Competition for FDI and benefits from tax discrimination

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“Sandoz seeks more tax-friendly location”
(Financial Times, April 14, 2005)

“Sandoz [...] is trying to exploit latent tax competition between Germany, Austria and Switzerland in what could be one of the highest-profile company relocations this year.”

• generics subsidiary of Switzerland’s drugs maker Novartis

• currently located in Vienna, but it is considering a move elsewhere and it has asked the above countries to state what they could offer in terms of taxes and other benefits

• according to its chief executive, the key factors will be financial and tax considerations as well as closeness to existing operations and to customers, in addition to access to the best people

• Sandoz eventually moved to the Munich area (FT, Apr 27, 2005)
“South Korea sees fall in planned FDI”
(Financial Times, January 6, 2006)

Foreign direct investment plans reported to the South Korean government fell 9.6 per cent last year [...] The fall in FDI plans was expected as a tax reduction period for foreign investors had been cut to seven years from 10 years from the beginning of 2005. The [Commerce] ministry said: “It will be difficult for the FDI to increase significantly because of high global oil prices, rising interest rates, the unstable foreign exchange rate and competition with a neighbouring country.”
Aim of the paper

Analyze policy competition between countries to attract FDI

where

- Countries offer different before-tax profitability of the investment and have different statutory tax rates
- firms differ in the relative before-tax profitability of the alternative locations

The subject of investigation is the non-discrimination principle:

We explore:

- its objectives
- its effectiveness
- its effect on the efficient allocation of resources
Rationale of the non-discrimination principle

- no equity motivation supporting the non-discrimination principle for firms
- an efficiency motivation: prevent the distortion of allocation of capital in the economy.
- but it does not work internationally
- the main argument: preventing a race to the bottom in tax revenues by linking the tax rate on mobile base to the less mobile base
- In fact it is recommended by both the European Union and the OECD to counter “harmful” tax competition between governments seeking to attract FDI
  \[\Rightarrow\] State Aid Control in the EU
- However, there is evidence of increasing tax competition in OECD countries (Devereux, Lockwood and Redoano, 2008)
Our model in a nutshell

- Two countries within the same region that differ in both before-tax profitability for the firm and tax rates;
- A continuum of firms, characterized by different profit levels in each of the two countries, choose where to invest in order to provide some final good to the whole region;
Our model in a nutshell

- Two countries within the same region that differ in both before-tax profitability for the firm and tax rates;
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- Two different tax competition frameworks:
  - competition on non-discriminatory tax rates
  - competition with firm-specific tax rates
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- Two different tax competition frameworks:
  - competition on non-discriminatory tax rates
  - competition with firm-specific tax rates
- The tax competition game: Two-stage game with perfect information:
  1. The two governments simultaneously and independently define the tax rates that each foreign investor has to pay
  2. The foreign multinationals choose the location and realize profits
- Leviathan government: maximizes tax revenue
Main results

- Tax discrimination improves the efficiency of the location choice of the MNE (distorted by differences in statutory tax rates)

- **in a one-shot interaction** tax discrimination does not necessarily lower tax revenues for the countries;

- **in a repeated setting** tax discrimination makes easier to sustain cooperative agreements on tax rates and avoid *wasteful competition* between countries on statutory tax rates.
Policy implications

- Competition for FDI with tax discrimination wipes out the distortions created by differences in statutory tax rates (restores efficient location choices)
  - by efficiency we mean social surplus maximization
- In a one-shot game tax revenues are not necessarily lower with discrimination
- In the repeated game, tax discrimination is a powerful tool to foster coordination on high statutory tax rates
  - so you may never see tax discrimination in equilibrium, but its availability may foster coordination on high statutory tax rates
Related literature

- one of the first contribution on tax competition between asymmetric countries is Kanbur and Keen (1993)
- Kanbur and Keen, 1993; Huizinga and Nielsen, 2000) focused on minimum tax rates as a way of reducing harmful tax competition
- A literature more related with our contribution discusses restriction on “Targeted tax competition” (Janeba and Peters, 1999; Keen, 2001; Janeba and Smart, 2003, Bucovetsky and Haufler, 2006)
  - Models with internationally mobile and immobile tax bases.
  - Depending on the elasticities of the tax bases, their conclusions show non-discrimination may or may not be beneficial in terms of tax revenues
- Haupt and Peters (2005), introducing investors home bias, find that restrictions on differentiation increase tax revenues
- Finally Haufler and Wooton (2006) highlight how optimal coordination may lead to a decrease rather an increase of tax
The Model

- Two countries, $A$ and $B$;
- all firms are mobile;
- A mass 1 of firms that can profitably invest in one country only;
- each firm is characterized by before-tax profits $\Pi^A_i$ and $\Pi^B_i$ obtained when firm $i$ invests in country $A$ or country $B$;
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- **Assumption 1**: $0 < \Pi_i^A \leq \Pi_i^B = 1 \; \forall i$
  
  *this means that the efficient allocation is the one in which all firms locate in country B*
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- **Assumption 2:** $\Pi^A_i \sim F(.)$ on $[0, 1]$
- **Assumption 3:** governments maximize tax revenue
Full specification of the game

This is a two stage game of complete information

- Players: the two governments, and a mass 1 of firms
- Payoff: tax revenues for the governments and net profits for the firms
- Strategies: (uniform or individual) tax rates for the governments, and location choice for firms
- Timing: as specified below
- Solution concept: Subgame-perfect equilibrium
Timing

$t = 1$ the governments of the two countries simultaneously and irreversibly choose the statutory tax rate;

$t = 2$ the previous choices are revealed to all players and

a) one firm is randomly drawn from the distribution

i) if discrimination is allowed, the two governments simultaneously and irreversibly offer an individual tax rate

ii) the firm chooses where to locate

b) Another firm is drawn and the previous sequence of choices is repeated

...

$t = 3$ profits are realized and taxes are collected
Equilibrium with no discrimination

**Stage 2** Any firm $i$ invests in country $A$ if and only if

$$
(1 - t^A) \Pi_i^A > (1 - t^B) \Pi_i^B
$$

that is, by finding the indifferent type $\Pi_i^{A*} = \frac{1-t^B}{1-t^A}$

- any firm $i$ s.t. $\Pi_i^A \in (\Pi_i^{A*}, 1]$ will choose to locate in country $A$
- any firm $i$ s.t. $\Pi_i^A \in [0, \Pi_i^{A*}]$ will choose to locate in country $B$
Equilibrium with no discrimination

Stage 1 the two governments choose the tax-revenue maximizing rate

- country B optimization problem:

\[ \max_{t^B} TR_B = F \left( \Pi_i^{A*} \right) \times t^B \times 1 \]

- country A optimization problem:

\[ \max_{t^A} TR_A = \int_{\Pi_i^{A*}}^1 t^B z dF(z) \]
Assume uniform distribution $\implies F(z) = z$

- country B optimization problem becomes:

$$\max_{t^B} TR_B = \Pi_i^{A^*} \times t^B = \frac{(1 - t^B) t^B}{1 - t^A}$$

and the solution is: $t^B^* = \frac{1}{2}$ that is independent of $t^A$. 
Equilibrium with no discrimination

Assume uniform distribution $\Rightarrow F(z) = z$

- country A optimization problem becomes:

\[
\max_{t^A} TR_A = \int_{\frac{1-t^B}{1-t^A}}^{1} t^B z \, dz = t^A \left( \frac{1}{2} - \frac{(1 - t^B)^2}{2(1 - t^A)^2} \right)
\]

The reaction function is implicitly identified by the following FOC:

\[
\frac{1}{2} - \frac{(1 - t^B)^2}{2(1 - t^A)^2} - \frac{t^A(1 - t^B)^2}{(1 - t^A)^3} = 0
\]
The equilibrium tax rates are

\[ t^{A*} = 0.3106, \quad t^{B*} = 0.5 \]

The indifferent type

\[ \Pi_{i}^{A*} = 0.72527 \]

The tax revenues are:

\[ TR^{*}_A = 0.07361, \quad TR^{*}_B = 0.362635 \]
Equilibrium with tax discrimination

Stage 2 Any firm $i$ invests in country $A$ if and only if

$$(1 - \tau^A_i) \Pi^A_i > (1 - \tau^B_i) \Pi^B_i$$

where $\tau^k_i$ is the individual tax rate for firm $i$ set by country $k = A, B$

Stage 1 the two governments choose the individual tax rate for each firm $i$

- it is a first price auction with complete information
- country $B$ always wins and the eq. tax rates are:
  $$\tau^A_i = 0, \tau^B_i = 1 - \Pi^A_i$$

- With uniform distribution, the equilibrium tax revenues are

$$TR_A = 0; \ TR_B = \int_0^1 (1 - \Pi^A_i) d\Pi^A_i = \frac{1}{2}$$
Comparative statics for the one-shot game

**Proposition 1**

- Tax discrimination restores the efficient allocation of resources, which may be distorted by differences in statutory tax rates.
- With uniform distribution of firms in terms of relative profitability, tax discrimination increases tax revenues for the region as a whole.
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- With uniform distribution of firms in terms of relative profitability, tax discrimination increases tax revenues for the region as a whole.

Extending the results to other distributions:

- With other distributions, the second point of Proposition 1 may not hold true. Discrimination may reduce tax revenue. We have assumed full mobility of the firms. However,

- One can interpret the differences in profitability as a proxy of imperfect mobility (you can move to another country but at a cost...)
Comparative statics for the one-shot game

it is easy to show that by reducing the difference in profitability (improving mobility with the previous interpretation) tax revenues decrease in both discrimination and non-discrimination case.

**A numerical example**

- set the lower bound of the distribution 0.5
- all firms will have positive profits of locating in A
- the ND equilibrium tax rates are $t^B = 0.29$, $t^A = 0.16$
- The ND tax revenues are: $TR^*_A = 0.046$, $TR^*_B = 0.202$
- with discrimination country $B$ always wins all the firms
- tax revenues are just $TR_B = \frac{1}{4}$ (but higher than under ND)
Effects of tax discrimination in dynamic perspective

We have analyzed the effect of introducing discrimination in a one shot interaction.

We now consider the repeated interaction between governments and firms.

Assume:

- a mass 1 of firms that at every period have to choose where to (re-)locate between country $A$ and $B$
- in every period the game described earlier is played
- the game is repeated indefinitely
- we explore the possibility that countries may cooperate on setting their tax rate
- we analyze the effect of introducing tax discrimination on this possibility
Recall that the non-cooperative solution entails:

- the equilibrium tax rates are: \( t_B^* = \frac{1}{2}, \ t_A^* = 0.3106 \)
- the tax revenues are: \( TR^*_A = 0.07361, \ TR^*_B = 0.362635 \)

A cooperative agreement

The two governments maximize total tax revenues if all firms locate in country \( B \) and are taxed 100% with they can share the revenue in some (Pareto improving) way here we use the Nash bargaining solution; i.e., country \( B \) makes a side payment \( x \) to country \( A \) such that:

\[
(1 - x - TR^*_B)(x - TR^*_A) \]

is maximized.

The Nash bargaining solution is:

\( TR^*_A = x = 0.36 \); \( TR^*_B = (1 - x) = 0.64 \).
NON-DISCRIMINATION REGIME

Recall that the non-cooperative solution entails:
- the equilibrium tax rates are: $t^B = \frac{1}{2}$, $t^A = 0.3106$
- the tax revenues are: $TR^*_A = 0.07361$, $TR^*_B = 0.362635$

A cooperative agreement
- The two governments maximize total tax revenues if all firms locate in country $B$ and are taxed 100% with $TR_B = 1$
- they can share the revenue in some (Pareto improving) way
- here we use the Nash bargaining solution; i.e., country $B$ makes a side payment $x$ to country $A$ such that:

$$ (1 - x - TR^*_B) (x - TR^*_A) $$

is maximized.
- the Nash bargaining solution is:

$$ TR^C_A = x = 0.36; \quad TR^C_B = (1 - x) = 0.64 $$
The reduced form of the game with cooperation vs non-cooperation on statutory tax rate is the following:

<table>
<thead>
<tr>
<th></th>
<th>Country A</th>
<th></th>
<th>Country B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>coop</td>
<td>non-coop</td>
<td>coop</td>
</tr>
<tr>
<td>coop</td>
<td>0.36, 0.64</td>
<td>0, 1</td>
<td></td>
</tr>
<tr>
<td>non-coop</td>
<td>0.5, 0</td>
<td>0.07, 0.36</td>
<td></td>
</tr>
</tbody>
</table>

Cooperation can be sustained as an equilibrium in the repeated setting (when the game is played every year) if each government cares enough about future tax revenues and assume that both players play a grim trigger strategy. The discount factor ($\delta$) needed to support cooperation is a measure of the likelihood of cooperation. It can be shown that for Country $A$, $\delta_A > 0.33$ and $\delta_B > 0.56$ for Country $B$. 
DISCRIMINATION REGIME

If the governments can offer an individual tax rate at each firm, in the non-cooperative solution

- all firms choose country $B$ and the eq. tax rates are:
  \[
  \tau_i^A = 0, \quad \tau_i^B = 1 - \Pi_i^A
  \]

- the eq. tax revenues are
  \[
  TR_A^* = 0; \quad TR_B^* = \int_0^1 (1 - \Pi_i^A) d\Pi_i^A = \frac{1}{2}
  \]
If the governments can offer an individual tax rate at each firm, in the non-cooperative solution

- all firms choose country $B$ and the eq. tax rates are:
  \[ \tau^*_A = 0, \quad \tau^*_B = 1 - \Pi^A_i \]

- the eq. tax revenues are
  \[ TR^*_A = 0; \quad TR^*_B = \int_0^1 (1 - \Pi^A_i) d\Pi^A_i = \frac{1}{2} \]

the cooperative Nash bargaining solution

- all firms are taxed at 100% and choose to locate in $B$
- side payment to country $A$

\[ TR^C_A = x = 0.25; \quad TR^C_B = (1 - x) = 0.75 \]
The reduced form of the game with cooperation vs non-cooperation on tax rate is the following:

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<tbody>
<tr>
<td>coop</td>
<td>0.25, 0.75</td>
<td>0, 1</td>
</tr>
<tr>
<td>non-coop</td>
<td>(\epsilon, 0.5 - \epsilon)</td>
<td>0, 0.5</td>
</tr>
</tbody>
</table>

now any deviation from country A can be punished almost immediately by country B

As before, we analyze the possibility that cooperation is sustained as an equilibrium in a repeated setting (when the game is played every year)

assume that both players play a grim trigger strategy

the discount factors (\(\delta\)) needed to support cooperation are for Country A \(\delta_A > 0\) and \(\delta_B > 0.5\) for Country B
Proposition 2

Tax discrimination dramatically increases the chance of a cooperative agreement on (high) corporate tax rates in an indefinitely repeated interaction.
Comparative statics for the repeated game

**Proposition 2**

*Tax discrimination dramatically increases the chance of a cooperative agreement on (high) corporate tax rates in an indefinitely repeated interaction.*

Notice that:

- Tax discrimination would be a powerful instrument to punish deviation from a cooperative agreement
- It may well remain just a threat not occurring in equilibrium if cooperation is achieved
- this result is obtained assuming that in every period all firms may re-locate
Uncomfortable with 100% tax rate?

Suppose there is an (untaxed) outside option $\Pi$

- this will limit the tax rate especially with discrimination (the highest)
- this might affect the tax revenues with discrimination in the short run
- however the results in Proposition 2 are unaffected

A numerical example

- uniform distribution of $\Pi_i^A$ on $[0.5, 1]$
- (after-tax) outside option $\Pi = 0.3$
Uncomfortable with 100% tax rate?

Under non discrimination, the payoff matrix becomes

<table>
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<tbody>
<tr>
<td><strong>Country A</strong></td>
<td>coop</td>
<td>non-coop</td>
</tr>
<tr>
<td>coop</td>
<td>0.27, 0.43</td>
<td>0, 0.7</td>
</tr>
<tr>
<td>non-coop</td>
<td>0.32, 0.12</td>
<td>0.16, 0.29</td>
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the discount factors (\(\delta\)) needed to support cooperation are for Country A \(\delta_A > 0.31\) and \(\delta_B > 0.53\) for Country B

Under discrimination the payoff matrix becomes

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<td>coop</td>
<td>non-coop</td>
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<tr>
<td>coop</td>
<td>0.225, 0.475</td>
<td>0, 0.7</td>
</tr>
<tr>
<td>non-coop</td>
<td>(\epsilon, 0.25 - \epsilon)</td>
<td>0, 0.25</td>
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</tbody>
</table>

the discount factors (\(\delta\)) needed to support cooperation are for Country A \(\delta_A > 0\) and \(\delta_B > 0.5\) for Country B.
It is not necessary a side payment to sustain cooperation.

Consider the following treaty between country A and B:

- The corporate tax rate in the region is fixed at 70%.
- If the present agreement is violated, countries are allowed to implement tax discrimination.
- A corporate tax rate not below 63% in country A will not be considered a violation of the present treaty.

The payoff matrix becomes Under discrimination becomes

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the discount factors ($\delta$) needed to support cooperation are for Country A $\delta_A > 0$ and $\delta_B > 0.56$ for Country B.
Concluding remarks

We highlight two undesired effects of the non-discrimination principle:

- The non-discrimination principle may not be the most effective way of preventing a race to the bottom of tax rates since countries still compete on tax rates.
- The location choice of the firms is distorted by differences in uniform tax rates.

In our model, when tax discrimination is possible:

- Tax competition always induces an efficient location choice.
- In a one-shot game, tax competition may or may not induce a reduction in tax revenues.
- In a repeated setting, the possibility of tax discrimination is a very effective device to persuade recalcitrant governments to an agreement on (high) corporate tax rates.
- If a cooperative agreement is achieved, non-discrimination would...