

The Impact of International Tax-Competition for FDI on Environmental Policy

Barbara Stoschek*

Department of Economics, Christian Albrechts Universität zu Kiel
Olshausenstr. 40, 24098 Kiel, Germany

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Abstract

This paper uses a simple two-country model to analyze the effects of international tax-competition for FDI on the domestic environmental-policy levels in the competing countries. The question is, how the level of a welfare-maximizing emissions-tax rate changes if strategic profit-tax rates are adjusted downwards due to intensified FDI competition. Will this competition come at the expense of environmental degradation? In addition, the paper addresses the impact of market integration, represented by declining trade costs, on environmental-policy levels.

It turns out that an intensification of tax competition for FDI induces stricter environmental policy and is thus beneficial from an environmental point of view. The impact of market integration cannot be predicted in general but depends on the level of transport costs.

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*Tel.: +49-431-8803283; Fax: +49-431-8803150
Email: barbara.stoschek@econ-theory.uni-kiel.de

1 Introduction

The notion, that increasingly mobile capital and integrating markets (both often referred to as “globalization”) might lead to an intensification of international policy-competition between countries wishing to attract foreign investments, is widespread in the public debate as well as among economists. Following that line of argument, the concern to deter (foreign) investments induces governments to engage in downward competition with respect to environmental policy. This phenomenon is termed “Race to the Bottom” (RtB; see below).

This paper investigates whether the RtB-result is sustainable if it is considered that governments have more than one policy instrument at their disposal. Specifically, I analyze the interrelation between environmental- and tax policy in a framework where countries compete for international capital (i.e. FDI) by offering most favorable profit-tax conditions to a foreign investor: Which impact does international tax-competition for FDI have on the domestic level of environmental policy (and thus on environmental conditions) in the competing countries?¹

Since not only international capital- but also -goods markets become increasingly integrated, this paper addresses a second question: Building on the results with respect to the environmental-/tax policy interrelation, the impacts of international economic integration are investigated. Which effects do declining trade-costs have on the intensity of international competition for FDI and thus on environmental policy?

The issues to be analyzed in the current paper are of considerable practical relevance. On the one hand, there is plenty of recent anecdotal evidence for an intensification of international tax-competition. On the other hand, a public debate on environmental degradation, conjecturally caused by this increased competition and by market integration, goes on in many industrialized countries (and is supported by economic research). This debate, however, does not match with the actually observable policy-patterns in the competing countries, which indicate a RtT rather than a RtB in environmental policy.

A recent example for the intensity of FDI competition is Germany’s effort to lead the microchip-producer AMD to build a new plant at its established location in Dresden rather than in the State of New York in the US. Both regions were fiercely competing for the investment by offering considerable financial incentives. Finally, in the end of the year 2006, the US outbid the German government by providing an incentive of 650

¹Such model framework implicitly assumes that tax incentives are a decisive determinant for a MNE’s location choice. It has to be mentioned here, that this view is not uncontroversial: Some authors argue that other factors like e.g. economic fundamentals, political stability or market size etc. are more relevant (see e.g. Oman (2000); a review of empirical studies on the impact of taxes on capital location is provided by Devereux/Griffith (2002)). However, potential FDI host-countries, especially if located within the same region like assumed in this paper (as an example, one can mention the EU), become increasingly similar with respect to those factors. Hence, different tax-levels gain importance as a distinguishing factor in FDI competition (a similar argument is made by Bjorvatn/Eckel (2006)).

million US-dollars to AMD.

In 2007, however, AMD is planning to expand its existing production facilities once again. Like before, the firm faces the choice between its locations in the US and in Germany. In the light of this new chance to attract the investment to Germany, the EU-Commission has recently allowed the German government to offer financial incentives of 262 million Euros to AMD.

Another recent example is Germany's enterprise-tax reform ("Unternehmenssteuerreform") which was agreed upon in the middle of 2007 and will be implemented in 2008. Its main component is a reduction of corporate- and other tax rates on firms from an average of 38,7 percent to 29,8 percent. The explicit aim of this reform is to keep domestic firms from moving to low-tax countries abroad and to attract foreign investment.

The development of investment incentives, offered by different country groups, over time has been investigated e.g. by Oman (2000) and UNCTAD (1996). For the period between the 1980s and 1990s, they find evidence for an increasing use, both in range and in the number of countries, of financial and fiscal incentives. Most often, corporate-tax-rate reductions are applied.

The findings of Haufler (2001) support the results: In the EU, average corporate-tax rates decreased by more than 13 percentage points within the same period. Similar trends can be observed in non-EU countries.

With respect to the environmental aspect, recent anecdotal evidence for increasing- rather than declining policy levels is mainly provided by examples related to the issue of climate change. In the middle of 2007, the G8-countries on their yearly summit agreed to continue negotiating on a "post-Kyoto"-agreement on GHG-emissions and to conclude this process until 2009. Specifically, global GHG-emissions are to be reduced by 50 percent up to the year 2050. Even countries formerly very reluctant to commit to emissions reductions now start to make concessions in that respect.

A related example are recent climate policies in the EU and in Germany: In 2007, the EU-member countries decided to "unilaterally" reduce union-wide CO_2 emissions by 20 percent compared to 1990-levels up to 2020. In case an international agreement succeeds, even a 30-percent reduction is intended.

Germany, in the same year and conditional on the implementation of the above-mentioned EU-agreement, goes even farther and considers CO_2 -reductions of 40 percent until 2030. In order to achieve this goal, a vast number of single policy instruments are currently discussed. This German example is especially interesting as within the same year, both a reduction of corporate taxes (see above) and a significant increase in environmental-policy efforts were concluded. That is, intensified competition for capital goes hand in hand with intensified environmental-protection efforts- the opposite of what the RtB-literature would suggest.

Hence, the aim of this paper is to shed light on this contradiction between the pessimistic environmental "predictions" of public debates and economic analyses and the

more optimistic observations of actual policy-patterns. For that purpose, the interrelations between different policy-instruments are considered in the analysis. Rather than investigating strategic environmental-policy choices, the question is, how incentives with respect to environmental policy change if the strategic tax-policy choice is adjusted to changing market conditions.

To analyze the issue, a simple two-country model is applied: Identical neighbor countries are engaged in tax competition for FDI from a third country by strategically choosing their profit-tax rates. The investor has already decided to invest in one of the countries, but not in which of them, so that his final location choice is determined by those tax rates.

As there is no domestic firm in neither country, both will exhibit a monopolistic market structure when the FDI has taken place: The FDI host is served by domestic output of the foreign monopolist, the other country imports from its neighbor and thus incurs trade costs. Production of the foreign firm in the host country causes pollution which is assumed to be purely local.

The model takes the form of a sequential 4-stage game: Tax competition for FDI takes place in the first stage and determines the MNE's location choice in the second stage. Only then, a welfare-maximizing output-based emissions tax is chosen by the countries in stage three which in turn determines the MNE's profit maximizing output in the last stage.

To address the impact of tax competition for FDI on the competing countries' optimal environmental-policy choice, the analysis follows a stepwise approach. First, the general relationship between the two policy instruments is established. As a benchmark scenario, a situation without competition for FDI, i.e. with fixed location of the MNE, is considered. The resulting tax-policy equilibrium is then compared to the one arising in a scenario with FDI competition. Based on the general environmental-/tax-policy interrelation, conclusions with respect to the impacts of FDI competition on the environment can be drawn.

The main results of the analysis can be summarized as follows: With respect to the first research question, the paper shows that there is a negative relationship between tax- and environmental policy. That is, a lower profit-tax rate (implying more intense FDI competition) corresponds to a higher emissions-tax rate (implying a higher level of environmental protection). Since in the benchmark scenario, welfare in the FDI host country exceeds that in the importing country, both have an incentive to compete for the investment if its location is no longer fixed. This leads to non-cooperative equilibrium values of the profit-tax rate lower than in the benchmark equilibrium without competition. Hence, due to the negative policy-interrelation, it can be concluded that FDI competition exerts an upward pressure on the level of environmental policy and is thus "good for the environment". A RtT rather than a RtB prevails.

In what concerns the second research question, results are not as clear-cut: Whether market integration intensifies or weakens FDI competition depends on the level of transport costs between the competing countries, i.e. on their current state of integration.

For large transport-cost values, market integration induces intensified FDI competition and is thus beneficial for the environment, whereas the opposite holds for transport costs below a certain threshold value. Hence, in order to draw precise conclusions, it would be necessary to know the respective countries' state of economic integration.

This paper relates to different literature branches. Primarily, it combines the literature on international tax-competition for mobile capital/FDI with the literature on environmental-policy competition.

The *tax-competition literature* can be divided into two groups, with the first one taking a mainly public-finance perspective on the issue. Capital flows are analyzed in a perfect-competition framework with many countries. A basic model goes back to Zodrow/Mieszkowski (1986). Literature surveys are provided e.g. by Wilson (1999) on a theoretical- and by Devereux/Griffith (2002) on an empirical basis.

More relevant, however, for the current paper, is the second group within the tax-competition literature: It concentrates on the analysis of competition for FDI through tax-/subsidy incentives in a two-country-, imperfect-competition setting. Those papers in general address the consequences of strategic tax-policy choices on the FDI decision of a foreign investor and on domestic welfare. Examples include Haaland/Wooton (1999), Haufler/Wooton (1999), Barros/Cabral (2000), Fumagalli (2003) or Bjorvatn/Eckel (2006).

Though those models differ with respect to several features,² their main findings can be summarized as follows: Countries will indeed engage in (downward-)tax competition for FDI, but the induced non-cooperative tax-policy patterns are not necessarily detrimental for welfare. On the contrary, a more efficient location choice of the MNE might be induced, leading to an increase in aggregate regional welfare.

The *literature on environmental-policy competition* for FDI in a similar manner addresses strategic environmental-policy choices and its consequences for FDI and welfare. It focusses on the question whether FDI competition induces a RtB in environmental policy and is hence detrimental for environmental quality. In addition to the "standard" welfare-determinants, governments in these models have to consider the negative welfare-impacts of FDI due to the pollution it causes. Hence, the politicians' decision problem is more complex than without the environmental component.

Surveys on the economic RtB-literature are e.g. provided by Wilson (1996) and Oates (2001). Depending on the specific features of the applied models, conclusions are mixed. A very prominent paper finding theoretical evidence for an environmental RtB is Markusen et al. (1995). Among others, Rauscher (1995) and Hoel (1997) show that both a RtB or a RtT ("Race to the Top") may occur if countries engage in

²There are mainly three such features to be mentioned: The specific strategic policy-instruments are either modeled in terms of lump-sum-, or in terms of output-related taxes/subsidies. Market structure is either monopolistic or oligopolistic, depending on whether a domestic firm is assumed to exist in the host country. Usually, asymmetric countries are considered, but asymmetries stem from different factors like e.g. market size, technological advancement or labor market conditions.

environmental-policy competition. De Santis/Stähler (2000) do not find any evidence for a RtB.

Building on the two above-mentioned literature branches, a third group, like the current paper, analyzes both issues simultaneously. These “*integrated approaches*” introduce environmental-policy competition into the “traditional” tax-competition models through the following assumption: Governments aim at maximizing a representative agent’s utility, which is determined by consumption, environmental quality and the provision level of some public good. To do so, they simultaneously choose a capital tax and some environmental-policy instrument. With respect to the methodological approach, these papers thus take a public-finance perspective, building on the first group of tax-competition models mentioned above.

One basic theoretical model within this group was developed by Oates/Schwab (1988). Building on this and on the basic tax-competition model by Zodrow/Mieszkowski (1986), further approaches were developed, e.g. by Bayindir-Upmann (1995), Kim/Wilson (1997), Rauscher (2001) or Bjorvatn/Schjelderup (2002).

Concerning the research question, the emphasis of this group of papers lies on the questions how tax- and environmental policies are chosen and whether this multiple-policy choice is efficient. In this respect, it is thus these “integrated approaches”, the current paper is most related to: Both intend to find out whether competition for capital/FDI induces a RtB in environmental policy- under consideration of its interrelation with tax policy.³

The main results of these “integrated approaches” can be summarized as follows: Competitive policy-outcomes are in general not efficient (i.e. environmental quality is at a too low- or too high level and capital taxes differ from zero), but efficient outcomes may, under certain restrictive conditions, also arise. Inefficient capital-tax levels induce a RtB in environmental policy because it then serves a means to correct for the capital-tax-induced inefficiencies.⁴

To conclude, the current paper analyzes a research question similar to that in the existing tax-competition literature incorporating environmental policy (the “integrated approaches”), but applies a model framework more related to approaches analyzing both policy instruments separately (the FDI- resp. environmental-policy-competition literature).

³It has to be mentioned, however, that, due to the differing theoretical frameworks, both approaches deviate in their assessment method: Whereas in the “integrated approaches”, the efficient (Pigouvian) level of environmental policy (where marginal damage equals marginal abatement cost) serves as a reference point to identify a RtB, the current paper uses the welfare-maximizing policy level in a benchmark scenario without FDI competition. This benchmark environmental-policy level need not be efficient from a regional perspective, as externalities on the neighbor country are not taken into account by the FDI host.

⁴Inefficient capital-tax levels in these models correspond to a profit-tax rate under FDI competition that deviates from the one chosen in a “no-competition” benchmark scenario in the current paper.

The results of the current paper are opposing those of a majority of the existing ones, especially from the “integrated” group: As mentioned, this paper finds support for a RtT in environmental policy if countries engage in tax competition, whereas the existing approaches predict a RtB in environmental policy in case of inefficient tax policies.

The rest of the paper is organized as follows: The next section introduces the model and explains the basic rationales behind governmental decision-making which will constitute the basis for the subsequent analysis. Section 3 presents the policy analysis. As a preliminary step, in section 3.1, a benchmark scenario without FDI competition is characterized. The resulting policy equilibrium serves as a reference point for the main analysis carried out in section 3.2, where the non-cooperative policy-choice in a framework with FDI competition is derived. Section 4 adds an additional aspect to the analysis by investigating the effects of market integration on the policy equilibrium. Finally, section 5 concludes.

2 The model

The research questions in this paper are analyzed within a simple two-country model-framework. Identical neighbor countries A and B constitute a region in which an investor from a third country has already decided to set up a plant. As there is no domestic firm in neither A nor B, both countries are characterized by a monopolistic market structure: One country becomes host for the foreign owned monopolist, the other is served by exports from its neighbor. Due to the countries’ symmetry, the MNE’s decision of whether to invest in A or B is solely determined by governmental (tax-)policies.

The government in country y , $i=A, B$, has two policy instruments at its disposal: A tax $s_i \in [-\infty, 1]$ per unit of foreign (gross-)profit Π_i generated in the host country, and an emissions tax τ_i per unit of output produced in the host country for the domestic market (q_i) or for exports to the neighbor country (q_j). Both policy instruments only become effective if country i actually hosts the FDI. Otherwise, domestic production and MNE profit are equal to zero.

The model takes the form of a sequential 4-stage game. First, both regional governments A and B choose their profit-tax rates simultaneously and non-cooperatively with the aim of attracting the foreign firm. Based on these profit-tax conditions, in the second stage, the MNE decides where to locate. In the third stage, each government determines its welfare-maximizing emissions-tax rate.⁵ In the last stage of the game, the foreign firm chooses its output for domestic consumption and export.⁶

⁵As stated above, this choice, however, is only relevant for the country that succeeded in attracting the investment.

⁶This game structure implies that countries can commit to a certain profit-tax policy before the MNE settles down. On the contrary, environmental policy is only chosen after the location decision and thus subject to potential changes. For a motivation of this order of moves see e.g. Haufler/Wooton

2.1 Consumption

Consumption in country i is characterized by a representative household. It derives utility from the consumption of two goods: q and z , with z being the numeraire. The utility function of a consumer in country i is quadratic:

$$U_i = q_i - \frac{1}{2}q_i^2 + z_i - D_i. \quad (1)$$

Environmental damage in country i , D_i , is considered as exogenous by the consumer.

The budget constraint is given by:

$$I = \frac{T_i + S_i}{N_i} + M_i = p_i q_i + z_i. \quad (2)$$

$T_i = \tau_i(q_i + q_j)$ is environmental-tax revenue, $S_i = s_i \Pi_i$ is the profit-tax revenue (resp. subsidy payment for values of $s_i < 0$), N_i is population size, M_i is an exogenous income-component, p_i the domestic price for good q and I total income. Hence, total income consists of redistributed environmental- and profit-tax revenues and an exogenous component.

Utility maximization s.t. the budget constraint yields inverse demand

$$p_i = 1 - q_i. \quad (3)$$

2.2 Production

By assumption, the foreign firm can price-discriminate between markets in A and B. Production is characterized by constant marginal cost c , identical in A and B, with $0 < c < 1$. Transport costs between A and B are t per unit of output, with $0 < t < 1$.⁷

With the investment located in country i , the MNE's gross profit Π_i consists of a domestic- and an export-component:

$$\begin{aligned} \Pi_i &= q_i(p_i - c - \tau_i) + q_j(p_j - c - \tau_i - t) \\ \Rightarrow \Pi_i &= q_i(1 - q_i - c - \tau_i) + q_j(1 - q_j - c - \tau_i - t). \end{aligned} \quad (4)$$

Profit maximization with respect to q_i resp. q_j yields:

$$q_i = \frac{1 - c - \tau_i}{2}, \quad q_j = \frac{1 - c - \tau_i - t}{2}. \quad (5)$$

(1999), p. 131, who apply a similar policy framework.

⁷Plant-level fixed costs are omitted here, although their absence would usually imply that the MNE, in order to avoid transport costs, preferred locating in both A and B rather than in only one market. The "one-plant" decision is based on the implicit assumption that plant-level fixed costs are sufficiently high relative to intra-regional trade costs to prevent a double-plant strategy of the MNE. This is done for reasons of simplicity: Adding fixed costs would neither change the MNE's location decision between the regional countries nor its output decision. All relevant qualitative results with respect to the research questions posed would be unaffected.

Both c and t are assumed to be sufficiently small and, throughout the whole paper, parameter values are assumed to take on values such that the emissions-tax rate τ will be non-prohibitive at its optimal level. These assumptions ensure positive output for both domestic- and foreign consumption, i.e. $1 - c - \tau_i > 1 - c - \tau - t_i > 0$.⁸

Due to the linear demand-structure, foreign monopoly-profit is

$$\begin{aligned} \Pi_i &= q_i^2 + q_j^2 \\ &= \frac{(1 - c - \tau_i)^2}{4} + \frac{(1 - c - \tau_i - t)^2}{4}. \end{aligned} \quad (6)$$

The net-of-tax profit (“net profit” in the following) of the MNE is thus given by

$$(1 - s_i)\Pi_i = (1 - s_i) \left(\frac{(1 - c - \tau_i)^2}{4} + \frac{(1 - c - \tau_i - t)^2}{4} \right). \quad (7)$$

2.3 The Environment

One unit of output produces one unit of emission, so that total emissions in the host country, E_i , are equal to the MNE’s total production-volume: $E_i = q_i + q_j = Q_i$. Environmental damage in the FDI host country i is a function of domestic emissions:

$$D_i = D_i(E_i(Q_i)) = \delta E_i = \delta Q_i, \quad (8)$$

where δ with $0 < \delta < 1$ is constant marginal environmental damage.

The model abstracts from emissions spillovers to the neighbor country j by assuming that pollution is purely local: $D_j(E_i(Q_i)) = 0$.

2.4 Social Welfare

Social welfare in the regional countries in general consists of consumer surplus CS, environmental tax revenue T, environmental damage D and the share of foreign profit extracted by profit taxation (possibly negative in case of a subsidy): $W = CS + T - D + S$.

⁸Similar assumptions are e.g. taken in Markusen et al. (1995).

Parameter values inducing prohibitive emissions-tax rates would yield the so-called “NIMBY”-case (“Not In My Backyard”; see Markusen et al. (1995)) with pollution being so severe that countries prefer importing from abroad to production in their own country. This scenario is excluded by assumption in this paper, since it does not make sense to analyze the effects of FDI competition in a setting where countries do not wish to attract an investor. (In particular, in the model framework applied here, a NIMBY parameter-constellation would lead to an equilibrium with countries taxing MNE profit at the maximum rate $s=1$. The country which then “attracts” the FDI would set $\tau_i = 1 - c$ and so induce zero production.)

Specifically, consumer surplus in the host country (in the following referred to as “country i”) resp. the importing country (“j” in the following) is given by:

$$CS_i = \frac{1}{2}q_i^2 = \frac{(1 - c - \tau_i)^2}{8}, \quad CS_j = \frac{1}{2}q_j^2 = \frac{(1 - c - \tau_i - t)^2}{8}. \quad (9)$$

Environmental-tax revenue in the host- resp. importing country equals

$$T_i = \tau_i Q_i = \tau_i(1 - c - \tau_i - \frac{t}{2}), \quad T_j = 0. \quad (10)$$

Analogously, environmental damage in country i resp. j is given by:

$$D_i = \delta Q_i = \delta(1 - c - \tau_i - \frac{t}{2}), \quad D_j = 0. \quad (11)$$

In the following, environmental-tax revenue and environmental damage in the host country will be aggregated as “net revenue”:

$$\text{net rev.} = (\tau_i - \delta)(1 - c - \tau_i - \frac{t}{2}). \quad (12)$$

Finally, extracted MNE-profit in country i yields a profit-tax revenue equal to

$$S_i = s_i \Pi_i = s_i \left(\frac{(1 - c - \tau_i)^2}{4} + \frac{(1 - c - \tau_i - t)^2}{4} \right). \quad (13)$$

2.5 Governmental Decision-Making

What are the basic rationales behind governmental decision-making?

Due to the sequential game structure, in stage 3, the FDI host country chooses its emissions tax τ_i as welfare-maximizing response to a given equilibrium profit-tax rate previously determined in stage 1. When doing so, it faces a tradeoff between two distortions to be corrected for: The *market distortion* due to the monopolistic market structure and the *pollution distortion* due to the environmental externality not considered in the output choice of the MNE.

The market distortion implies an incentive for a negative output tax as, compared to the socially optimal output level, the monopolist produces too little and sells at too high prices which leads to sub-optimally low CS. The pollution distortion, on the contrary, implies a positive tax on output as, from an environmental point of view, too much is produced.

When choosing τ , the government has to consider that the foreign profit generated by the MNE negatively depends on the emissions tax. Hence, the more output is taxed, the lower the profit-tax revenue for the host country will be.

Whether the optimal emissions tax will be positive or negative, depends on which distortion dominates. Specifically, a positive tax will result for marginal environmental damage sufficiently high.

In the first stage, each potential FDI host country chooses the optimal rate at which to tax the MNE's profit for the case it succeeds in attracting the investment. If there is no competition for FDI between countries A and B, all that has to be ensured to keep the firm (and thus positive output) in the domestic country is zero net profit. Hence, it is possible to set the profit-tax rate equal to one and so extract the complete foreign profit. This profit thus adds to domestic welfare as if the foreign firm was a domestic one. In such a situation, environmental policy is "neutral" from a welfare perspective as the amount paid by the MNE (negatively impacting on domestic welfare) and governmental tax revenue exactly equal out.

In a competitive scenario,⁹ the profit-tax rate is used as a means to give the MNE an incentive to invest in the domestic- rather than in the neighbor country. Such FDI competition will occur if the countries' net surplus from hosting the FDI rather than importing from the regional neighbor (Willingness to Pay, "WTP" in the following) is positive. This WTP is the sum of a gain in CS due to avoided transport costs, the net emissions-tax revenue and the share of MNE-profit that can be extracted (i.e. the profit-tax revenue).

3 Policy Analysis

3.1 Preliminary Step: A "No-Competition" Benchmark-Scenario

This section first establishes the general relationship between tax- and environmental policies. This is of major importance for the subsequent analysis as all results concerning the environmental (-policy) consequences of exogenous changes in policy-competition patterns or other market conditions rely on this relationship.

As the policy interrelation is actually only relevant for the country hosting the FDI, a "no-competition" benchmark-scenario with fixed location of the MNE is then characterized and the respective policy equilibrium is derived. This serves as a reference point for the main analysis in the subsequent sections focussing on the effects of FDI competition.

Lemma 1 states the *general relationship* between the two policy instruments under consideration:

- **Lemma 1** *The welfare-maximizing emissions tax rate in the FDI host country i , τ_i , depends negatively on the level of the profit-tax rate s_i : $\frac{\partial \tau_i}{\partial s_i} < 0$.*

⁹Throughout the paper, the term "competitive" does not refer to the market structure which is always a monopolistic one, but rather to the pattern of inter-governmental FDI competition.

Proof: According to the explanations in section 2.4, welfare in the FDI host country is constituted of CS, net revenue and the extracted foreign-profit share:

$$\begin{aligned}
 W_i^{FDI} &= \underbrace{\frac{(1-c-\tau_i(s_i))^2}{8}}_{CS_i} + \underbrace{(\tau_i(s_i) - \delta)(1-c-\tau_i(s_i) - \frac{t}{2})}_{netrev_i} \\
 &+ s_i \underbrace{\left(\frac{(1-c-\tau_i(s_i))^2}{4} + \frac{(1-c-\tau_i(s_i) - t)^2}{4} \right)}_{\Pi_i}. \tag{14}
 \end{aligned}$$

Maximizing W_i^{FDI} with respect to τ_i yields:

$$\tau_i(s_i) = \frac{3-4s_i}{7-4s_i} \left(1-c - \frac{2-2s_i}{3-4s_i} t \right) + \frac{4}{7-4s_i} \delta. \tag{15}$$

The derivative of this term with respect to s_i can be shown to be negative for non-prohibitive emissions-tax rates $\tau_i < 1-c-t$. \square

The intuition behind Lemma 1 is quite straightforward: A high tax on the MNE’s profit implies a large profit-share to be extracted by the host country and thus adding to domestic welfare positively. Hence, the welfare-maximizing government has an incentive to allow for a high (gross-)profit which can c.p. be achieved by a low emissions-tax rate. On the contrary, if s_i is small (or even negative), a larger profit share flows to the foreign country instead of increasing domestic welfare. Hence, the domestic government has no interest in allowing this profit to be large.

In the “no-competition” benchmark-scenario, there are no strategic interactions between countries A and B; they do not compete for the FDI as the MNE’s location is fixed. Lemma 2 states the resulting policy-choice:

- **Lemma 2** *Without having to compete for the mobile foreign firm, the FDI host country will tax the MNE’s domestic profits at the maximum feasible rate $s_i^n = 1$ and set the emissions-tax rate at a level of $\tau_i^n(s_i^n = 1) = -\frac{1}{3}(1-c) + \frac{4}{3}\delta$.*¹⁰

Proof: In order to prove that a profit tax of 1 will be raised in equilibrium, it has to be shown that domestic welfare with FDI positively depends on the profit tax rate: $\frac{\partial W_i^n}{\partial s_i} > 0$. Using eqs. 14 and 15, this can be shown to hold for non-prohibitive levels of the emissions tax τ_i^n .

Hence, without any competitive pressure on profit taxes from the neighbor country, the maximum feasible rate of s_i still sustaining the FDI will constitute the welfare-maximizing one for the host country. \square

The intuition behind Lemma 2 was already discussed in section 2.5: Without FDI competition, the domestic country knows for sure that the investment is

¹⁰The superscript n stands for policy variables in the “no-competition” scenario.

sustainable as long as the MNE does not incur a loss. Hence, the complete profit can be extracted, leaving the MNE with zero net profit and thus indifferent towards the FDI. The emissions-tax rate can then be chosen as if the MNE was a domestic firm, because the whole profit becomes an element of domestic welfare.

To summarize, Lemmas 1 and 2 taken together allow for the following conclusion: Without competing for FDI, governments tax MNE profits at a maximum rate and so appropriate these profits completely. As a consequence, when choosing the optimal emissions tax rate, foreign profit is treated like domestic profit.

Insofar strategic policy-interactions between countries competing for FDI induce lower profit-tax rates than in this benchmark scenario (i.e. $s_i^c < 1$)¹¹, those countries will have an incentive to raise their emissions-tax rate compared to the benchmark value (i.e. $\tau_i^c > \tau_i^n$). Hence, environmentally beneficial effects of tax competition for FDI can be expected; in other words, competition for FDI induces a “Race to the Top” rather than a “Race to the Bottom” in environmental policy. Whether this conclusion can actually be drawn will be investigated in the next section.

3.2 The Non-Cooperative Nash-Equilibrium with FDI Competition

The following section presents the main analysis, focussing on a scenario in which countries A and B are engaged in competition for the foreign investment, i.e. in which the MNE has not yet decided where in the region to locate. Each country, if it considers being the FDI host as the more attractive option as compared to importing from the neighbor (i.e. if the WTP for the FDI is positive; see section 2.5), has to provide an incentive for the MNE to invest there rather than in the neighbor country. In this model, such incentives are given in terms of profit-tax conditions in the first stage of the game (see section 2).

With FDI competition, the profit-tax rates $s_i(s_j)$ are strategic complements. This implies that both countries will mutually undercut their tax rates offered to the MNE until they reach their maximum WTP for the FDI- a situation corresponding to charging the minimum necessary s (s_i^{min} in the following) to ensure a net surplus from FDI equal to zero.

The best-reply (BR) function of country i is thus the following:

$$s_i(s_j) = \begin{cases} s_j - \epsilon & \text{for } s_j > s_i^{min} \\ s_i^{min} & \text{for } s_j \leq s_i^{min} \end{cases} \quad (16)$$

In words, country i will undercut its competitor j by the small amount ϵ as long as this bid does not fall short of its minimum necessary tax rate. Country i’s minimum bid,

¹¹The superscript c stands for policy variables in the FDI-competition scenario.

$s_i^{min} > 0$, will be chosen if j bids an amount smaller than or equal to this minimum so that country i is no longer willing to undercut.

Figure 1 illustrates the BR-functions of countries i and j and the resulting non-cooperative policy equilibrium $\{s_i^{min}; s_j^{min}\}$ in which both countries offer their maximum WTP to the MNE:

[to be added]

As argued in section 3.1, in order to draw conclusions on the effects of FDI competition on environmental policy, it has to be shown that for a competitive situation as described above, there will actually exist a non-cooperative Nash-equilibrium in profit-tax rates $\{s_i^c = s_i^{min}; s_j^c = s_j^{min}\}$ and that the equilibrium tax-rates are smaller than their “no-competition”-counterparts $s_i^n = s_j^n = 1$, i.e. that the minimum necessary tax rates are smaller than 1. Proposition 1 states the result:

- **Proposition 1:** *In a scenario where countries i and j compete for the investment of a foreign MNE via tax policy, a non-cooperative Nash-equilibrium in profit-tax rates $\{s_i^c = s_i^{min}; s_j^c = s_j^{min}\}$ with $s_i^{min} < 1$ and $s_j^{min} < 1$ exists.*

Proof: In order to prove the existence of an equilibrium as characterized in Proposition 1, two conditions have to be fulfilled:

- (1) Each country must have an incentive to actually compete for the FDI by lowering its profit tax rate below the “no-competition”-level. This will be the case if the domestic welfare level as host country exceeds welfare as importing country in the benchmark scenario: $W_i^{FDI}(s_i = 1, \tau_i(s_i = 1)) > W_j^{Imp}(\tau_i(s_i = 1))$. Hence, for given s_j , lowering s_i by a small amount to a level slightly below s_j and so attracting the investment, will lead to a welfare gain in i .

The general welfare function in the host country is given by eq. 14. Plugging in $s_i = 1$ and $\tau_i(s_i = 1) = -\frac{1}{3}(1 - c) + \frac{4}{3}\delta$ yields:

$$\begin{aligned} W_i^{FDI}(s_i = 1, \tau_i(s_i = 1)) &= \frac{2}{3}(1 - c - \delta)^2 - \frac{4}{9}(1 - c - \delta) \left(1 - c - \delta - \frac{3t}{8}\right) \\ &+ \frac{4}{9} \left(1 - c - \delta - \frac{3t}{4}\right)^2. \end{aligned} \quad (17)$$

Welfare in the neighbor country is simply comprised of CS from importing:

$$W_j^{Imp} = \frac{1}{8}(1 - c - \tau_i(s_i = 1) - t)^2. \quad (18)$$

Plugging in $\tau_i = -\frac{1}{3}(1 - c) + \frac{4}{3}\delta$ yields:

$$W_j^{Imp}(\tau_i(s_i = 1)) = \frac{2}{9} \left(1 - c - \delta - \frac{3t}{4} \right)^2. \quad (19)$$

Comparing eqs. 17 and 19 shows that the first condition $W_i^{FDI}(s_i = 1, \tau_i(s_i = 1)) > W_j^{Imp}(\tau_i(s_i = 1))$ is satisfied for non-prohibitive τ_i .¹²

- (2) There must be some lower bound for the profit-tax rate below which further decreases of s are not attractive anymore. This implies welfare of the FDI host country to depend positively on the profit tax rate: $\frac{\partial W_i^{FDI}(s_i, \tau_i(s_i))}{\partial s_i} > 0$. Hence, at some value s_i^{min} , welfare cannot be increased anymore by attracting the FDI rather than importing. At this point, welfare in the host country equals that in the importing country: $W_i^{FDI}(s_i^{min}, \tau_i(s_i^{min})) = W_j^{Imp}(\tau_i(s_i^{min}))$. This second condition for the existence of a Nash-equilibrium corresponds to the condition necessary to prove Lemma 2 and has already been discussed in section 3.1. \square

What are the characteristics of the non-cooperative Nash-equilibrium derived above? As both countries have an incentive to offer their maximum WTP for the FDI (i.e. their minimum necessary tax rate), both will achieve the same welfare level in equilibrium: $W_i^{FDI} = W_j^{Imp}$. This outcome is due to the fact that the complete net surplus the host country can generate from hosting the investment is “competed away” to the foreign firm.

An interesting question not considered so far is, whether in the Nash-equilibrium, countries charge a “real” profit tax $s_i^{min} > 0$ from the MNE or whether they offer a subsidy $s_i^{min} < 0$ in order to attract the investment. The result is stated in Proposition 2:

- **Proposition 2:** *In the non-cooperative equilibrium characterized by Proposition 1, both countries will offer a subsidy $s_i^{min} < 0$ per unit of profit to the foreign investor.*

Proof: In order to prove that there are incentives to set $s_i^{min} < 0$, it has to be shown that even without any extractable MNE profit in the host country, hosting the FDI is still preferred to importing: Welfare with FDI, given $s_i = 0$, has to exceed welfare without FDI. In other words, the WTP for the FDI has to be positive even in the absence of any profit share charged from the foreign firm.

Formally, the above condition can be written as $W_i^{FDI}(s_i = 0, \tau_i^0) > W_j^{Imp}(\tau_i^0) \Leftrightarrow s_i^{min} < 0$ with $\tau_i^0 \doteq \tau_i(s_i = 0)$.

In such a scenario, welfare in the host country is:

$$W_i^{FDI}(s_i = 0, \tau_i^0) = \underbrace{\frac{(1 - c - \tau_i^0)^2}{8}}_{CS_i} + \underbrace{(\tau_i^0 - \delta)(1 - c - \tau_i^0 - \frac{t}{2})}_{netrev_i} + \underbrace{0}_{s_i \Pi_i}. \quad (20)$$

¹²To see this, note that $\tau_i(s_i = 1) < 1 - c - t$ implies $1 - c - \delta - \frac{3t}{4} > 0$. Hence, all terms in brackets in eqs. 17 and 19 are positive.

Plugging in the induced emissions tax rate $\tau_i^0 = \frac{3}{7}(1 - c - \frac{2t}{3}) + \frac{4}{7}\delta$ yields:

$$W_i^{FDI}(s_i = 0, \tau_i^0) = \frac{2}{49} \left(1 - c - \delta + \frac{t}{2}\right)^2 + \frac{12}{49} \left(1 - c - \delta - \frac{2t}{3}\right) \left(1 - c - \delta - \frac{3t}{8}\right). \quad (21)$$

Welfare in the importing country equals CS:

$$W_j^{Imp}(\tau_i^0) = \frac{2}{49} \left(1 - c - \delta - \frac{5t}{4}\right)^2. \quad (22)$$

As for non-prohibitive emissions-tax rates, all terms in brackets in eq. 21 are positive, it is obvious that $W_i^{FDI}(s_i = 0, \tau_i^0) > W_j^{Imp}(\tau_i^0)$ and hence $s_i^{min} < 0$. \square

This result is quite intuitive: The importing country j derives welfare solely from CS spilling over from production in its neighbor country. This CS, however, due to the incurred trade costs, is lower than that attainable with production in the domestic country. In addition to a gain in CS when being the host for FDI, the host country also derives welfare from a positive net environmental-tax revenue (the second summand in eq. 21).¹³

Proposition 2 implies that the WTP for FDI becomes zero only for some negative value of the profit-tax rate, i.e. when the positive effects of FDI on CS and net revenue are completely offset by the rising cost from subsidy payments to the MNE.

The main research question analyzed in this paper is concerned with the impact of international tax-competition for FDI on domestic environmental-policy levels. What can we conclude in this respect from the results obtained so far?

Firstly, if firms are internationally mobile, potential host countries have an incentive to use profit-tax rates as an instrument to attract foreign investment. By doing so, they deviate from their optimal “no-competition” policy.

Second, as there is a negative relationship between profit-tax- and emissions-tax rates, a decrease in the former induced by FDI competition will lead to a rise in the latter. That is, domestic environmental policy is strengthened (compared to a situation without competition) if a country is engaged in tax competition for FDI. This rather unexpected result of a “Race to the Top” in environmental policy is driven by the consideration of multiple policy-instruments, specifically, by the consideration of the negative tax-/environmental-policy interrelation.

Overall, it can be concluded that international tax-competition for FDI is “good for the environment” because it creates incentives for stricter environmental policy in the involved countries.

¹³This net revenue is positive for values of τ_i^0 larger than δ . This condition can be shown to hold.

4 The Effects of Market Integration

The analysis so far has examined the interrelation between the strength of domestic environmental policy and international tax-competition for FDI and found that intensified FDI competition is favorable for the environment.

This section builds on the preceding results and investigates the effects of increasing economic integration between countries which is represented by declining intra-regional transport costs: Will market integration and the induced increase in trade volumes come at the expense of environmental degradation?

In the model framework applied here, this question is approached indirectly: Due to the sequential game structure, environmental policy is chosen as a reaction to beforehand determined tax policy. Hence, the question is whether economic integration will reduce or intensify FDI competition and so induce environmental degradation or improvements. Proposition 3a states the result:

- **Proposition 3a:** *The impact of declining transport costs between countries A and B on the intensity of FDI competition and thus on the strength of environmental policy depends on the level of t , i.e. on the current degree of integration, as follows: Let $\tilde{t} = \frac{34}{87}(1 - c - \delta)$. For $t > \tilde{t}$, a decrease in t leads to lower equilibrium values of s_i^{min} and thus to intensified FDI-competition, whereas for $t < \tilde{t}$, further decreases in t induce higher equilibrium values of s_i^{min} and thus weaken FDI competition.*

Proof: We know from Proposition 2, that a positive WTP for FDI at a zero profit tax rate implies a negative equilibrium value of s : $WTP(s_i = 0) > 0 \Leftrightarrow s_i^{min} < 0$. This implies that, in order to obtain zero WTP (a condition that holds in a non-cooperative equilibrium; see section 3.2), the host country must actually *pay* a subsidy to the MNE rather than *charge* a tax: $s_i^{min} \Pi_i < 0$ (i.e. the MNE's net profit becomes $(1 - s_i^{min}) \Pi_i > \Pi_i > 0$).

The impact of declining t -values on the level/amount of the subsidy ($s_i^{min} \Pi_i$) depends on two opposing effects: Firstly, t influences $WTP(s_i = 0) = W_i^{FDI}(s_i = 0, \tau_i^0) - W_j^{Imp}(\tau_i^0)$, which in turn determines the equilibrium value of s_i^{min} (the higher the net surplus a country can derive from FDI, the more would it be willing to subsidize the investment; hence, the more negative will s_i^{min} be). Secondly, t also exerts influence on the MNE's profit Π_i .

The WTP effect of declines in t is positive: Calculating the $WTP(s_i = 0)$ from eqs. 21 and 22 yields:

$$\begin{aligned}
 WTP(s_i = 0) &= \frac{2}{49} \left(1 - c - \delta + \frac{t}{2}\right)^2 + \frac{12}{49} \left(1 - c - \delta - \frac{2t}{3}\right) \left(1 - c - \delta - \frac{3t}{8}\right) \\
 &\quad - \frac{2}{49} \left(1 - c - \delta - \frac{5t}{4}\right)^2. \tag{23}
 \end{aligned}$$

The derivative of this term with respect to t is negative:

$$\frac{\partial WTP(s_i = 0)}{\partial t} = -\frac{11}{98}(1 - c - \delta - \frac{3t}{22}) < 0. \quad (24)$$

Hence, economic integration leads to rising WTP for FDI and so (for given Π_i) induces higher incentives for FDI competition between neighbor countries. This impact is reflected in decreasing non-cooperative equilibrium profit-tax rates s_i^{min} (resp. increasing rates at which the MNE is subsidized). The amount paid to the MNE, $s_i^{min} \Pi_i$, increases.

The profit effect of declines in t is also positive and counteracts the WTP effect on the equilibrium tax rate. Gross MNE-profit with zero profit taxation is:

$$\Pi_i(s_i = 0, \tau_i^0) = \frac{(1 - c - \tau_i^0)^2}{4} + \frac{(1 - c - \tau_i^0 - t)^2}{4}. \quad (25)$$

Differentiating this expression with respect to t yields:

$$\frac{\partial \Pi_i(s_i = 0, \tau_i^0)}{\partial t} = -\frac{(1 - c - \tau_i^0 - t)}{2} = -\frac{2}{7}(1 - c - \delta - \frac{5t}{4}) < 0. \quad (26)$$

For a foreign investor, economic integration between two regional countries raises the profitability of investing in that region. As the subsidy to the MNE is paid per unit of profit, an increase in the number of units exerts a negative impact on the rate at which each single unit has to be subsidized in order to achieve a given amount $s_i^{min} \Pi_i$. Hence, this profit effect of declining trade costs lowers the downward pressure on s_i^{min} induced by the WTP effect.

The overall impact of declining trade costs t on the equilibrium value of s and thus on the intensity of FDI competition depends on which of the two effects (each depending on the value of t) dominates. In order to obtain a threshold value \tilde{t} at which WTP- and profit effects equal out, the absolute values of the two effects are compared:

$$\underbrace{\frac{11}{98}(1 - c - \delta - \frac{3t}{22})}_{|WTP-effect|} = \underbrace{\frac{2}{7}(1 - c - \delta - \frac{5t}{4})}_{|profit-effect|} \Rightarrow \tilde{t} = \frac{34}{67}(1 - c - \delta). \quad (27)$$

Hence, for values of t above \tilde{t} , the WTP effect dominates the profit effect, which implies that the minimum necessary tax rate s_i^{min} declines and FDI competition intensifies. The opposite holds for values of t below \tilde{t} . The minimum value of s_i^{min} , $s_i^{min}(\tilde{t})$, i.e. the most intense competition for FDI, results from a state of economic integration corresponding to transport costs of \tilde{t} . This minimum value can be considered as a lower bound for the range of possible equilibrium profit-tax values: $s_i^{min}(\tilde{t}) \doteq \underline{s}_i^{min}$. \square

To summarize, it can be stated that starting from the threshold trade-cost level, market integration raises the countries' WTP for FDI, given that the profit tax

is zero (which is equivalent to the subsidy amount they are willing to offer to the MNE) by the same degree as the MNE's profit increases anyway. Hence, the increase in the subsidy-payment necessary to retain the equilibrium condition of zero WTP, is achieved without any adjustment in the tax rate. FDI competition is unaffected. Analogously, for market integration starting at higher(lower) values of t , the increase in MNE profit is not(more than) sufficient to achieve the rise in the subsidy payment necessary to retain zero WTP. The difference is then balanced out by downward(upward) adjustments in the profit-tax rate. FDI competition intensifies(weakens).

The additional welfare-surplus over importing which the FDI host country can generate if markets integrate is mainly induced by a rise in net environmental-tax revenue due to the expanded export-output of the MNE. Net revenue rises because in equilibrium, $\tau_i^0 > \delta$ holds, i.e. net revenue is positive. Hence, if output rises, this welfare component becomes even more positive. In addition, the level of τ_i^0 depends negatively on t . As a consequence, declines in t raise the emissions tax rate which leads to additional increases in net revenue.

A consideration of the two extreme cases, autarky and completely integrated markets, adds to a complete characterization of the interrelation pattern between declining transport costs, the intensity of FDI competition and environmental policy:

Autarky is represented by a prohibitively high level of transport costs, leading to zero exports of the MNE. In this case, the MNE only produces for the domestic host-country market. The resulting profit-tax equilibrium is described in Proposition 3b:

- **Proposition 3b:** *In an autarky equilibrium with transport costs at a level of at least $t^p = 1 - c$, tax competition for FDI may either induce positive- or negative profit-tax rates $s_i^{min} >< 0$, depending on the level of marginal environmental damage δ : Let $\tilde{\delta} = \frac{5}{8}(1 - c)$. For $\delta < \tilde{\delta}$, a subsidy will be paid to the MNE: $s_i^{min} < 0$. For $\delta > \tilde{\delta}$, a "real" profit tax will be charged: $s_i^{min} > 0$.*

Proof: As demonstrated in connection with Proposition 2, a positive WTP for FDI at zero profit taxation implies negative equilibrium values of s_i^{min} . In autarky, this WTP is given by:

$$WTP(s_i = 0, \tau_i^0(t^p)) = \underbrace{\frac{(1 - c - \tau_i^0(t^p))^2}{8}}_{CS_i} - \underbrace{0}_{CS_j} + \underbrace{\frac{1}{2}(\tau_i^0(t^p) - \delta)(1 - c - \tau_i^0(t^p))}_{netrev_i}. \quad (28)$$

Plugging in $\tau_i^0(t^p) = \frac{1}{7}(1 - c) + \frac{4}{7}\delta$ yields:

$$WTP(s_i = 0, \tau_i^0(t^p)) = \frac{9}{98} \left(1 - c - \frac{2}{3}\delta\right)^2 + \frac{3}{49} (1 - c - 3\delta) \left(1 - c - \frac{2}{3}\delta\right) >< 0. \quad (29)$$

Setting $WTP(s_i = 0, \tau_i^0(t^p)) > 0$ and solving for δ yields: $\tilde{\delta} = \frac{5}{8}(1 - c)$. \square

The intuition behind Proposition 3b is straightforward: If environmental damage is severe, the FDI host country will suffer from relatively high pollution. As a consequence, tax competition for FDI is less intense in situations with high environmental externalities.¹⁴

Proposition 3b implies that in autarky, $WTP(s_i = 0)$ is generally at lower levels than in open-market scenarios. Hence, also the intensity of FDI-competition will be comparably low. We can conclude that the non-cooperative profit tax rate in autarky, $s_i^{min}(t^p)$, constitutes an upper bound for the range of possible equilibrium tax levels: $s_i^{min}(t^p) \doteq \bar{s}_i^{min}$.

Complete integration is represented by transport costs of $t=0$. Hence, as both regional markets are equal in size, the MNE will produce identical output-levels for the domestic market of the host country and for exports to the neighbor market. Proposition 3c characterizes the resulting equilibrium:

- **Proposition 3c:** *When regional markets are completely integrated, an unambiguously negative profit-tax rate $s_i^{min}(t = 0) < 0$ prevails in equilibrium.*

Proof: When $t=0$, CS in the host- and the importing country is identical. Hence, $WTP(s_i = 0)$ solely consists of net environmental-tax revenue:

$$WTP(s_i = 0, \tau_i^0(t = 0)) = (\tau_i^0(t = 0) - \delta)(1 - c - \tau_i^0(t = 0)). \quad (30)$$

Plugging in $\tau_i^0(t = 0) = \frac{3}{7}(1 - c) + \frac{4}{7}\delta$ yields:

$$WTP(s_i = 0, \tau_i^0(t = 0)) = \frac{12}{49}(1 - c - \delta)^2 > 0. \quad (31)$$

Hence, the condition for $s_i^{min}(t = 0) < 0$ is unambiguously fulfilled. \square

It is quite obvious that, for a positive net environmental-tax revenue, the WTP for FDI must be positive even in the absence of any extracted MNE-profit. Net revenue is positive for environmental-tax rates exceeding marginal environmental damage (and, of course, positive output), which is fulfilled for non-prohibitive values of $\tau_i^0(t = 0)$.

Figure 2 summarizes and illustrates Propositions 3a-c:

[to be added]

¹⁴Of course, this relationship is not only valid in autarky but also in integrated markets. Autarky, however, is the only scenario in which possibly positive profit tax rates result, whereas in the general case with non-prohibitive t , the MNE is always subsidized.

The impacts of increasing market openness on the intensity of FDI competition and, to the opposite direction, on the strength of the competing countries' environmental-policy levels, depend on the current status of economic integration as measured by intra-regional trade costs.

Starting from completely separated markets (i.e. autarky) characterized by prohibitively high trade costs and the highest equilibrium rate of profit taxation \bar{s}_i^{min} , a decline in t will first lead to intensified tax competition which is reflected by decreasing profit tax rates and, induced by this, rising emissions-tax rates.

This intensification of competition proceeds until a threshold \tilde{t} is reached. In this "intermediate"-integration scenario, the lowest level of the equilibrium profit-tax rate, \underline{s}_i^{min} , prevails; tax competition is the most intense and hence, environmental policy at its strictest level. Below transport costs of \tilde{t} , further market integration lets FDI competition become less intense, and environmental policy weaker, again until markets are completely integrated at $t=0$.

To conclude, the question whether market integration is beneficial or harmful for the environment (i.e. whether it induces a "Race to the Top" or a "Race to the Bottom" in environmental policies) cannot be answered clearly within this model framework. Nevertheless, the findings provide some hint of the tendency of environmental-policy adjustments if it is possible to judge the current status of market integration between the countries under consideration. In addition, the very pessimistic view that economic integration is *always* harmful for the environment can be considered as incomplete and misleading.

5 Conclusion

This paper examined the impacts of international tax-competition for FDI, and increasing market integration between the competing countries, on those countries' domestic environmental-policy levels.

It turned out, that, due to a generally negative interrelation between tax- and environmental policy, intensified FDI competition (by inducing lower equilibrium-values of the profit-tax rate) leads to stricter environmental-policy levels (i.e. higher emissions-tax rates). FDI competition is thus beneficial from an environmental point of view. Hence, the widespread notion that FDI competition leads to a RtB in environmental policies and thus to environmental degradation is not supported.

This result is perfectly consistent with recent anecdotal evidence on investment incentives and environmental policies mentioned in the introduction: There are some examples for intense FDI-competition going hand in hand with increasingly strict environmental legislation.

Whether economic integration between countries engaged in FDI competition, represented by declining intra-regional trade costs, is also stimulating environmental efforts

cannot be answered unambiguously: The impacts of market integration depend on the prevailing level of transport costs. However, the most pessimistic view, that increasing economic integration through rising trade volumes necessarily comes at the expense of the environment, is not supported.

As compared to public concerns and the results of a large number of analyses within the (environmental-)tax-competition literature, the conclusions of this paper are quite optimistic. The reason might be that, rather than treating environmental policy as the only instrument of strategic governmental policy-making, interrelations between different instruments are explicitly considered here. In such a framework, environmental policy is not “misused” as a means of attracting foreign investment.¹⁵

The fact that a very simple model-framework was applied to analyze the research questions in this paper provides some scope for future research:

Firstly, additional insights could be obtained by expanding the existing model with more general assumptions. As already mentioned, firm-level fixed costs incurred by the MNE make sense. This additional feature allows to derive some comparative-statics results with respect to varying levels of fixed costs: Although qualitative results would not change, the equilibrium-condition that the MNE must not incur a loss, reduces the host country’s extractable profit-tax revenue and so exerts influence on the optimal policy choices.

Similarly, allowing for transboundary pollution might constitute a source of additional insights. Such model framework represents “real” environmental issues much better than the assumption of purely local pollution. Especially the issue of climate change, mentioned in the introduction, constitutes a global environmental problem with complete spillovers (i.e. environmental damage is the same world-wide, no matter where the emissions are produced). It would be interesting to investigate, how partial or complete pollution-spillovers from the FDI host to the importing country change the incentives for FDI competition, and thus equilibrium policy choices.

Furthermore, introducing asymmetry between the regional countries seems sensible. If countries differ in market size, the MNE’s location decision becomes more complex, and tax policy no longer constitutes the only determinant for this decision. It would be interesting to see, how the intensity of FDI competition, and thus the level of environmental policy, is influenced by the degree of asymmetry between the competing countries.

Secondly, in addition to those model expansions, more fundamental modifications can be considered which might allow to focus on some additional research questions. One example could be the assumption that the regional countries decide to cooperate in the first stage of the game (which, for example, seems plausible in the light of recent efforts to harmonize tax systems within the EU). If profit taxes are chosen cooperatively,

¹⁵This explanation, however, does not match the “integrated approaches” introduced above. Those use the policy interdependency as an explanation for rather than an argument against a RtB (see section 1).

how will incentives with respect to the environmental-policy choice be affected? In particular, might this tax-cooperation induce environmental policy become a substitute means in strategic competition for FDI?

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