Does tax competition make mobile firms more footloose?

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Abstract

We analyse the tax competition between two countries to attract FDI in a dynamic setting. While the existing literature analyses tax competition in a static setting, we develop a two period model in which countries compete for a firm in both periods. One country is initially bigger in size, whereas we assume the second country catches up in the second period. We derive conditions under which firms may become “more” footloose, in the sense that they choose to locate in the bigger country in the first period and then move their operations in the second.
1. Introduction

Do firms become more footloose as a result of fiscal competition? In 2007 the German public was outraged as Nokia announced the relocation of its production to Romania, two years after Germany had won the investment by offering subsidies. In this paper we investigate whether fiscal competition incentivises firms to become more footloose as suggested by the case of Nokia. We develop a model of repeated fiscal competition between potential host countries for a firm. From the model we derive that fiscal competition between the countries may lead to a firm relocating its production from the country it initially choose as its export platform, while this behaviour would not be optimal in the absence of fiscal competition.

We consider a world with evolving geographic advantage, for example because of increasing production costs or improved infrastructure. With the existence of set-up costs for a firm's operations - for instance building the facilities or research for the optima location - relocating production is more costly. Thus, if the evolving geographical advantage implies that the country will eventually attract the firm, one would intuitively suspect that the country with the geographic advantage in the medium-run would be able to outbid the other country in the first place and win the firm in a fiscal competition. Using the decision of the firm in the absence of fiscal competition as a benchmark, we argue that this logic only holds if the geographic dis-advantage of the evolving country is not too large.

The argument is framed in a model with two active governments, offering a lump-sum subsidy to attract the FDI by a single firm owned in the rest of the world. We consider two time periods, in which both governments can make a fiscal offer to the firm. The firm can move at the beginning of each period. We assume that one country is initially more attractive for the firm, whereas in the second period, the other country has a geographic advantage over the other country, which implies that the firm will locate there in the second period.

Once the firm has decided on a location, it has to pay a set-up cost. We extend the existing literature by assuming a second period in which both governments are active again, and the firm has the potential to relocate. As a benchmark we derive the
location decision of the firm if government are inactive. We show that, depending on the magnitude of the geographic advantage of the stagnant country, the firm might choose to relocate over time.

Considering conditions under which the firm will locate the growing country in the second period, we show that under fiscal competition, depending on the relative size difference of the two countries, the firm would locate in A in the first period, whereas under Laissez Fair the firm would locate the B in both periods. From this we can conclude that there exist conditions under which firms indeed become more footloose as a result of fiscal competition.

[Literature Review here]

2. A two-period model of fiscal competition for FDI

We consider a single firm, owned in the rest of the world. The firm wants serve a market, which we call the "host region", by locating a production facility in. We assume further that the host region has two countries, A and B, which are potential locations for the firm's FDI. For simplicity, we assume two time periods, P1 and P2. The size of country A remains constant over time and is normalised to 1. In contrast, country B grows over time: In P1, B's size is \( m > 0 \), and this grows to \( (1 + g)m \) in P2, where \( g \) is the growth rate.

Setting up a plant requires a one-off sunk capital cost of \( F \). Once a plant has been established, the capital does not depreciate over time.\(^1\) In addition, operating a plant requires a per-period fixed cost of \( C \). We assume that \( C \) is sufficiently large that the firm will only ever operate one plant even if it owns two.\(^2\)

In the first period the firm chooses its initial location. At the beginning of period two the firm can choose to move its plant to the other country or remain in the same

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\(^1\) This assumption is standard in the trade literature. We discuss the effect depreciation has on the outcome of the model at a later stage.

\(^2\) Ensuring one-plant production is the sole reason for including C in the model. Furthermore, we assume that C is sufficiently high to rule out two-plant production in P2, but small enough to make one-plant production profitable in P1.
In each period, the firm earns profits from both local and export sales, and households in the host countries enjoy consumer surplus. We adopt the following notation for the instantaneous or within-period levels of profits and consumer surplus:

- $\pi_L$ and $\pi_F$ are, respectively, the per-capita profits from local and foreign (exports) sales.
- $S_L$ and $S_F$ are, respectively, the per-capita levels of consumer surplus under local and foreign (imported) production. Thus, $V = S_L - S_F$ is the gain in consumer surplus per head from FDI.

We assume that there are trade costs between $A$ and $B$, which implies that $V > 0$ and $\pi_L - \pi_F > 0$. Although these differences between local production and export destination are not modelled explicitly, it can be rationalised as an outcome of a standard trade model. In particular the profit inequality states that selling in the local market is more profitable than the profits from exporting. The expression $(1-m)(\pi_L - \pi_F)$ gives us the geographic advantage. If the expression is positive, $A$ has a geographic advantage over $B$, because the profit in the larger market is higher.

As is conventional, we solve the model backwards to isolate its subgame perfect Nash equilibrium in pure strategies. In particular, our equilibrium concept implies that both firms and governments are forward-looking.

3. Laissez-faire

Under laissez-faire, the governments refrain from setting taxes in either period. Thus, the firm decides its location solely on the basis of profit comparisons. We develop the optimal-location conditions under laissez-faire first, which we use as our benchmark for the later analysis.

**Period 2** First, we assume that the firm chooses $A$ in P1. In P2, the firm relocates from $A$ to $B$ if and only if the profits from relocating the plant are larger than the profits from staying in $A$. Formally this yields

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3 This formulation for profits and consumer surplus is consistent with Haufler and Wooton, 1999.
\[(1 + g)m\pi_L + \pi_F - F - C > \pi_L + (1 + g)m\pi_F - C\]

\[(1 + g)m > 1 + \frac{F}{\pi_L - \pi_F} \quad (1)\]

Equation (1) implies that, for the firm to relocate, country B must be larger than country A in P2. Moreover, (1) is also sufficient to ensure that the firm will stay in B in P2 if it previously chose B in P1.\(^4\)

**Period 1** We assume that (1) holds, so that the firm chooses B in P2 regardless of its P1 choice. Therefore, the firm chooses A in P1 under laissez-faire if and only if

\[
\pi_L + m\pi_F - F - C + \delta[(1 + g)m\pi_L + \pi_F - F - C] \\
> m\pi_L + \pi_F - F - C + \delta[(1 + g)m\pi_L + \pi_F - C] \\
(1 - m)(\pi_L - \pi_F) > \delta F \\
m < 1 - \frac{\delta F}{\pi_L - \pi_F} \quad (2)
\]

where \(\delta < 1\) is the discount rate. The second line can be interpreted as follows. The firm locates in A in P1, and subsequently moves, if the additional profits from selling in the bigger country, A, and exporting to the smaller country in P1 exceed the discounted moving costs. In other words, the firm will relocate at the beginning of P2 if and only if the geographic advantage of A in P1 is large enough to compensate the firm for discounted relocation costs. Equation (3) provides us with the condition for which size of B the latter statement is true.

Furthermore, note in (2) that R.H.S. \(< 1\), so the firm might choose B in P1 even if B begins smaller than A. This is because the firm pays F only once (rather than twice) over its lifetime if chooses B in P1. Furthermore, note that in (2) only \(\delta F\) shows up. The reason is that the firm has to pay F in P1, regardless where it locates. Finally,

\(^4\)The condition for this is \((1 + g)m > 1 - F(\pi_L - \pi_F)\), and it is less demanding than (1) because no new capital investment is required in order to remain in B.
note that (2) is independent of $g$. Thus, both (1) and (2) can be satisfied simultaneously by choosing $m$ to satisfy (2) and $g$ to satisfy (1).

4. Fiscal competition for FDI

Under fiscal competition, the two governments set lump-sum taxes, denoted by $t$, in both periods. We assume that there is no commitment on the side of governments or firms across each time period. We start by analysing the behaviour of the firm, given the optimal policy of the countries. We then derive the optimal policies.

4.1. Period 2

First we assume that the firm has established a plant in $A$ during P1. In this case, $B$ will win the P2 contest if and only if its surplus from hosting the firm is larger. Formally this implies that

\[
(1 + g)mV + (1 + g)m\pi_L + \pi_F - F - C > V + \pi_L + (1 + g)m\pi_F - C
\]

\[(1 + g)m > 1 + \frac{F}{\Delta}. \quad (3)\]

where $\Delta = V + \pi_L - \pi_F > 0$. There are two things to note. First, B’s valuation is scaled by its growth. Second, the profits from locating in $B$ include the fixed costs $F$, whereas if the firm stays in $A$ it does not incur the fixed costs again. Thus, $B$ will only win production away from $A$ in P2 if its market size is sufficiently larger than $A$’s to compensate the firm for paying $F$ for relocating. In what follows, we will assume that (3) holds. As with (1), it will be convenient to think of (3) as a restriction on the growth of country $B$, $g$.

Condition (3) is sufficient to ensure that $B$ retains production in P2 if it previously won the P1 contest. The condition for this is $(1 + g)m > 1 - F/\Delta$. As under laissez-faire, it is easier for $B$ to retain production in P2 than to win production away from $A$ because retaining production implies no new capital spending by the firm. Thus, by invoking condition (3), we are assuming for the rest of the paper that country $B$ wins the P2
contest regardless of which country won the P1 contest.

4.2. The countries’ valuations in period 1

Country A  We first derive A’s valuation (or “reservation price”) in P1. If A wins the firm in P1, its net present value of social welfare is $S_L + \delta S_F$. Alternatively, if A loses the firm in P1, its net present value of social welfare is $S_F + \delta S_F$. Therefore, A’s valuation in P1 is simply the difference in welfare levels, $V = S_L - S_F$.

Country B  Country B’s P1 valuation is more complex to derive because, as we shall see, B’s social welfare in P2 depends on whether it wins or loses the firm in P1. If B wins the firm in P1, its net present value of social welfare is

$$mS_L + \delta[(1 + g)mS_L + t_{\text{retain}}] \quad (4)$$

where $t_{\text{retain}}$ is B’s winning tax offer in P2 to retain the firm. The fiscal offer is derived by solving the location decision of the firm,

$$\frac{(1 + g)m\pi_L + \pi_F - C - t_{\text{retain}}}{\text{Profits in B}} \geq \frac{\pi_L + (1 + g)m\pi_F - F - C + V}{\text{Profits in A}}.$$

The optimal fiscal offer is found at the point for which the firm is indifferent between the two locations. Therefore the optimal fiscal offer for retaining the firm is

$$t_{\text{retain}} = [(1 + g)m - 1](\pi_L - \pi_F) + F - V$$

The fiscal offer is simply the difference in net profits between the two location in P2 less the fiscal offer by country A. From the equation we can see that country B’s equilibrium tax increases in F because if the firm was to move it would have to pay the moving costs. This gives the country more leeway in taxing the firm. Furthermore, country B’s equilibrium tax in P2 increases with its geographic advantage but decreases with A’s valuation, because A offers a subsidy equal to V.

Alternatively, if B does not attract the firm in P1, its lifetime welfare is
\[ mS_F + \delta[(1 + g)mS_L + t_{\text{Capture}}] \]  \hspace{1cm} (5)

where \( t_{\text{Capture}} \) is \( B \)'s winning tax offer in P2 to capture the firm away from A. Country B will capture the firm in P2 if

\[
\frac{(1 + g)m\pi_L + \pi_F - F - C - t_{\text{Capture}}}{\text{Profits in } B} \geq \frac{\pi_L + (1 + g)m\pi_F - C + V}{\text{Profits in } A}
\]

Using the same logic as before we can derive the optimal fiscal offer to be

\[ t_{\text{Capture}} = [(1 + g)m - 1](\pi_L - \pi_F) - F - V. \]

Note that in the case of B capturing the firm, the optimal fiscal offer depends negatively on \( F \). Now, cards are stacked against B because it has to compensate the firm for the moving costs.

It is straightforward to show that \( t_{\text{Retain}} \) is strictly greater than \( t_{\text{Capture}} \):

\[ t_{\text{Retain}} - t_{\text{Capture}} = 2F \]  \hspace{1cm} (6)

Intuitively, country \( B \) is able to make a lower fiscal offer in P2 if it won the firm in P1. This is because, if B retains the firm, the firm does not have to invest in a new plant in order to produce in \( B \) in P2. Effectively, the firm receives some “compensation” from government \( B \) (in the form of a lower tax bill) if it relocates from A to B in P2.

Finally, subtracting (5) from (4) and using (6), we obtain country \( B \)'s valuation in P1:

\[ m(S_L - S_F) + \delta(t_{\text{Retain}} - t_{\text{Capture}}) = mV + 2\delta F \]

In country \( B \)'s P1 valuation, the first term represents the P1 gain in consumer surplus and the second represents the P2 gain in tax revenue.

4.3. The period 1 contest
We can now solve the P1 contest for FDI. The firm decides to locate in A in P1 if the discounted profits plus the fiscal offers it receives from A are larger than the respective amount the firm receives from locating in B. Therefore, in P1, country A wins the firm if and only if

$$\Pi_A + V > \Pi_B + mV + 2\delta F \quad (7)$$

where $\Pi_i$ is the present discounted value of profits if the firm chooses country $i$ in P1. The expressions for the present discounted values for the firm's location choice are:

$$\Pi_A = \pi_L + m\pi_F - F - C + \delta[(1 + g)m\pi_L + \pi_F - F - C - t_{CAPTURE}]$$

$$\Pi_B = m\pi_L + \pi_F - F - C + \delta[(1 + g)m\pi_L + \pi_F - C - t_{RETAIN}]$$

In the P1 contest, both the governments and the firm are forward-looking. Country B's valuation reflects the fact that the firm's P1 location choice will affect its own P2 tax revenue. Likewise, in P1, country A anticipates the fact that it will never host the firm in P2. In P1, the firm takes account not just of how P1 operating profits differ between A and B, but also of how its after-tax profits in P2 depend on its P1 location choice.

The difference in profit streams is

$$\Pi_B - \Pi_A = (m - 1)(\pi_L - \pi_F) + \delta F - \delta(t_{RETAIN} - t_{CAPTURE})$$

$$= (m - 1)(\pi_L - \pi_F) - \delta F$$

The second line reflects the fact that the firm must pay $F$ twice over its lifetime if it chooses A in P1.

We can now derive the location decision for the firm. From substituting for $\Pi_B - \Pi_A$ into (7) and solving the equation, we get that country A wins the firm in P1 if and only if
\[ m < 1 - \frac{\delta F}{\Delta}. \quad (8) \]

In (8), we have R.H.S. < 1. Therefore, for country A to win the firm in P1, we require that A be larger in P1 than B. This seems intuitive: If B is larger than A in P1, then it will be larger than A in both periods and B will therefore host the firm in both periods.

Moreover, increases in both country B’s relative size in P1 and discount factor make it more likely that B will win the P1 contest. The latter finding on $$\delta$$ might be connected to the fact that by investing in B initially, the firm saves a second investment of \( F \) in P2.

**Lemma:** The location decision of the firm is independent of the fiscal offers in P2.

*Proof:* ...

5. **Comparison between laissez-faire and fiscal competition**

By comparing (2) and (8), we derive our main result:

**Proposition:** Country A is more likely to win the firm in P1 under fiscal competition for FDI than under laissez-faire.

The proof of the proposition is illustrated in Figure 1. Under Laissez-Faire (LF) the location pattern is first country A and then country B, (A,B), to the left of the cut off derived from equation (2) and (B,B) otherwise. Under Fiscal Competition the cut off for the location pattern (A,B) is to the right of the cut off under Laissez-Faire. From
this we conclude that for certain sizes of country B in P1, the firm chooses (A,B) under fiscal competition, whereas it would choose (B,B) under Laissez-Faire.

[Equivalently, given our maintained assumption that B always wins in P2, we conclude that the firm is more likely to relocate (from A to B) in P2 under fiscal competition.]

The intuition for this result is as follows. While the firm relocates in period 2 it anticipates that country B's fiscal offers in P2. In particular the firm knows that even if country A captures the firm in P1, the firm will be compensated for the moving costs in P2. Furthermore, the valuation for the firm of country B depends on the fiscal offers in P2. Therefore, with fiscal competition in P1 the fiscal offers in the valuation of B and the location decision of the firm cancel each other out. Therefore, the location choice of the firm under fiscal competition in P1, compared to Laissez-faire, is independent of country A's growth and only depends additionally on the respective valuation of the two countries in P1. Because each country effectively offers a subsidy of the firm's location costs by bidding its valuation, the firm is more willing to locate in A in P1, and subsequently move, under fiscal competition. The cut off therefore depends on \( m \), the relative size of B, because country A has a relatively stronger valuation the smaller \( m \) is. Because of the positive valuation of country A, the firm is more likely to relocate between the two periods and thus fiscal competition makes firms more footloose.

**Extensions/Discussion** For the model we assumed that the capital costs \( F \) do not depreciate. The model's results would not be affected qualitatively by assuming a positive rate of depreciation. To see this imagine that \( F \) depreciates fully after a period. In this case the fiscal offers would be independent across time, because the firm would have to pay \( F \) in each period. This is effectively like C. Therefore, the stronger the depreciation rate of \( F \), the closer the solution would be to static game.

Furthermore, if we were to introduce depreciation into the model, the timing of the fiscal offer might matter. To see this argument assume for the sake of argument that

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5 This seems surprising. However, remember that the firms and both governments behave rational and with perfect foresight.
there are two countries, of which one is the host country and fiscally inactive. The second country might find it cheaper to wait for some time period to capture the firm, because waiting reduces the compensation the country has to pay to induce the firm to move.\footnote{Of course the second country might have an incentive to make an offer itself.}

For the model we assumed that the discount rates are identical for the two countries (and the firm). However, this might not be the case. For example, due to political pressure - high unemployment or elections - a country might be less patient. For example assume that B is less patient. This decreases B's P1 valuation for the firm, making it less likely for B to attract the firm in P1.

[Commitment governments]

[The time pattern of taxes]

6. Conclusion

\textit{[We could discuss commitment issues here. We have assumed that the host countries lack the power to commit in policy-setting. Such an assumption can be used to explain why initial subsidies are followed by taxation of established plants. However, what if the governments could commit?]}

7. References

Haufler and Wooton (1999)