Research School of International Taxation

The threat of tax evasion and its impact on corporate taxation and tax competition

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Working Paper
2/2019

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May 22, 2019

Abstract

This paper analyzes how corruption and fiscal institutions influence tax competition between countries. When trying to generate revenue from corporate taxation, a country is limited in doing so by firms' outside option and their ability to evade taxes. If the expected cost of tax evasion is low, due to a high corruption level or weak institutions, a country is forced to set a relatively low tax rate in order to induce compliant behavior by (resident) firms. As a consequence, such a country tends to set a lower tax rate than its competitors and is more likely to attract mobile investment in equilibrium. Overall, three factors are identified that determine the outcome of tax competition. First, high location-specific rents allow a country to charge a high tax, but only if firms' evasion incentives are sufficiently low. Second, smaller countries tend to set lower tax rates and be more aggressive in tax competition. The same holds true for countries in which tax evasion is attractive to firms, due to the mechanism described above.

Key words: Corporate taxation; Tax evasion; Tax competition; Corruption

JEL classification: F23; H25; H26; H32; H73

Acknowledgements: Comments by seminar participants at the University of Tübingen are gratefully acknowledged. I am particularly grateful to Manfred Stadler and Georg Wamser for numerous helpful suggestions.

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1 Introduction

In a globalized world, with increasing mobility of economic activity, both fiscal competition as well as heterogeneity of competitors are key aspects when analyzing economic and political interdependencies between countries. This seems to be particularly true regarding transition and developing economies, since these are about to play an increasingly important role as the process of globalization continues.

The present paper addresses this issue by analyzing how country-specific characteristics, like the prevalence of corruption and the quality of fiscal institutions, affect taxpayers' evasion incentives, which in turn influence countries' competitive tax setting.[1] In particular, we assume mobile and immobile firms which can choose whether to invest in a country and, if they do so, whether to attempt tax evasion by bribing the public agent in charge. Accordingly, when taxing these firms, a country is limited by their outside option and their possibility to evade. More precisely, the country is forced to set its tax rate low enough to induce market entry as well as compliant behavior by (at least some immobile) firms in order to generate revenue. Firms' incentives to evade taxes depend on country-specific characteristics and, therefore, differ across countries. If the attractiveness of evasion is relatively high, the affected country tends to set a lower tax rate than its competitor and is, thus, more likely to attract mobile firms in equilibrium.

Overall, we identify three main factors that determine the outcome of tax competition. First, high location-specific rents allow a country to charge a high tax, but only if the attractiveness of evasion is sufficiently low. Second, smaller countries tend to be more aggressive in tax competition, meaning that they set lower tax rates. Third, as indicated above, the same holds true for countries with a high corruption level and weak fiscal institutions, implying strong incentives to evade. Concerning the first two factors, these findings are in line with the existing literature on tax competition. By contrast, a possible link between corruption, institutional quality, firms' evasion incentives, and countries' competitive tax setting has not been investigated so far.

There is a large body of literature that relates tax competition to taxpayers' non-compliance in the context of cross-border tax evasion or avoidance. In these studies, differences in countries' tax rates induce investment for the sake of a lower tax burden, as opposed to investment for productivity rea-

[1] When referring to a country's competitive tax setting, we think of the tax-setting behavior that results when a country engages in tax competition with other countries (rather than implying that the country is able to compete with other countries).

sons. See Devereux et al. (2008), Hong and Smart (2010), and Slemrod and Wilson (2009), among others, for some major contributions to this topic. Obviously, this strand of literature is especially important in the context of tax havens.

By contrast, the present paper highlights how country-specific characteristics may be associated to intra-country tax evasion, and how the possibility of evasion affects a country's tax policy and, as a consequence, tax competition between countries. On a related note, Cremer and Gahvari (2000) analyze tax competition in a framework with "honest" and "evading" countries, meaning that tax evasion by firms takes place in some ("evading") countries, whereas it does not in others ("honest"). In their model, two equal-sized countries compete for mobile consumers (and not for potentially evading firms, as in our setting). They find that a country may be better off allowing tax evasion by firms, especially if tax rates are harmonized. The reason is that the tax rate is the only policy instrument at honest countries' disposal, whereas evading countries can additionally choose their audit rate. Similarly, Stöwhase and Traxler (2005) present a model in which regional governments compete over audit rates, while the statutory tax rate is determined by a higher layer of government and, thus, the same for all regions. Another related contribution is provided by Janeba and Peters (1999), who show that a preferential tax regime may be associated with more evasion and lower revenue than a non-preferential one. In their model, some tax evaders are restricted to domestic investment (and, thus, intra-country evasion), whereas others engage in cross-border evasion. Accordingly, there are two tax bases, an internationally mobile and an immobile one. In this regard, their setting is similar to the one of our model. However, tax evasion is not modeled explicitly in Janeba and Peters (1999), as opposed to our paper.

The present work is also related to several contributions which emphasize the impact of domestic determinants on countries' competitive tax-setting behavior. These determinants are manifold, including political factors like lobbying (Lai, 2014), partisanship (Osterloh and Debus, 2012), and institutional restrictions (Hallerberg and Basinger, 1998). Furthermore, budget rigidity (Swank and Steinmo, 2002), financial development (Mardan, 2018), norms of fairness (Plümper et al., 2009), and country risk (Mardan and Stimmelmayr, 2018, and Sanjo, 2012) seem to play a role. Basinger and Hallerberg (2004), Slemrod (2004), and Swank (2016a) estimate to what extent domestic factors and international competitive pressure have contributed to the decline of corporate tax rates since the 1980's.

In this paper, we show that a country's competitive tax setting may be

affected by the threat of corporate tax evasion, or, on a more detailed level, by country characteristics that make evasion more attractive to firms, like widespread corruption and weak institutions. Thus, our finding seems to be particularly, but by no means exclusively, relevant in the context of transition and developing countries (cf. Schneider and Enste, 2000; 2013).

Crivelli et al. (2016) show that international tax competition actually impacts the policy choices of developing countries, with both real investment and tax-planning activities playing a role in this context. In particular, the influence of profit shifting on a country's tax-setting behavior seems to be stronger in developing economies, compared to advanced ones. Analyses of the developments in corporate taxation in transition and developing countries are provided by Abbas and Klemm (2013), Abramovsky et al. (2014), Keen and Simone (2004), and Swank (2016b). On a related note, Besley and Persson (2013, 2014) investigate the link between taxation and development, while Bjørnskov (2011) and Dreher et al. (2009) examine the relationship between institutional quality, corruption, and informality. Gokalp et al. (2017) argue that formal firms may have strong incentives to evade taxes if they face competition from the informal sector, especially if they have to deal with inefficient institutions and burdensome regulations. In line with this finding, Bird et al. (2008) stress that well-functioning institutions are essential for raising adequate tax revenue.

All of these studies suggest that tax policies observed in developing countries often differ fundamentally from the ones of developed countries. Similar to our model, Gordon and Li (2009) provide a theoretical explanation for this pattern which is based on firms' possibility to evade taxes. Their analysis, however, focuses on the role of the financial sector. By contrast, corruption and institutional quality are the key determinants of tax evasion and the driving forces behind country differences in our model. Supporting this notion, Best et al. (2015) and Carrillo et al. (2017) provide empirical evidence that the credibility of tax enforcement crucially affects optimal tax policy. If tax enforcement is limited, which is usually the case in less developed countries, optimal tax policy can be considerable different from a situation with perfect enforcement. Similarly, Mardan (2018) and Mardan and Stimmelmayr (2018) show that a country's competitive tax setting depends on the ability to curb cross-border profit shifting, as well as on the country's level of development.

We contribute to the existing literature on tax competition by examining a previously neglected link between a country's corruption level and institutional quality and its competitive tax-setting behavior. We demonstrate

that bureaucratic corruption and weak institutions may force a country to set a rather low tax rate in order to prevent corporate tax evasion, thereby inducing the country to be more aggressive in tax competition. This finding seems to be particularly relevant for transition and developing economies. Thus, our paper also contributes to the literature that compares the tax-setting behavior of countries which are at different stages of development, by providing a novel explanation why the competitive tax policies of these countries may differ.

The outline of the paper is as follows. Section 2 introduces the model and discusses the impact of corporate tax evasion on a country's tax-setting behavior. Following this, tax competition between countries is examined in Section 3. Section 4 provides some further analysis, while Section 5 concludes.

2 Model setup

Consider an economy consisting of two countries, x and y, each of which hosts $i$mmobile firms of mass α_i^j, with $j = x, y$ denoting the country. Furthermore, there is a mass α_m of $m$obile firms, with $\alpha_i^j, \alpha_m \geq 0$. Firms are assumed to be risk-neutral and may only differ with respect to their mobility. In particular, immobile firms are restricted to their country of residence, due to prohibitive relocation cost, whereas mobile firms can relocate at zero cost.[2] All firms located in country j may enter the market in this country. Market entry is risky, though. It is successful with probability p_s^j, yielding gross profit $\Pi^j \geq 0$ in this case, and fails with probability $1 - p_s^j$, leaving nothing. Thus, market entry in country j is associated with an expected gross profit of $E[\Pi]^j = p_s^j \Pi^j$. The ex-ante success probabilities and the respective profit levels in both countries are common knowledge. Whether a firm's market entry is successful or not, however, is private information to the firm and the tax agent in charge and remains unknown to the government. In country j, firm profits are taxed at rate t^j. A firm can try to evade taxes, though, by offering a bribe payment B^j to the assigned tax agent. If the tax agent accepts the bribe, he reports a failure of the firm and, thus, profits of zero to

[2] Alternatively, the existence of mobile and immobile firms can be interpreted in a dynamic context, following King et al. (1993). If a firm's investment in a country is associated with sunk cost, its mobility is lower in the following period (after the investment took place). Accordingly, the immobile firms in our model may represent initially mobile ones which have chosen their location in a (not explicitly modeled) previous period.

country j's government.[3]

The game structure is as follows. In the first and second stage, the countries' governments sequentially set their tax rates. After observing these tax rates, mobile firms choose their location and all firms decide on market entry in their respective country of residence. In the fourth stage, the outcome of firms' market entry is determined. After that, firms choose between tax-compliant behavior and bribery. Tax agents decide on potential bribe offers and report firm profits to the government in the sixth stage. Finally, (net) payoffs of firms and agents as well as tax revenue of both governments are realized. The model is solved via backward induction.

2.1 Tax agents

In the penultimate stage of the game (before outcomes are realized), tax agents decide on whether to accept or reject bribe payments offered by firms. Tax agents are assumed to be risk-neutral and randomly assigned to firms. We assume two types of (otherwise identical) agents: *pliable* agents are susceptible to bribes, whereas *steadfast* agents are not. The share of steadfast agents in country j, s^j, is common knowledge. By contrast, an agent's type is his private information.[4] In country j, bribery is detected afterwards by the government with probability p_d^j. The corrupt tax agent loses his job and the associated wage w^j but still gets the bribe B^j in such a case.[5] For simplicity, we assume agents' opportunity wage to be equal to zero. Furthermore, being corrupt is associated with personal cost $\mu^j > 0$ for a tax agent in country j.[6]

[3] Cobham (2005) shows that both legal tax avoidance as well as illegal tax evasion pose serious problems to revenue collection in less developed countries. Within our framework, however, we primarily think of illegal tax evasion. The notion that cooperation between taxpayer and public agent gives rise to tax evasion is common in the literature. See, e.g., Ades and Di Tella (1999), Besley and McLaren (1993), or Sanyal et al. (2000). In such a setting, it may be optimal for a government, under certain circumstances, to tolerate tax evasion. This also applies to our model, as argued below and shown in Letsche et al. (2018). Empirically, Alm et al. (2016) identify corruption of tax officials as a significant determinant of firm tax evasion. Anecdotal evidence on the topic is provided by Cheung et al. (2012).

[4] We may think of the share of pliable agents in country j, $1 - s^j$, as a proxy for country j's corruption level (cf. Letsche et al., 2018).

[5] Assuming that bribe payments accrue to the government and become tax revenue in case of detection does not alter the qualitative results of the model.

[6] We think of μ^j as moral concerns or remorse associated with corrupt behavior. Consequently, μ^j is assumed to arise irrespective of whether bribery is detected by the govern-

Thus, a pliable agent accepts a bribe offer if

$$B^j + (1 - p_d^j)w^j - \mu^j \geq w^j \quad \Leftrightarrow \quad B^j \geq \tilde{B}^j \equiv p_d^j w^j + \mu^j.^7 \tag{1}$$

$\tilde{B}^j$ defines the lowest bribe that is accepted by a pliable agent in country j. We may motivate the existence of steadfast agents by arguing that the personal cost μ^j is infinitely high for a fraction s^j of all agents. For these agents, inequality (1) never holds. We assume p_d^j, w^j, μ^j, and, consequently, $\tilde{B}^j$ to be common knowledge.

2.2 Firms

Firm behavior is determined in the third, fourth, and fifth stage of the game. In the fifth stage, firms decide on whether or not to offer a bribe payment to the assigned tax agent. If the tax agent accepts the bribe, he reports a failure and zero profits of the firm to the government. Thus, a firm does not have to pay taxes at all if its bribe is accepted by the agent and not detected by the government. Note that a failed firm has no incentive to bribe, because its gross profit and, hence, its tax burden are zero.

Since the necessary bribe payment $\tilde{B}^j$ is common knowledge, a bribe attempt is rejected and reported only if the responsible tax agent is steadfast, with probability s^j in country j. Moreover, as already mentioned, accepted bribe attempts are detected ex post by the government with probability p_d^j. We suppose that the penalty on the firm is the same in both cases. In particular, we assume the penalty rate to be $\lambda^j > 1$ in country j. Thus, a firm's payment to the government is $\lambda^j t^j \Pi^j$ (instead of $t^j \Pi^j$) if attempted or accomplished bribery is exposed. We assume p_d^j and λ^j to be exogenously given.[8] Accordingly, a bribe attempt is associated with an expected net profit

ment or not. By contrast, some related contributions (like, e.g., Ades and di Tella, 1999) assume that corrupt agents incur personal cost only in case of detection. Our findings remain qualitatively unchanged if we adopt this premise.

[7] Without loss of generality, we assume that agents accept the bribe offer in case of indifference, while firms prefer compliant behavior over evasion and market entry over non-entry in case of indifference. In line with our above reasoning and inequality (1), Khan et al. (2015) provide evidence that both the level of bribe payments and the scope of tax evasion crucially depend on tax collector compensation, while Fjeldstad (2003) stresses that an increase of public wages may lead to higher bribes rather than reduced corruption if control mechanisms are inefficient and sanctions are weak.

[8] The results of the model are qualitatively the same if we allow for endogenous p_d^j and λ^j. It is reasonable (and common in the literature) to assume that country j's government

of

$$\hat{\pi}_e^j = (1 - q^j \lambda^j t^j)\Pi^j - (1 - s^j)\tilde{B}^j \tag{2}$$

in country j, with $q^j \equiv (1-s^j)p_d^j + s^j$ defining the overall probability of detection and e indicating evasive behavior.[9] In case of tax-compliant ('honest') behavior, which is indicated by h, a firm's net profit is

$$\pi_h^j = (1 - t^j)\Pi^j \tag{3}$$

in country j. Consequently, a firm attempts bribery if

$$\hat{\pi}_e^j > \pi_h^j \quad \Leftrightarrow \quad t^j > t_{eh}^j \geq 0, \tag{4}$$

where

$$t_{eh}^j \equiv \frac{(1 - s^j)\tilde{B}^j}{(1 - q^j \lambda^j)\Pi^j} \tag{5}$$

defines the tax rate for which a firm that operates in country j is indifferent between $h$onest and $e$vading behavior. Thus, t_{eh}^j constitutes an upper limit to taxation of compliant firms in country j.[10] Notably, t_{eh}^j is decreasing in the gross profit level: $\partial t_{eh}^j / \partial \Pi^j < 0$. This means that the higher country-specific profits Π^j are, the more likely, c.p., are bribe attempts and tax evasion by firms operating in this country.

Firms anticipate their subsequent compliance behavior in case of success when deciding on market entry in the second stage. Denoting the outside option of a firm located in country j by $\pi^{o,j}$, the market entry condition in country j is given by

$$p_s^j \hat{\pi}_e^j \geq \pi^{o,j} \Leftrightarrow t^j \leq t_{oe}^j \equiv \frac{1}{q^j \lambda^j}\left(1 - \frac{\pi^{o,j} + p_s^j (1 - s^j)\tilde{B}^j}{p_s^j \Pi^j}\right) \tag{6}$$

for evading firms and

$$p_s^j \pi_h^j \geq \pi^{o,j} \quad \Leftrightarrow \quad t^j \leq t_{oh}^j \equiv 1 - \frac{\pi^{o,j}}{p_s^j \Pi^j} \tag{7}$$

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is limited when deciding on these variables, due to monitoring or auditing cost (regarding p_d^j) and legal and political obstacles (regarding λ^j). Thus, tax enforcement is imperfect and firms may have an incentive to evade taxes even if p_d^j and λ^j are set optimal (cf. Carrillo et al., 2017).

[9] Although actual tax evasion only takes place if the bribe attempt is successful, we refer to all firms that attempt bribery as *evading*.

[10] Note that tax evasion is never worthwhile for firms if $q^j \lambda^j > 1$ (implying $t_{eh}^j < 0$). Accordingly, the threshold t_{eh}^j does not define an upper limit to taxation in this case.

for honest firms. t^j_{oe} and t^j_{oh} define the maximum tax rates for which *e*vading and *h*onest firms just prefer entering country j's market over their *o*utside option. Both of these threshold tax rates are increasing (decreasing) in Π^j ($\pi^{o,j}$). Hence, market entry as well as tax evasion are more likely if country-specific profits are high.[11] For mobile firms located in country j, the alternatives to market entry in j are relocation (to country $k \neq j$) and non-entry. By contrast, not entering the market is the only alternative for immobile firms located in j. Firms' payoff in case of non-entry is assumed to be the same in both countries and given by $\underline{\pi} \geq 0$. Accordingly, the (relevant) outside option of a firm located in j is

$$\pi^{o,j} = \begin{cases} \pi^{o,j}_m = \max\{E[\pi]^k, \underline{\pi}\} & \text{for } m\text{obile firms} \\ \pi^{o,j}_i = \underline{\pi} & \text{for } i\text{mmobile firms,} \end{cases} \tag{8}$$

where $E[\pi]^k$ denotes the expected net profit a firm can realize in country $k \neq j$.[12]

Note that the threshold tax rates referring to market entry, t^j_{oe} (6) and t^j_{oh} (7), may be lower for mobile firms, compared to immobile ones, since mobile firms have a weakly higher outside option: $\pi^{o,j}_m \geq \pi^{o,j}_i$, implying $t^j_{oe,m} \leq t^j_{oe,i}$ and $t^j_{oh,m} \leq t^j_{oh,i}$. This means that it tends to be more difficult for countries to induce market entry of mobile firms (by setting the tax rate sufficiently low). By contrast, the tax-compliance threshold t^j_{eh} (5) is the same for all firms. Thus, the difficulty for countries to prevent corporate tax evasion (by setting the tax rate sufficiently low) is the same for mobile and immobile firms.

2.3 Governments

At the game's first two stages, the two revenue-maximizing governments sequentially set their tax rates.[13] They are limited by firms' outside option

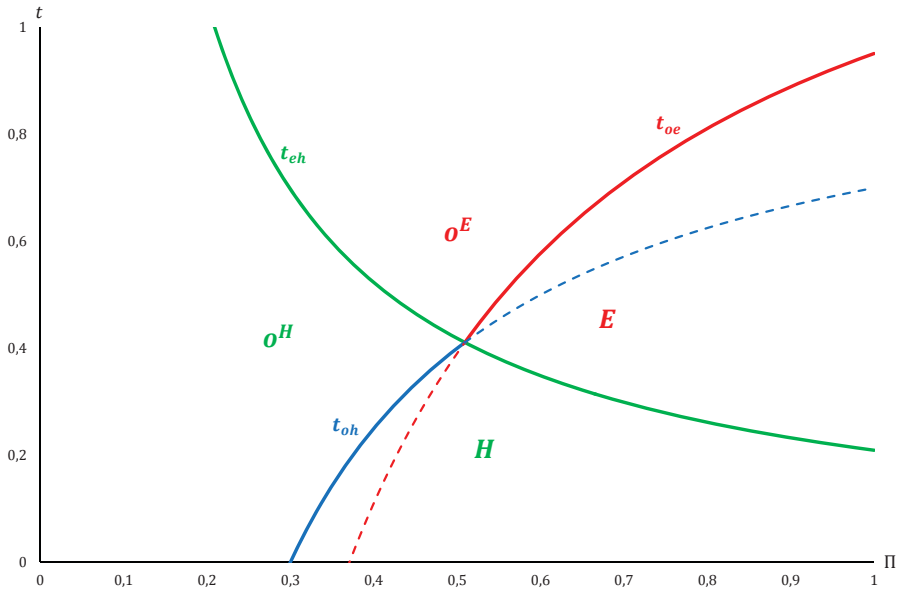
[11] If t^j_{oe} (t^j_{oh}) is negative, $t^j < 0$ (i.e., a subsidy) is necessary to induce evading (honest) firms to enter country j's market. Offering a subsidy cannot be optimal in our model for a revenue-maximizing government, though. Thus, evading (honest) firms do not enter country j's market if t^j_{oe} (t^j_{oh}) is negative.

[12] We only make use of the subscript m (i) when referring to *m*obile (*i*mmobile) firms exclusively. By contrast, we drop the firm subscript entirely when referring to both types of firms.

[13] In case of simultaneous tax setting, the game has no pure strategy equilibrium. Therefore, we assume a sequential structure for convenience and in order to focus on the country-specific determinants of tax competition.

and the possibility of tax evasion. The attractiveness of firms' alternatives is captured by the threshold tax rates t_{eh} (5), t_{oe} (6), and t_{oh} (7).[14] In Figure 1, all three threshold tax rates are depicted as functions of the gross profit level Π, which allows us to map firm behavior for different values of Π and t. From a country's perspective, Figure 1 can be divided into four areas, each representing a certain firm behavior.

Figure 1: Threshold tax rates and possible firm behavior



Note: For convenience, we let Π run from 0 to 1 (all parameters are scaled accordingly).

The lower right area denoted by H captures all combinations of Π and t for which it is optimal for firms to enter the country's market and behave compliant in case of success. Formally, $t \leq t_{oh}, t_{eh}$ holds in this area.

The upper right area denoted by E captures all combinations of Π and t for which it is optimal for firms to enter the country's market, but attempt bribery in case of success. Formally, $t_{eh} < t \leq t_{oe}$ and $t_{eh} < t_{oh}$ hold in this area.

The lower (o^H) and upper left area (o^E) capture combinations of Π and t for which it is optimal for firms not to enter the country's market and resort to

[14] For convenience, we drop the country superscript j in this subsection.

their outside option instead. In particular, the o^H-area depicts combinations for which firms would prefer paying taxes over attempting bribery if they were entering the country's market. Formally, $t_{oh} < t \leq t_{eh}$ holds in this case. By contrast, the o^E-area depicts combinations for which firms would prefer tax evasion over compliant behavior if they were entering the country's market. Formally, $t > t_{eh}, t_{oe}$ holds in that case.

Following this distinction and by inspection of Figure 1, it becomes clear that governments face a well-known tradeoff. For a given tax base, revenue is increasing in the tax rate t. However, raising t may lead to a decline of the tax base. More precisely, a higher tax rate might induce firms to change their behavior, from compliance to evasion or non-entry. Thus, these two alternatives limit a country's tax setting. Both market entry and tax compliance are less profitable if the tax rate is high. In Figure 1, the H-area becomes smaller and eventually vanishes for higher values of t. As can be seen, a country's tax rate must neither exceed t_{oh} nor t_{eh} for firms to enter the country's market and behave tax-compliant in case of success. Accordingly, the maximum tax rate a country can charge, while still inducing firms to enter the market and behave compliant, is given by

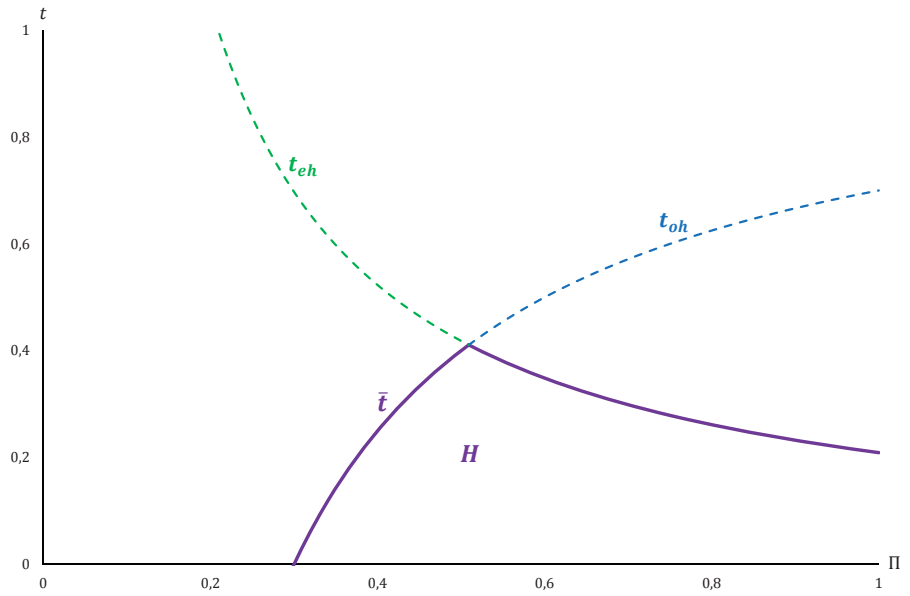
$$\bar{t} = \min\{t_{oh}, t_{eh}\}. \tag{9}$$

Figure 2 shows $\bar{t}$ (9) as a function of Π. Depending on the value of Π (and on the other determinants of t_{eh} (5) and t_{oh} (7)), either tax evasion or the outside option is more attractive to compliant firms and, therefore, limiting the country's tax setting. Accordingly, the $\bar{t}$-curve in Figure 2 follows directly from the upper boundary of the H-area in Figure 1, which is jointly determined by the blue t_{oh}- and the green t_{eh}-curves. The former (latter) curve is upward- (downward-)sloping, as the threshold tax rate t_{oh} (7) (t_{eh} (5)) is increasing (decreasing) in Π.

Evasion is the limiting factor of taxation if $t_{oh} > t_{eh}$. This applies to all points lying to the right of the intersection of the t_{oh}- and the t_{eh}-curve in Figure 1. Thus, tax evasion is the limiting factor if the gross profit level Π is sufficiently high. A high level of Π makes market entry as well as tax evasion in a country more attractive. In Figure 1, this is illustrated by the fact that the o^H- and the o^E-area become smaller for higher values of Π, whereas the E-area broadens. Consequently, the H-area broadens as well (implying an upward-sloping $\bar{t}$-curve in Figure 2) as long as firms' outside option is the limiting factor of taxation. If tax evasion is the limiting factor, the H-area diminishes (and the $\bar{t}$-curve in Figure 2 is downward-sloping) with increasing

Π, as evasion becomes more attractive (compared to both compliance and non-entry).

Figure 2: Maximum attainable tax rate



Note: For convenience, we let Π run from 0 to 1 (all parameters are scaled accordingly).

If evasion is the limiting factor of taxation, it may be worthwhile for a country to tolerate tax non-compliance to some extent, namely if the expected revenue from fines on detected bribery is sufficiently high. Thus, we may, in principle, distinguish between three different country types: it can either be optimal for a country to (i) ignore, (ii) combat, or (iii) tolerate tax evasion. See Letsche et al. (2018) for more details on the different country types. When analyzing tax competition between governments in the following, however, we restrict the analysis to the first two country types. That is, we assume that no country tolerates tax evasion.[15]

[15] Excluding the third or, alternatively, the first country type from our tax competition analysis seems reasonable, as type (i) and type (iii) countries should be very different from each other, regarding, e.g., their corruption level and institutional quality (cf. Letsche et al., 2018). Therefore, it is doubtful that firms which think about a type (i) country as a possible destination also consider type (iii) countries for their location decision. Accordingly, it should be appropriate to assume that type (i) and type (iii) countries are not tax competitors to each other.

3 Tax competition

Since firms are assumed to be homogeneous except for their mobility, all immobile firms that are located in country j behave in the same way. Analogously, this also applies for all mobile firms, which furthermore all locate in the same country. Nevertheless, the optimal behavior of mobile and immobile firms may differ, as the former's outside option is higher if $E[\pi]^k > 0$ (cf. (8)). As mentioned above, a higher outside option implies lower threshold tax rates t^j_{oe} (6) and t^j_{oh} (7).[16] In Figure 1, a higher outside option is associated with rightward-shifts of the blue t_{oh}- and the red t_{oe}-curves, as higher country-specific profits Π are necessary to attract a firm, given a certain tax rate. This implies that both the H- and the E- area are declining in firms' outside option, illustrating the intuitive result that firms with a higher outside option (that is, mobile firms) are less likely to enter a country's market. Consequently, the maximum tax rate $\bar{t}^j$ (9) country j can charge tends to be lower if it wants to attract mobile firms, as opposed to taxing the resident immobile ones only: $\bar{t}^j_m \leq \bar{t}^j_i$.

Following this reasoning, and given the fact that all firms of a certain type behave in the same way, governments' optimization problem is rather simple: a country can try to attract all mobile firms by setting its tax rate sufficiently low. Alternatively, it can tax the resident immobile firms only, at a (potentially) higher rate. In both cases, the country is limited in its tax setting by firms' outside option $\pi^{o,j}$ (8) and their possibility to evade, as captured by t^j_{eh} (5), t^j_{oh} (7), and $\bar{t}^j$ (9).

When comparing a country's alternatives in the following, firms' payoff in case of non-entry is assumed to be zero ($\underline{\pi} = 0$) for simplicity. Firms' outside option (8) is then given by

$$\pi^{o,j} = \begin{cases} \pi^{o,j}_m = \max\{E[\pi]^k, 0\} & \text{for } m\text{obile firms} \\ \pi^{o,j}_i = 0 & \text{for } i\text{mmobile firms,} \end{cases}$$

3.1 Benchmark

If only immobile firms are taxed in country j, the maximum attainable tax rate (9) that follows from substitution of $t^j_{eh,i}$ (5), $t^j_{oh,i}$ (7), and $\pi^{o,j}_i$ (8) is

[16] We reintroduce country superscripts at this point.

given by

$$\bar{t}_i^j = \min\{t_{oh,i}^j, t_{eh}^j\} = \min\left\{1, \frac{(1-s^j)\tilde{B}^j}{(1-q^j\lambda^j)\Pi^j}\right\}, \tag{10}$$

implying the expected tax revenue

$$E[R]_i^j = \bar{t}_i^j \alpha_i^j E[\Pi]^j = \alpha_i^j p_s^j * \min\left\{\Pi^j, \frac{(1-s^j)\tilde{B}^j}{1-q^j\lambda^j}\right\}. \tag{11}$$

Note that taxation is such that firms are induced to behave compliantly. Thus, firms' net profit in case of success is $\pi_h^j = (1-t^j)\Pi^j$ (3). Accordingly, the expected net profit of immobile firms in country j is

$$E[\pi]_i^j = p_s^j(1-\bar{t}_i^j)\Pi^j = \max\left\{0, p_s^j\left(\Pi^j - \frac{(1-s^j)\tilde{B}^j}{1-q^j\lambda^j}\right)\right\} \tag{12}$$

if only these firms are taxed. In the following, we use and refer to this outcome as *benchmark*.

The government's tax setting is limited by immobile firms' outside option if the first term of the curly brackets in equation (10) is binding, i.e. if

$$t_{oh,i}^j \leq t_{eh}^j \quad \Leftrightarrow \quad \Pi^j \leq \overline{\Pi}_i^j \equiv \frac{(1-s^j)\tilde{B}^j}{1-q^j\lambda^j}. \tag{13}$$

$\overline{\Pi}_i^j$ defines the gross profit level for which evasion becomes the limiting factor of taxation, meaning that the second term of the curly brackets in equation (10) becomes binding. Given this threshold value, we can specify equations (10), (11), and (12) to obtain

$$\left\langle \bar{t}_i^j, E[R]_i^j, E[\pi]_i^j \right\rangle =$$

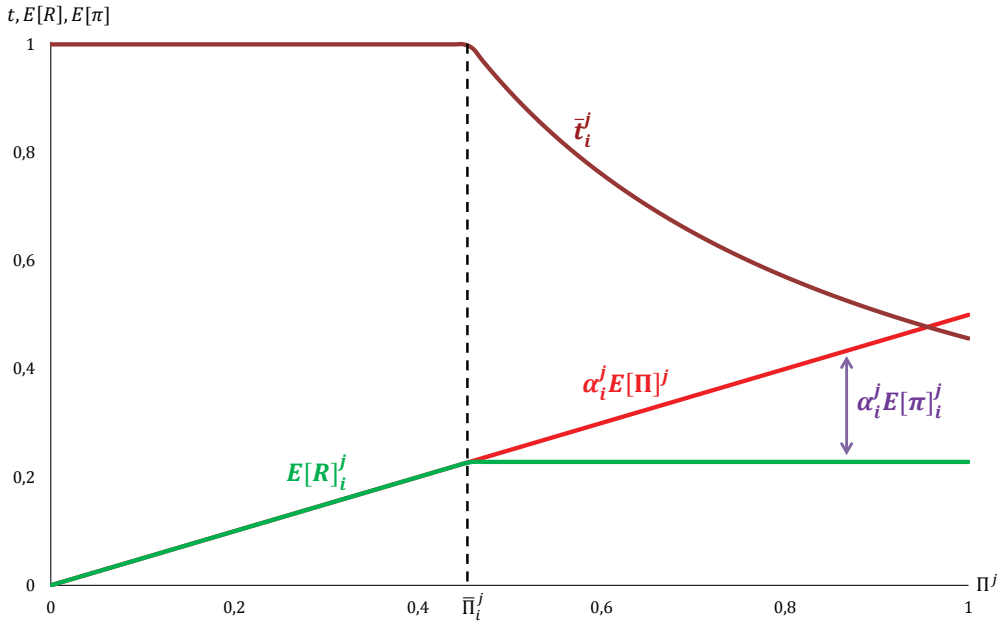
$$\begin{cases} \left\langle 1,\ E[\Pi]^j,\ 0 \right\rangle & \text{if } \Pi^j \leq \overline{\Pi}_i^j \\ \left\langle \frac{(1-s^j)\tilde{B}^j}{(1-q^j\lambda^j)\Pi^j},\ \alpha_i^j p_s^j \frac{(1-s^j)\tilde{B}^j}{1-q^j\lambda^j},\ E[\Pi]^j - \frac{p_s^j(1-s^j)\tilde{B}^j}{1-q^j\lambda^j} \right\rangle & \text{if } \Pi^j > \overline{\Pi}_i^j. \end{cases} \tag{14}$$

The obtained results for $\bar{t}_i^j$, $E[R]_i^j$, and $E[\pi]_i^j$ are illustrated in Figure 3 (where Π^j is, once again, used as explanatory variable).

If taxing immobile firms only, country j is able to reap firm profits entirely by setting $\bar{t}_i^j = t_{oh,i}^j = 1$ if $\Pi^j \leq \overline{\Pi}_i^j$. That is, as long as tax evasion is no relevant option for firms. If gross profits exceed this threshold ($\Pi^j > \overline{\Pi}_i^j$),

country j is limited in its tax setting by the threat of evasion. Thus, in order to induce compliance by firms, the country is forced to lower its tax rate to $t^j_{eh} = \frac{(1-s^j)\tilde{B}^j}{(1-q^j\lambda^j)\Pi^j}$. This is illustrated by the downward-sloping part of the brown $\bar{t}^j_i$-curve in Figure 3. As a consequence, country j is unable to additionally benefit from gross profits that exceed $\overline{\Pi}^j_i$ and expected revenue is limited to $\alpha^j_i p^j_s \frac{(1-s^j)\tilde{B}^j}{1-q^j\lambda^j}$ (cf. (14)). Accordingly, a firm's expected net profit $E[\pi]^j_i$ is zero for $\Pi^j \leq \overline{\Pi}^j_i$ and increases linearly in Π^j once the threshold value $\overline{\Pi}^j_i$ is reached. In Figure 3, the expected net profits of all immobile firms in country j, $\alpha^j_i E[\pi]^j_i$, are given by the distance between the red curve and the green $E[R]^j_i$-curve. The red curve depicts the expected gross profits of all immobile firms in country j, $\alpha^j_i E[\Pi]^j$. Through taxation, $\alpha^j_i E[\Pi]^j$ is divided into the sum of firms' expected net profits $\alpha^j_i E[\pi]^j_i$ and country j's expected tax revenue $E[R]^j_i$. As already stated above, country j can reap firm profits entirely until $\Pi^j = \overline{\Pi}^j_i$, but does not benefit from rents that exceed $\overline{\Pi}^j_i$.

Figure 3: Outcome if only immobile firms are taxed (benchmark)



Note: For convenience, we let Π^j run from 0 to 1 (all parameters are scaled accordingly).

This outcome is rather extreme, due to the strict assumption of homogeneous, entirely immobile firms with outside option $\pi_i^{o,j} = \underline{\pi} = 0$. Nevertheless, it shows that a country's tax policy, and the degree to which this tax policy translates into revenue, crucially hinges on firms' opportunities to evade taxes. More precisely, countries in which tax evasion is attractive to firms are far less likely to benefit from profits that accrue within their borders in an adequate manner.

As can be seen from t_{eh}^j (5), inequality (13), and Figure 1, high country-specific gross profits Π^j make country j more vulnerable to tax evasion. Taking a closer look at the threshold levels t_{eh}^j (5) and $\overline{\Pi}_i^j$ (13) allows us to identify further country characteristics that affect a government's ability to generate a decent amount of tax revenue. In particular, we have

$$\frac{\partial t_{eh}^j}{\partial \phi^j}, \frac{\partial \overline{\Pi}_i^j}{\partial \phi^j} > 0 \quad \text{for } \phi = w, \mu, s, p_d, \lambda.$$

High values of w^j, μ^j, s^j, p_d^j, and λ^j make tax evasion less profitable and imply higher threshold levels t_{eh}^j and $\overline{\Pi}_i^j$, allowing country j to reap a larger share of firm profits. Put the other way round and interpreting these variables rather generally, we can state that relatively poor countries (implying a low public wage w^j) with weak financial institutions (low detection probability p_d^j and penalty rate λ^j) and a high corruption level (low moral cost μ^j and share of steadfast agents s^j) are more limited in generating tax revenue from corporate income.

3.2 Determinants of tax competition

Instead of taxing only the resident immobile firms, at rate $\bar{t}_i^j$ (10), a country can attract the mass α_m of mobile firms by setting $t^j = \bar{t}_m^j \leq \bar{t}_i^j$. Doing so is optimal for country j if

$$\bar{t}_m^j(\alpha_i^j + \alpha_m)E[\Pi]^j \geq \bar{t}_i^j \alpha_i^j E[\Pi]^j \quad \Leftrightarrow \quad \bar{t}_m^j \geq t_{min}^j \equiv \frac{\alpha_i^j}{\alpha_i^j + \alpha_m}\bar{t}_i^j. \tag{15}$$

The country has to trade off a possible increase in the tax base (by $\alpha_m E[\Pi]^j$) against a lower tax rate ($\bar{t}_m^j \leq \bar{t}_i^j$) and, hence, revenue per firm. t_{min}^j defines the lowest tax rate country j is willing to set in order to attract the mass of mobile firms. We can identify two factors that influence t_{min}^j. The relative

size of a country, in terms of resident immobile firms α_i^j, and the attractiveness of tax evasion in the country, which is captured by $\bar{t}_i^j$. α_i^j and $\bar{t}_i^j$ (10) are country j's benchmark tax base and tax rate, respectively, and, therefore, jointly determine the opportunity cost the country incurs if it engages in tax competition for mobile firms. Low values of α_i^j and $\bar{t}_i^j$ imply low opportunity cost and, as a consequence, a low minimum tax rate t_{min}^j (15) of country j, representing a high *aggressiveness* in tax competition.

To explain this finding in more detail, we substitute $\bar{t}_i^j$ (10) in (15) to obtain

$$t_{min}^j = \frac{\alpha_i^j}{\alpha_i^j + \alpha_m} * \min\{t_{oh,i}^j, t_{eh}^j\} = \frac{\alpha_i^j}{\alpha_i^j + \alpha_m} * \min\left\{1, \frac{(1-s^j)\tilde{B}^j}{(1-q^j\lambda^j)\Pi^j}\right\}. \quad (16)$$

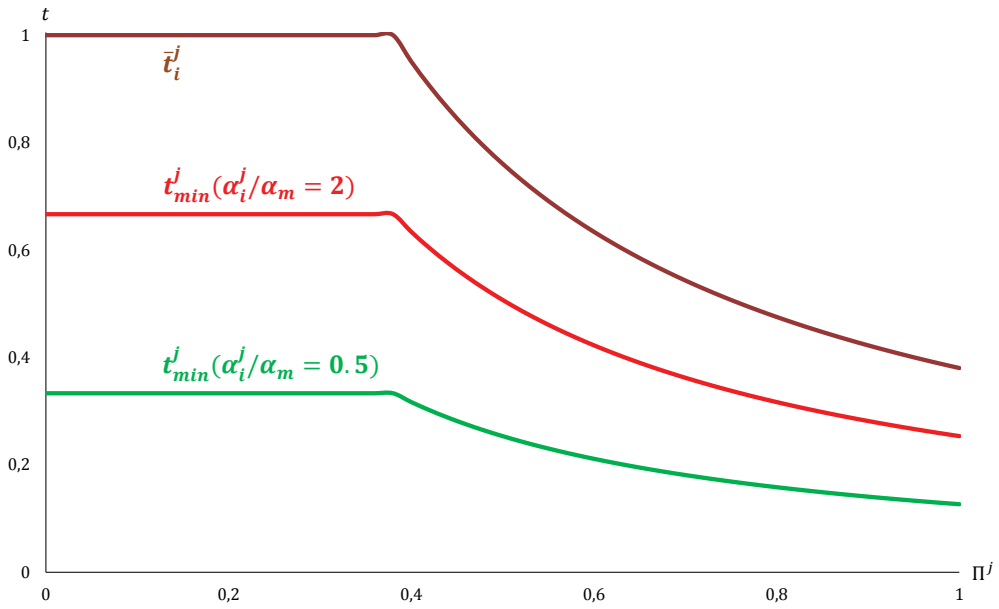
The first term in equation (16), $\frac{\alpha_i^j}{\alpha_i^j+\alpha_m}$, relates the tax base of country j if only immobile firms are taxed to the potential tax base if the country is able to attract the mass α_m of mobile firms. This fraction represents the tax cut country j is willing to bear for the sake of attracting the mobile firms, as t_{min}^j is a constant and discounted fraction of the benchmark tax rate $\bar{t}_i^j$, with $\frac{\alpha_i^j}{\alpha_i^j+\alpha_m}$ being the discount factor (cf. (15)). Accordingly, t_{min}^j (16) is affected by Π^j, w^j, μ^j, s^j, p_d^j, and λ^j in the same way as $\bar{t}_i^j$ (10).

Unsurprisingly, governments are more inclined to cut their tax rate if the mass of mobile (immobile) firms is high (low), since attracting the mobile firms is associated with a relatively large increase of the tax base in this case: $\partial t_{min}^j/\partial\alpha_m < 0 < \partial t_{min}^j/\partial\alpha_i^j$. This is illustrated in Figure 4, where a country's benchmark tax rate $\bar{t}_i^j$ (10) and the corresponding t_{min}^j (16) in case that firms are rather mobile (green curve) or immobile (red curve) are depicted. Thus, tax competition between countries is more severe if α_m is high (α_i^x and α_i^y are low).[17] Since the mass of resident immobile firms, α_i^j, may be interpreted as the size of a country, we can state that smaller countries (i.e., those with lower values of α_i^j) tend to be more aggressive in tax competition, as indicated by a lower t_{min}^j (16). This is a common result in the literature on asymmetric tax competition (see, most notably, Bucovetsky, 1991, and Wilson, 1991). In the following, we will refer to this feature as *size effect*. Figure 4 can be interpreted in this context, too, as the green and the red curves may represent the minimum tax rates of a small (green) and a large (red) country which differ in size but not in their benchmark tax rate.

[17] In the limit case without immobile firms ($\alpha_i^x = \alpha_i^y = 0$), $t_{min}^x = t_{min}^y = 0$, implying the well-known "race to the bottom" result (with equilibrium tax rates $t^x = t^y = 0$).

Remarkably, a country's competitive tax setting further depends on the attractiveness of tax evasion in that country, as the latter affects $\bar{t}_i^j$ (10) and, consequently, t_{min}^j (16) via the threshold tax rate t_{eh}^j (5). If evasion is the limiting factor of taxation, $\bar{t}_i^j = t_{eh}^j$ holds, meaning that a change in t_{eh}^j translates into a proportional change in t_{min}^j. Thus, we can state that high country-specific profits Π^j, low public wages w^j, widespread corruption (implying low values of μ^j and s^j), and weak tax enforcement (low values of p_d^j and λ^j) make evasion more attractive to firms (which is indicated by a lower threshold tax rate t_{eh}^j (5)), tend to limit a country's ability to raise revenue (cf. Subsection 3.1), and may induce the country to be more aggressive in tax competition (as indicated by a lower t_{min}^j (16)). We refer to the latter outcome as *evasion effect*.

Figure 4: Benchmark and minimum tax rates in case of high (green curve) and low (red curve) firm mobility



Note: For convenience, we let Π^j run from 0 to 1 (all parameters are scaled accordingly).

Besides country size and firms' incentive to evade taxes, location-specific rents can be identified as a third determinant of tax competition. To see this, recall that both countries set their tax rates such that resident firms prefer

tax-compliant behavior over evasion. Therefore, firms' expected net profit follows from π_h^j (3) and is given by

$$E[\pi]^j = p_s^j \pi_h^j = (1 - t^j) E[\Pi]^j \tag{17}$$

when operating in country j. Mobile firms are able to locate in the country where their expected net profit is highest. Accordingly, all mobile firms locate in country x if

$$\left(1 - t^x\right) E[\Pi]^x \geq \left(1 - t^y\right) E[\Pi]^y.^{18} \tag{18}$$

Obviously, firms are attracted by country-specific rents, as captured by expected profits $E[\Pi]^j = p_s^j \Pi^j$, and willing to bear a (somewhat) higher tax burden in order to locate in the country with the higher $E[\Pi]^j$. Other things equal, the respective country is, thus, able to charge a higher tax rate than its competitor while still attracting the mobile firms.[19] Be aware, however, that large country-specific rents do not necessarily translate into a high tax rate and high revenue if there are tax evasion opportunities for firms. In particular, country j's tax rate and revenue are increasing in Π^j if firms' outside option is the limiting factor of taxation ($\bar{t}^j = t_{oh}^j$), but fail to do so if tax evasion is ($\bar{t}^j = t_{eh}^j$), as both locating in country j as well as evasion are more attractive to firms if Π^j is high. In the latter case, the country is forced to set a rather low tax rate in order to prevent firms from evading taxes (cf. Figures 2 and 3). This pattern may explain why some countries are able to generate high revenue from large country-specific rents, while others are not. Our results suggest that such rents only translate into a high tax and high revenue if firms' evasion incentives are sufficiently low.[20]

To summarize, we identify three different factors that determine countries' competitive tax setting and, as a consequence, the outcome of tax competition:

(1) Rents - high location-specific rents Π^j allow a country to charge a higher tax, but only if firms' evasion incentives are sufficiently low.

[18] Without loss of generality, we assume that firms prefer country x in case of indifference.

[19] Similar findings are documented in the literature for different sources of country-specific rents. These include, for example, agglomeration effects (Baldwin and Krugman, 2004; Kind et. al, 2000), market structure (Ferrett and Wooton, 2010; Haufler and Wooton, 2010), market size (Bjorvatn and Eckel, 2006; Haufler and Wooton, 1999), public good provision (Pieretti and Zanaj, 2011; Zissimos and Wooders, 2008), and natural resource abundance (Ogawa et al., 2016).

[20] See Letsche et al. (2018) for a more detailed analysis which includes countries that tolerate tax evasion.

(2) Size - small countries (as indicated by a low mass α_i^j of immobile firms) tend to be more tax aggressive (*size effect*).

(3) Evasion incentives - countries in which tax evasion is attractive to firms (as indicated by low values of t_{eh}^j (5) and $\overline{\Pi}_i^j$ (13)), due to, e.g., bureaucratic corruption and limited tax enforcement, tend to be more tax aggressive (*evasion effect*).

Note, however, that these findings may not fully apply to countries in which tax evasion is highly attractive to firms. As argued in Subsection 2.3 and shown in Letsche et al. (2018), it can be optimal for such countries to tolerate tax evasion, at least to some extent. Accordingly, the threat of evasion does not limit these countries' tax setting. Thus, the *evasion effect* should not apply to countries that tolerate tax evasion.

This reasoning is supported by descriptive statistics provided in Keen and Simone (2004). Analyzing the developments in corporate taxation from 1990 to 2001, they find that statutory tax rates have decreased the most in upper- and middle-income developing countries, compared to developed and low-income developing countries.[21] In the context of our model, it seems reasonable to think of upper- and middle-income developing countries as the ones which feature a moderate level of evasion attractiveness, while developed (low-income developing) countries should be characterized by a low (very high) attractiveness of tax evasion. Accordingly, the *evasion effect* predicts upper- and middle-income developing countries to be more aggressive in tax competition than their counterparts, which seems to be in line with the observations of Keen and Simone (2004).[22]

3.3 Optimal tax policy

When analyzing countries' optimal tax policy in the following, we assume $E[\Pi]^x = E[\Pi]^y$ for convenience. Equation (18) then simplifies and all mobile firms locate in country x if

$$(1 - t^x) \geq (1 - t^y) \quad \Leftrightarrow \quad t^x \leq t^y. \tag{19}$$

[21] On average, the tax rates of all country types have declined over time. This, at least partially, reflects an increasing capital mobility and an intensification of tax competition.

[22] Obviously, this is a rather superficial assessment and a more thorough empirical analysis is necessary in order to determine the practical relevance and validity of our findings.

This means that the country with the lower t^j_{min} (16) is able to attract the mass of mobile firms in equilibrium, by setting a lower tax rate than its competitor. We will focus our analysis on country x. Nevertheless, the results analogously apply for country y.

If $t^x_{min} > t^y_{min}$, country x prefers to tax only the resident immobile firms. Then, its tax rate and expected revenue are as described in Subsection 3.1 (benchmark case) and given by $\bar{t}^j_i$ (10) and $E[R]^j_i$ (11).

In order to attract the mobile firms, country x must be willing to (marginally) undercut its competitor's minimum tax rate. That is, $t^x_{min} \leq t^y_{min}$ must hold. Country x is able to attract the mobile firms without setting its tax rate below the benchmark level if $\bar{t}^x_i \leq t^y_{min}$ holds.[23] Therefore, the sequential order (i.e., which country moves first) only affects country x's tax setting if $t^x_{min} \leq t^y_{min} < \bar{t}^x_i$. Then, in case of moving first, country x's tax rate must not exceed t^y_{min} in order to prevent country y from attracting the mobile firms. By contrast, country y anticipates that country x will attract the mobile firms and sets $t^y = \bar{t}^y_i$ if moving first. This allows country x to attract the firms with a tax rate as high as $\bar{t}^y_i$ if moving second. If $\bar{t}^x_i < \bar{t}^y_i$ additionally holds, however, country x is forced to set its tax equal to $\bar{t}^x_i$ (and below $\bar{t}^y_i$) in order to prevent tax evasion by firms.[24]

Accordingly, the optimal tax rate t^x_{opt} of country x is given by

$$t^x_{opt} = \begin{cases} \tilde{t}^x & \text{if} \quad t^x_{min} \leq t^y_{min} < \bar{t}^x_i \\ \bar{t}^x_i & \text{otherwise} \end{cases} \tag{20}$$

and yields an expected tax revenue of

$$E[R]^x_{opt} = \begin{cases} \tilde{t}^x(\alpha^x_i + \alpha_m)E[\Pi]^x & \text{if} \quad t^x_{min} \leq t^y_{min} < \bar{t}^x_i \\ \bar{t}^x_i(\alpha^x_i + \alpha_m)E[\Pi]^x & \text{if} \quad t^x_{min} \leq \bar{t}^x_i \leq t^y_{min} \\ \bar{t}^x_i \alpha^x_i E[\Pi]^x & \text{if} \quad t^x_{min} > t^y_{min}, \end{cases} \tag{21}$$

where $\tilde{t}^x \leq \bar{t}^x_i$ is defined as follows:

$$\tilde{t}^x = \begin{cases} t^y_{min} & \text{if country } x \text{ moves first} \\ \min\{\bar{t}^x_i, \bar{t}^y_i\} & \text{if country } x \text{ moves second.}[25] \end{cases} \tag{22}$$

[23] Since $t^x_{oh,i} = 1$ and $t^y_{min} < 1$ for $\alpha_m > 0$, such an outcome can only arise if tax evasion is the limiting factor of taxation in country x, i.e. for $\bar{t}^x_i = t^x_{eh} < 1$.

[24] Be aware that $t^x_{min} \leq t^y_{min}$ does not necessarily imply $\bar{t}^x_i < \bar{t}^y_i$. Moreover, $\bar{t}^x_i < \bar{t}^y_i$ requires evasion being the limiting factor of taxation in country x ($\bar{t}^x_i = t^x_{eh}$).

[25] The results derived in this subsection remain qualitatively unchanged if we allow for

In case of $\bar{t}_i^x \leq t_{min}^y$, country x attracts the mobile firms and raises more expected revenue, due to a larger tax base, while still being able to charge its benchmark tax rate $\bar{t}_i^x$ (10). By contrast, country x is forced (and willing) to cut its tax rate to $\tilde{t}^x$ (22) in order to attract the mobile firms if $t_{min}^x \leq t_{min}^y < \bar{t}_i^x$. Then, the associated expected revenue is higher than in the benchmark case, but lower than in a scenario where $\bar{t}_i^x \leq t_{min}^y$ (unless $\tilde{t}^x = \bar{t}_i^x$).

The expected net profit of firms that are located and behave tax-compliant in country x follows from π_h^x (3) and t_{opt}^x (20) and is given by

$$E[\pi]_{opt}^x = \begin{cases} (1-\tilde{t}^x)E[\Pi]^x & \text{if} \quad t_{min}^x \leq t_{min}^y < \bar{t}_i^x \\ (1-\bar{t}_i^x)E[\Pi]^x & \text{otherwise.} \end{cases} \tag{23}$$

Obviously, a tax reduction (from $\bar{t}_i^x$ to $\tilde{t}^x$) by country x translates into higher profits for all firms located in x. Thus, immobile firms benefit if mobile firms are attracted to their country of residence, but only if the attracting country is forced to reduce its tax rate. This result crucially hinges on two assumptions of the model. First, we assume firm profits to be independent of the number of firms located in a country and, second, we abstract from preferential tax regimes.[26] Further note that this finding does not represent any agglomeration effects. Firms' expected net profit is higher, if at all, due to a lower tax rate, not because of a higher gross profit level induced by the presence of other firms.

Finally, be aware that the limiting factor of taxation in country x may change if the country engages in tax competition. In particular, this is the case if country x is initially limited by the threat of evasion (implying $\bar{t}_i^x = t_{eh}^x$) and able to attract the mobile firms, but only by setting its tax rate below the benchmark level: $t_{opt}^x = t_{min}^y < \bar{t}_i^x = t_{eh}^x$. Then, the limiting factor of taxation in country x changes, from tax evasion to mobile firms' outside option (which must be equal to $\pi_m^{o,x} = E[\pi]^y > \underline{\pi}$ in such a case, cf. (8)).

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more than two countries, as illustrated by Marceau et al. (2010) for a setting without tax evasion. Further note that the game has no pure strategy equilibrium in a scenario where $t_{min}^x \leq t_{min}^y < \bar{t}_i^x$ if governments set their taxes simultaneously. Instead, both countries play mixed strategies in equilibrium.

[26] Both Janeba and Peters (1999) and Marceau et al. (2010) compare preferential and non-preferential tax regimes in the presence of a perfectly mobile and a perfectly immobile tax base. They both find countries' tax revenue to be larger if a non-preferential regime is applied.

4 The impact of country size and evasion attractiveness on tax competition

In order to highlight the influence of *size effect* and *evasion effect* on the outcome of tax competition, we continue to assume $E[\Pi]^x = E[\Pi]^y$ in this section. Following the above reasoning and making use of the definition of t^j_{min} in (15), we can state that country x attracts the mobile firms if

$$t^x_{min} \leq t^y_{min} \quad \Leftrightarrow \quad \frac{\overline{t}^x_i}{\overline{t}^y_i} \leq \frac{\alpha^y_i}{\alpha^y_i + \alpha_m} \left(\frac{\alpha^x_i}{\alpha^x_i + \alpha_m} \right)^{-1}. \tag{24}$$

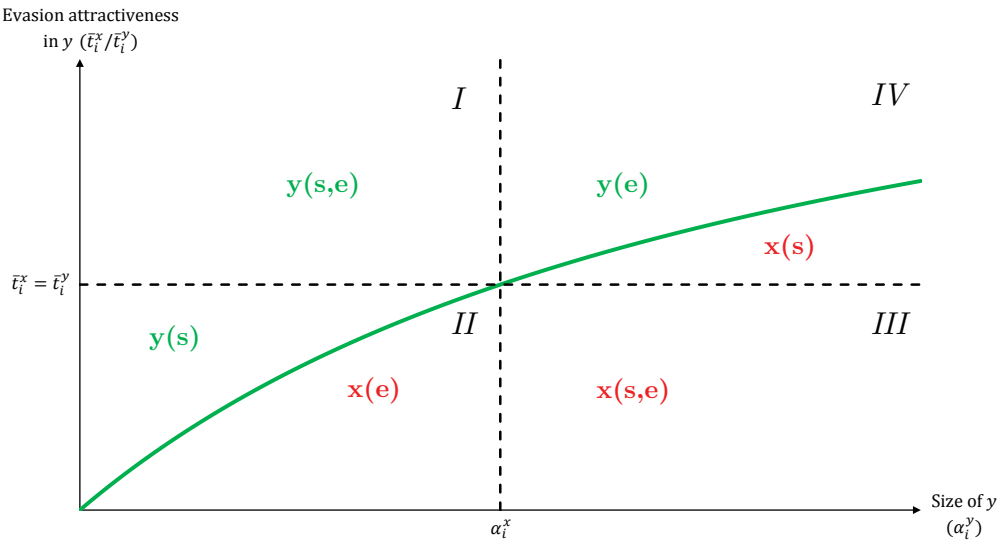
The fraction on the left-hand side of inequality (24) puts the attractiveness of tax evasion in country x in relation to the one in country y. If the fraction is larger than one (i.e., if $\overline{t}^x_i > \overline{t}^y_i$), tax evasion is more attractive to firms, and a stricter limitation of the government's tax setting, in country y. The expression on right-hand side of (24) relates the initial size of country y, in terms of resident immobile firms, to the initial size of country x and to the mass of mobile firms. The expression exceeds one if country y is larger than country x, i.e. for $\alpha^x_i < \alpha^y_i$.

Figure 5 illustrates how both factors, country size and evasion attractiveness, jointly determine the outcome of tax competition. For that purpose, the relative attractiveness of tax evasion in country y, as measured by $\overline{t}^x_i/\overline{t}^y_i$, is plotted against the size of country y, α^y_i, while constant values are assumed for α^x_i and α_m. The green curve depicts all combinations of α^y_i and $\overline{t}^x_i/\overline{t}^y_i$ for which (24) holds with equity ($t^x_{min} = t^y_{min}$). Accordingly, country x (y) sets a lower tax rate and attracts the mobile firms for all points lying below (above) this curve, for which $t^x_{min} < t^y_{min}$ ($t^x_{min} > t^y_{min}$) holds. The vertical dashed line marks all points for which $\alpha^x_i = \alpha^y_i$, meaning that the countries are of equal size, while $\alpha^x_i < \alpha^y_i$ (country x is smaller than country y) holds for all points lying right to this line. The horizontal dashed line indicates all points for which the countries' benchmark tax rates are equal, implying $\overline{t}^x_i/\overline{t}^y_i = 1$. This means that the *evasion effect* is the same for both countries along this line. If tax evasion is more attractive in country y, $\overline{t}^x_i/\overline{t}^y_i > 1$ holds, which is the case for all points lying above the horizontal line.

Given the two dashed lines, we can distinguish four areas, or regimes, present in the Figure 5.

The upper left area denoted by I depicts a regime where country y is smaller ($\alpha^x_i > \alpha^y_i$) and characterized by a higher attractiveness of tax evasion ($\overline{t}^x_i/\overline{t}^y_i > 1$), compared to country x.

Figure 5: Size (s) and evasion (e) effect as determinants of tax competition



The lower left area denoted by II depicts a regime where country y is smaller ($\alpha_i^x > \alpha_i^y$) and characterized by a lower attractiveness of tax evasion ($\bar{t}_i^x/\bar{t}_i^y < 1$), compared to country x.

The lower right area denoted by III depicts a regime where country y is larger ($\alpha_i^x < \alpha_i^y$) and characterized by a lower attractiveness of tax evasion ($\bar{t}_i^x/\bar{t}_i^y < 1$), compared to country x.

Finally, the upper right area denoted by IV depicts a regime where country y is larger ($\alpha_i^x < \alpha_i^y$) and characterized by a higher attractiveness of tax evasion ($\bar{t}_i^x/\bar{t}_i^y > 1$), compared to country x.

Recall that a low number of resident immobile firms (*size effect*, s) and a high attractiveness of evasion (*evasion effect*, e) make a country more aggressive in tax competition, implying a lower t_{min}^j (16). Accordingly, country x unambiguously attracts the mobile firms in Regime III, as both effects make country x more aggressive than country y. This is indicated by the label x(s,e) in Figure 5. Analogously, country y unambiguously attracts the mobile firms in Regime I.

By contrast, the outcome of tax competition is, in principle, ambiguous in Regimes II and IV, since either country may attract the mobile firms, depending on whether the *size* or the *evasion* effect dominates. In Regime

II (*IV*), country x attracts the mobile firms if the *evasion* (*size*) effect dominates. This is the case for all combinations of α_i^y and $\overline{t}_i^x/\overline{t}_i^y$ lying below the green curve, in the x(e) (x(s)) area.

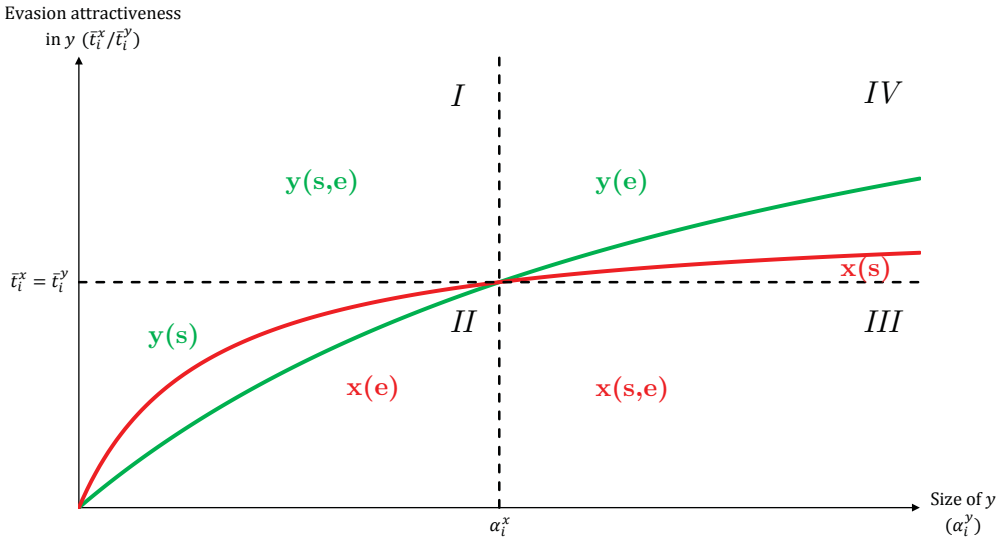
In earlier models of asymmetric tax competition, like Bucovetsky (1991) and Wilson (1991), only the *size effect* is present, implying that larger countries always set higher tax rates and act as capital exporters in equilibrium. As argued above, this does not necessarily apply if countries differ with respect to the location-specific rents they provide. By contrast, a larger country may attract mobile investment, despite charging a higher tax, if, for instance, trade cost (Haufler and Wooton, 1999) or agglomeration effects (Kind et al., 2000) are considered. In addition (and opposed to this), our findings show that the possibility of corporate tax evasion allows for an outcome where the larger country attracts mobile investment, even if location-specific rents are the same and the *size effect* is in place, by setting a lower tax rate.[27] For such an equilibrium to arise, the size difference between the two countries must be relatively small, compared to the difference in evasion attractiveness. That is, the *evasion effect* must dominate the *size effect*. Regarding this, it is interesting to note that the *size effect* is less important and more likely to be dominated by the *evasion effect* if the mass of mobile firms is low. This is illustrated by Figure 6, which is identical to Figure 5 except for the addition of the red curve. The latter depicts a scenario with a lower share of mobile firms ($\alpha_m = 0.3$), compared to the green curve stemming from Figure 5 ($\alpha_m = 1.7$).

In Figure 6, the red curve is more concave than the green one, implying larger (smaller) areas of x(e) and y(e) (y(s) and x(s)). This shows that the *evasion effect* dominates the *size effect* for more combinations of α_i^y and $\overline{t}_i^x/\overline{t}_i^y$ if the mass α_m of mobile firms is low. The explanation is as follows. The possibility of broadening the tax base by attracting the mobile firms provides an incentive for countries to lower their tax rate. This incentive is stronger for the country with the (initially) smaller tax base α_i^j (*size effect*) and increasing in the mass α_m of mobile firms. Thus, the smaller country is more willing, and likely, to attract the mobile firms if α_m is large, which

[27] Janeba and Osterloh (2013) and Lai (2014) obtain similar results in the absence of tax evasion. In Janeba and Osterloh (2013), larger jurisdictions face fiercer competition and may, thus, set lower tax rates than their smaller counterparts, reversing the usual *size effect*. Lai (2014) introduces lobbying into a standard framework of asymmetric tax competition and finds the associated downward pressure on the capital tax to be stronger in the larger country. Accordingly, the larger country sets a lower tax rate if the *size effect* is dominated by the *political effect* that arises from lobbying.

means that the *size effect* is more important in such a case.

Figure 6: Size (s) and evasion (e) effect as determinants of tax competition (cont.) - the role of firm mobility



Besides the mass of mobile firms (α_m), the gross profit level Π^j determines the outcome of tax competition in a scenario where evasion is more attractive in the larger country (cf. Regimes *II* and *IV* in Figure 5). Recall that both countries may, in principle, attract the mobile firms in such a case, depending on whether the *size* or the *evasion effect* dominates. Notably, the *evasion effect* only comes into play if at least one country's benchmark tax rate (10) is limited by firms' threat of evasion, which requires $\bar{t}_i^j = t_{eh}^j$ and, hence, country j's gross profit level Π^j to exceed the threshold $\overline{\Pi}_i^j$ (13). If this is the case, the *evasion effect* becomes stronger for higher levels of Π^j. Thus, an equilibrium in which the larger country sets a lower tax rate and attracts the mass of mobile firms, due to a higher attractiveness of evasion, is more likely if firms' gross profits (in both countries) are high (be aware that we continue to assume $E[\Pi]^x = E[\Pi]^y$). By contrast, a country unambiguously attracts the mass of mobile firms if it is smaller (lower α_i^j) and characterized by a higher attractiveness of tax evasion (lower t_{eh}^j (5) and $\overline{\Pi}_i^j$ (13)), as shown by Regimes *I* and *III* in Figure 5.

Figure 7 illustrates the two different cases. It is divided into two columns,

with each column showing one case.[28] The two cases only differ with respect to the size of country y, α_i^y. In particular, the left (right) column of Figure 7 depicts a scenario where country x is smaller (larger) and characterized by a higher attractiveness of tax evasion than country y, that is, Regime III (II) from Figure 5. Each of the two columns consists of two diagrams. In both columns, the upper diagram depicts the benchmark ($\bar{t}_i^x, \bar{t}_i^y$ (10), solid lines) and minimum tax rates (t_{min}^x, t_{min}^y (16), dashed lines) of countries x (red curves) and y (green curves) as a function of gross profit $\Pi^x = \Pi^y = \Pi$. These tax rates jointly determine the optimal tax rates of both countries, t_{opt}^x and t_{opt}^y (20), which are depicted in the lower diagram. At the point where $\Pi = \overline{\Pi}_i^x$ ($\Pi = \overline{\Pi}_i^y$), evasion becomes the limiting factor of taxation in country x (y) in the benchmark case. Thus, the $\bar{t}_i^x$ ($\bar{t}_i^y$)- and t_{min}^x (t_{min}^y)-curves feature a kink at this point (cf. Figures 3 and 4).

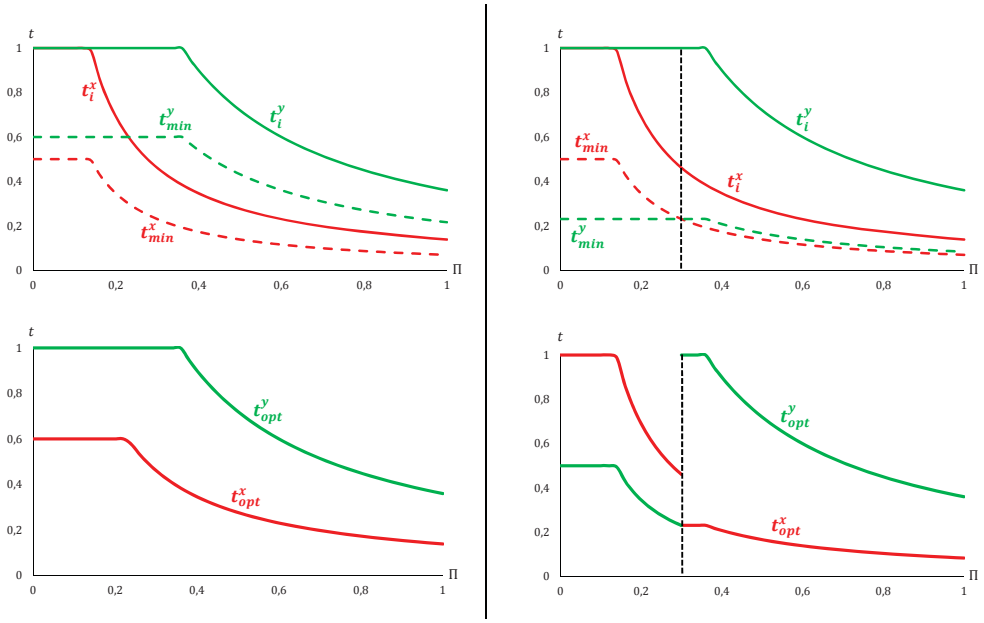
If country x is smaller and characterized by a higher attractiveness of evasion than country y (left column of Figure 7, where $\alpha_i^x \leq \alpha_i^y$ and $\overline{\Pi}_i^x \leq \overline{\Pi}_i^y$), $t_{min}^x < t_{min}^y$ holds for all values of Π. Thus, country x unambiguously attracts the mobile firms in this case. As argued above, $\bar{t}_i^j$ and t_{min}^j are decreasing in Π for $\Pi \geq \overline{\Pi}_i^j$ (cf. Figure 4). Accordingly, $t_{opt}^x = t_{min}^y$ ($t_{opt}^x = \bar{t}_i^x$) if Π is sufficiently low (high), meaning that country x's tax rate is limited by firms' outside option (threat of evasion). Furthermore, $t_{opt}^y = \bar{t}_i^y$ and country y only taxes resident immobile firms for all values of Π.

If country x is larger and characterized by a higher attractiveness of evasion than country y (right column of Figure 7, where $\alpha_i^x > \alpha_i^y$ and $\overline{\Pi}_i^x \leq \overline{\Pi}_i^y$), both countries may, in principle, attract the mobile firms. In particular, $t_{min}^x > t_{min}^y$ if Π is sufficiently small, meaning that the *size effect* dominates and the smaller country y attracts the mobile firms. For higher values of Π, firms' threat of evasion becomes a (stricter) limit to taxation, especially in country x. Therefore, the *evasion effect* becomes more important and eventually dominates the *size effect* as Π increases, making country x more tax aggressive ($t_{min}^x < t_{min}^y$). Thus, the larger country x sets a lower tax rate and attracts the mobile firms, due to a higher attractiveness of evasion, if Π

[28] In principle, four different regimes are possible, as described in the context of Figure 5: (I) Country y is smaller and characterized by a higher attractiveness of evasion; (II) Country y is smaller and characterized by a lower attractiveness of evasion; (III) Country x is smaller and characterized by a higher attractiveness of evasion; (IV) Country x is smaller and characterized by a lower attractiveness of evasion. As cases (I) and (III) as well as (II) and (IV) are symmetric, we only analyze cases (II) and (III) explicitly. Furthermore, we abstract from order of play considerations and simply assume $\tilde{t}^j = t_{min}^k$ (cf. (22)).

is sufficiently high. Accordingly, the t^x_{opt}- and t^y_{opt}-curves in the right column of Figure 7 have jump discontinuities at the level of Π for which $t^x_{min} = t^y_{min}$. Up to (beyond) this point, which is highlighted by the vertical dashed lines in the respective diagrams, country y (x) sets a lower tax rate and attracts the mobile firms.

Figure 7: Optimal tax rates depending on gross profit Π



Note: For convenience, we let Π run from 0 to 1 (all parameters are scaled accordingly).

Taken together, the results presented in this section suggest that the *evasion effect* is stronger, compared to the *size effect*, if firm mobility is rather low (as indicated by a low mass α_m of mobile firms) and gross profits Π are high. Thus, the *evasion effect* seems to be especially important for countries that are endowed with an abundance of natural resources, as the latter typically entail high location-specific rents as well as the formation of a rather immobile industry.

5 Conclusions

In this paper, we model tax competition between two countries that try to attract investment by mobile and immobile firms in order to generate revenue. Countries are limited in their tax setting not only by their competitor and firms' outside option, but also by the threat of corporate tax evasion. In particular, a firm can try to bribe the assigned tax agent in order to evade taxes on profits. Whether such behavior is worthwhile for the firm depends on various country characteristics, like the corruption level, institutional quality, and location-specific rents. Using this framework, we are able to identify three different factors that determine countries' optimal tax policy and the outcome of tax competition.

First, country-specific rents attract firms and may allow a country to charge a higher tax. This finding is in line with the existing literature on tax competition. However, we demonstrate that the degree to which countries are able to benefit from rents that accrue within their borders, in terms of tax revenue, crucially depends on firms' evasion incentives. If the latter are rather strong, a country's ability to tax corporate profits is limited, even if these profits are bound to the country. In such a case, the limitation arises from firms' possibility to evade taxes, as opposed to firms' outside option which is the only source of limitation in traditional models of tax competition.

Second, and in line with the literature on asymmetric tax competition, we find that smaller countries, as measured by the mass of resident immobile firms, tend to set lower tax rates, in order to attract mobile firms. That is, smaller countries are more aggressive in tax competition (*size effect*).

Third, extending the literature, the model shows that countries in which tax evasion is attractive to firms (due to, for instance, a high corruption level or weak fiscal institutions) tend to be more tax aggressive (*evasion effect*). If evasion is attractive to firms, a country is forced to set a rather lower tax rate, even if it does not (try to) attract mobile investment, in order to induce resident immobile firms to behave tax-compliant. Therefore, the opportunity cost that is associated with attracting mobile firms (by setting the tax rate sufficiently low), in terms of lower revenue per firm, is rather low for countries that are small or characterized by a high attractiveness of tax evasion. Thus, such countries tend to be more aggressive in tax competition.

Furthermore, our findings show that the tax aggressiveness of countries is increasing in firm mobility. This applies, in particular, to small countries. Accordingly, the *size effect* is stronger if the share of mobile (immobile) firms is high (low). By contrast, the *evasion effect* proves to be more important if

firm profits are high.

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