capital, globalization in terms of shares of goods and foreign ownership).

  - Compute the utilities of both and find proportional increase in Steady States that equate them.

  - Still, it is a conservative (in the sense of right wing) statement that ignores inequaility.
Welfare implications

- Indifference between transition with 2020 new parameters and 1990 steady state where consumption is raised by $g$:

\[(1 + g)^{1 - \sigma} \Omega \left( s_0; \alpha_{90}, \lambda_{90}, \theta_{90} \right) = \Omega \left( s_0; \alpha_{20}, \lambda_{20}, \theta_{20} \right).\]

- Welfare gain is 0.55% ($g = 0.0055$).
Extension to a bit of Heterogeneity

- Two types (one hand to mouth). Predictable findings: Poor gain but not a lot relative to loses of rich.

- Political Bias in favor of the poor (more of the same)

- Some Myopia: Even worse disaster

- The answers are all charged as taxing profits is a huge disincentive to capital accumulation and no role of public expenditures.
CONCLUSION

- The growing importance of intangible capital and financial globalization alter tax competition in different directions.

- We find that the growth of intangible has dominated financial globalization with consequent reduction in capital taxes.

- The welfare consequences are positive (because of the Rep Agent Assumption) because the lower taxation of capital increases investment.
HETEROGENEITY
Extended model

- Two types of households

- Type I: Same as before, $\mu$.

- Type II: Hand-to-mouth households with labor income only, $1 - \mu$.

- $1 - \mu$ is an index of inequality.
Inequality and taxes

\[
\max_{\tau} \left\{ \mu \tilde{\Omega}(s, \tau, \tau^*; \Psi) + (1 - \mu) \tilde{U}(s, \tau, \tau^*; \Psi) \right\}
\]
**Political bias**

\[
\max_{\tau} \left\{ \rho \cdot \mu \cdot \tilde{\Omega}(s, \tau, \tau^*; \psi) + (2 - \rho) \cdot (1 - \mu) \cdot \tilde{U}(s, \tau, \tau^*; \psi) \right\}
\]

\[\rho = 0.5\]
Political myopia

\[
\max_{\tau} \left\{ \mu \cdot \left[ u\left( \tilde{c}(s, \tau, \tau^*; \Psi) \right) + \gamma \beta \Omega(s; \Psi) \right] + (1 - \mu) \cdot \left[ u\left( \tilde{c}^{hm}(s, \tau, \tau^*; \Psi) \right) + \gamma \beta U(s; \Psi) \right] \right\},
\]

\[\gamma = 0.5\]