Essays on Corporate Income Taxation and Firm Behavior

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Chapter 1

Introduction

Globalization and economic integration tend to hamper governments' ability to raise revenue from corporate taxation, as a growing number of countries competes over an increasingly mobile tax base. This problem is amplified by the fact that trade and financial liberalization induce countries to rely less on 'easy to collect' taxes like tariffs and more on 'hard to collect' income taxes (cf. Aizenman and Jinjarak, 2009). The associated fiscal competition between countries is not restricted to the attraction of internationally mobile firms by setting a sufficiently low statutory tax rate on corporate income, but takes place over various dimensions and instruments.[1] For instance, Devereux et al. (2008) demonstrate that countries simultaneously compete for firm investment (over effective marginal tax rates) and profits (over statutory tax rates). Profit shifting by firms plays an important role in this context and, as shown by Peralta et al. (2006), offers governments an additional policy instrument over which they compete: the tightness of controlling for such practices. Whether a government is able and willing to limit tax avoidance (or evasion) by firms depends on various country characteristics, like institutional quality, level of development, and country size. This dissertation contributes to the literature by examining the impact of social values within a country on corporate taxation and (tax-reducing) firm behavior.[2] Moral

[1] Nevertheless, reducing the statutory tax rate on corporate income is still a common policy measure when the goal is to promote investment, as demonstrated very recently by the 2017 US "Tax Cuts and Jobs Act".

[2] While few studies analyze the impact of cultural values and social norms in the context of corporate taxation (Bame-Aldred et al., 2013; DeBacker et al., 2015), the existing literature on the topic mainly focuses on private income taxation (e.g., Alm and Torgler,

concerns (or lack thereof) about abusive behavior and tax non-compliance may limit (or encourage) both legal tax avoidance and illegal tax evasion by firms. For example, the tax-planning practices of multinational companies have become a highly discussed topic in several countries in recent years, and public pressure may help to limit such activities.[3] By contrast, raising adequate tax revenue is by far more difficult for a government that faces a corrupt environment with low tax morale (along with weak institutions). Such differences across countries with respect to social values, tax morale, and institutional quality seem to be of particular importance when comparing advanced and developing economies. Therefore, this dissertation also contributes to the literature by highlighting similarities and differences between these types of countries with respect to optimal corporate tax policy.

In the following, the interdependencies between social values, institutional quality, corporate taxation, and firm behavior are analyzed from different perspectives. Taking an "intra-firm view" on the topic, the second chapter focuses on the tax avoidance decision of a single firm and the associated effect on the latter's employees. By contrast, the role of the government is emphasized in Chapters 3 and 4. The third chapter, which is joint work with Elias Steinmüller and Georg Wamser, examines the influence of corruption, institutional quality, and location-specific rents on corporate tax evasion and a country's optimal tax policy. Accordingly, the chapter adopts an "intra-country view", whereas the fourth chapter accounts for an "inter-country view" by analyzing the effect of firms' tax evasion incentives on tax competition between countries.

More precisely, the model introduced in Chapter 2 suggests a negative link between a firm's tax-planning activities and its long-term performance. In particular, we suppose that tax avoidance may reduce the motivation and effort of a firm's employees. If a firm neglects or underestimates this effect, it avoids too much taxes and, as a result, suffers from lower production and profit levels in the long run. The relevance of this result is highlighted by the fact that public concern about corporate tax avoidance has increased strongly after the 2008-2009 financial crisis and several tax data leaks, like the Panama and Paradise Papers in 2016 and 2017.

The third chapter analyzes how differences across countries, especially regarding corruption, institutional quality, and location-specific rents, may

2006, 2011; Dulleck et al., 2016; Hallsworth et al., 2017).

[3] This can be seen from the Starbucks case described in Chapter 2.

lead to different, and possibly even opposing, tax policies. In a framework where firms can attempt to bribe public agents in order to evade taxes, we identify three different "tax-setting regimes" under which countries may operate. To be more precise, our theory predicts a country to either (i) ignore, (ii) combat, or (iii) tolerate tax evasion. Our findings suggest that countries which are characterized by widespread corruption, weak fiscal institutions, and high location-specific rents (e.g., due to natural resource abundance) are very likely to follow a tax policy that tolerates evasion. Moreover, it shows that such countries often lack the incentive to improve their current system of tax collection and, thus, are in danger of never being able to effectively combat tax evasion and raise adequate revenue from corporate income.

Broadening the single-country perspective of Chapter 3, the fourth chapter examines how tax competition between countries is affected by (differences with respect to) corruption and institutional quality and the associated threat of corporate tax evasion. We demonstrate that a country tends to set a rather low tax rate and, thus, be aggressive in tax competition if firms operating in that country have a strong incentive to evade taxes. Aside from that, the outcome of tax competition is found to be also determined by location-specific rents and the size of competing countries. In line with previous literature on tax competition, we find the tax rate on corporate income to be positively related to location-specific rents and country size.

Chapter 2

On the relationship between paying taxes and firm performance

2.1 Introduction

A common view on companies' attitudes towards paying taxes is that most of them try to avoid corporate profit taxes and only a few are willing to pay their fair share. This view is supported by a number of prominent cases of big multinational firms whose tax payments, despite of high earnings, are known to be very little. Public concern about this topic has increased strongly in recent years.[1] This process was triggered by the 2008-2009 financial crisis and further amplified by civil society campaigning and the release of several data leaks, like the Panama Papers in 2016 and the Paradise Papers in 2017 (cf. Dallyn, 2017; Forstater and Christensen, 2017; Murphy, 2013).[2] Accordingly,

[1] Most prominently, Starbucks became the target of massive protests in the UK in 2012 after media reports revealed that the company has failed almost entirely to pay taxes on its corporate income since starting operations in the UK in 1998. This induced Starbucks to voluntarily pay £20 million more taxes than what would have been required by law. See Campbell and Helleloid (2016) for more details.

[2] Oei and Ring (2018) show how data leaks have lead to recent changes in tax legislation. On a related note, the dissemination of taxpayers' misbehavior is facilitated and accelerated by the ongoing progress in information technology. As a consequence, tax shaming has become an important factor of revenue collection in several countries (Bø et al., 2015; Dyreng et al., 2016; Perez-Truglia and Troiano, 2015).

the question arises how the assessment of a tax-avoiding firm changes if its misbehavior is exposed and, furthermore, what the associated consequences are?

It is reasonable to assume that the growing public interest in and the large number of disclosures on tax avoidance were, at least to some extent, unexpected by both the public and the respective companies, which gives rise to the conjecture that the latter may have underestimated the negative consequences of their tax-planning activities. Thus, examining the relationship between tax avoidance, firm reputation, and performance seems to be particularly worthwhile.

In this chapter, we develop a novel theoretical framework which suggests a negative link between a firm's tax-planning activities and its long-term performance. In particular, we assume a multi-period firm-employees relationship where the latter's effort depends on the firm's tax payments. More precisely, tax avoidance negatively affects workers' future motivation and effort, and, consequently, the production and profit of the avoiding firm. This effect is supposed to be particularly strong if workers can easily observe and strongly condemn tax avoidance. Thus, a firm optimally takes this *indirect cost of tax avoidance* into account when deciding on tax-planning activities. If it fails to do so, it avoids too much taxes and experiences a subpar long-term performance, in terms of lower output, (potentially) higher wages and employee turnover, and lower profit. This outcome is particularly likely in case of an unexpected exposure or change in employees' attitude towards tax avoidance.

The chapter is organized as follows. Section 2.2 puts our contribution into perspective to related research. The theoretical model is presented and analyzed in Section 2.3. Following this, some model variations and robustness checks are presented in Section 2.4. Section 2.5 concludes.

2.2 Motivation of supposed mechanism and related research

We contribute to the existing literature by proposing a link between tax avoidance and firm performance that has been neglected so far. That is, we suppose that employee effort and, as a consequence, the productivity and profit of a firm are reduced by tax avoidance.

The literature on employee well-being and worker productivity motivates such a link. This literature provides conclusive evidence that employee satisfaction and trust is associated with higher productivity levels and better firm performance (e.g., Edmans et al., 2014; Guiso et al., 2015; Nagin et al., 2002). For example, Guiso et al. (2015) find a positive relationship between managerial integrity and ethics, as perceived by employees, and firm performance. Similarly, Minkler (2004) provides survey evidence that workers tend to shirk more if they believe their employer to be dishonest.

Similarly, Lins et al. (2017) show that firms with high social capital, as measured by high corporate social responsibility (CSR) intensity, performed better during the 2008-2009 financial crisis, in terms of higher stock returns, profitability, growth and sales per employee. Most important with respect to our model, the increase in sales per employee remained (at a lower rate) after the crisis and was not accompanied by a higher employee layoff, which strongly suggests a positive effect of social capital on employee productivity.[3] In line with Guiso et al. (2015) and Minkler (2004), Lins et al. (2017) argue that this pattern is driven by the role of trust. Accordingly, social capital and firm ethics prove to be particularly valuable when trust in corporations is, in general, low.

It seems reasonable to expect a similar pattern with respect to tax avoidance. That is, firms which avoid taxes may be considered not trustworthy and perform worse, especially in periods of low trust. This should be particularly true if there is a negative shock to trust caused by the divulgence of tax-sheltering activities, as in the cases of the Panama Papers and the Paradise Papers.[4]

A lot of (mostly indirect) evidence suggests that employees care about their employer's tax-planning behavior. For instance, Chyz et al. (2013) show that firms' tax aggressiveness is reduced by the impact of labor unions, while Oei and Ring (2018) highlight that most leaks of tax data happen due

[3]Several studies highlight the positive effect of CSR on employee satisfaction and commitment. See, e.g., Bauman and Skitka (2012), Hansen et al. (2011), and Kim et al. (2010).

[4]A growing number of literature analyzes the relationship between corporate tax payments and CSR, finding mixed results. Lanis and Richardson (2012, 2015) argue that socially responsible firms are less likely to avoid taxes. By contrast, Davis et al. (2016) and Hoi et al. (2013) provide evidence that CSR and tax payments act as substitutes, and Campbell and Helleloid (2016) stress the discrepancy between Starbucks' tax avoidance practices and the public image the company tried to create by self-promoting its commitment to CSR.

to employee whistleblowing. In line with these findings, Dyck et al. (2010) argue that employees, as well as other non-traditional players like media and industry regulators, play an important role in the detection of corporate fraud. However, their findings also suggest that employee whistleblowers face severe costs. They are often fired, forced to quit by themselves, or assigned significantly different responsibilities. Therefore, in many cases whistleblowers prefer to stay anonymous. Consequently, Dyck et al. (2010, p. 2245) state that "the surprising part is not that most employees do not talk, but that some talk at all." One reason for employees to do so, besides monetary incentives and the desire to avoid potential liability, might be a personal aversion to corporate fraud by their employer. Given the aforementioned negative consequences of open opposition, however, most workers probably prefer other ways of punishing misbehavior by their employer. In this regard, providing less effort may serve as an easier and less costly alternative, since work effort is usually hard to observe. Supporting this conjecture, Cornelissen et al. (2013) show that perceived injustice in taxation leads to more absenteeism from work. Using data on German employees, they find that individuals who believe that the top income earners don't pay enough taxes accrue 20% more sick days. In line with our above reasoning, Cornelissen et al. (2013) argue that being absent more often, which they interpret as a reduction of the effort level, is the most convenient way for employees to "compensate" for perceived tax unfairness. By contrast, the often-suggested response of evading taxes (Alm et al., 1993; Andreoni et al., 1998) is usually impracticable for employees because of third-party reporting (Kleven et al., 2011).[5]

Several surveys provide evidence for a considerable and increasing public concern about corporate tax avoidance. According to UK data (Institute of Business Ethics, 2017), corporate tax avoidance has been the greatest concern of the British public in business conduct in each year from 2013 to 2017. Similar results are obtained for the US, where participants' main complaint about the tax system is that some corporations do not pay their fair share of taxes (Pew Research Center, 2017). Moreover, 62% state that they are bothered "a lot" by this perception. When asked whether cheating on taxes is

[5] Nevertheless, the perception of fairness seems to be important in explaining individual tax avoidance and tax evasion. If individuals believe that they are taxed on fair grounds (compared to other individuals or firms), they tend to be more willing to accept their own tax burden and will not try to avoid or evade taxes (Alesina and Giuliano, 2011; Fortin et al., 2007).

justifiable, the vast majority (59.2%) of participants in the World Values Survey (WVS, 2015) stated that cheating on taxes is never justifiable, whereas only 1.8% of participants said that cheating on taxes is always justifiable. In the light of this development, both PwC (2013) and Ernst & Young (EY, 2014) conducted surveys among CEOs and managers with a specific focus on tax strategies and the associated effects on reputation. Their results show that executives have become increasingly worried about the potential reputation cost of tax avoidance.[6] For instance, EY (2014) reports that 89% of the largest companies are somewhat or significantly concerned about media coverage of firms' tax activities, constituting a sharp increase from the previous survey in 2011 (60%). By contrast, only 9% of firms are unconcerned, in comparison to 40% in 2011. Consistently, 99% of participants state that the importance of managing tax risk and controversy has increased or at least stayed constant in the previous two years, and 81% expect this development to continue in the following two years.

The growing public interest in corporate tax planning has given rise to several papers which investigate the relationship between tax avoidance and firm reputation. Both Dyreng et al. (2016) and Kanagaretnam et al. (2016) demonstrate that public pressure can limit corporate tax avoidance, thereby highlighting the role of tax activists (Dyreng et al., 2016) and independent media (Kanagaretnam et al., 2016), respectively. Loretz and Moore (2013) argue that the reputation loss of a firm avoiding taxes depends on the tax-planning activities of its competitors. The reasoning is as follows: since it may be difficult for stakeholders to evaluate whether the firm's tax payments are appropriate (unless actual tax avoidance is revealed), they compare them to the ones of the firm's peer group, i.e. its competitors. Supporting these theoretical considerations, Loretz and Moore (2013) provide empirical evidence of a positive correlation between the effective tax rates of firms within the same country and of firms within the same industry. Similar to our approach, Hardeck and Hertl (2014) suggest a negative relationship between tax avoidance and firm performance that is driven by individual (i.e., household) behavior. While we focus on employees, Hardeck and Hertl (2014) highlight the role of consumers. They employ two laboratory experiments in order to analyze how tax planning affects corporate reputation and consumer behavior. Their results suggest that aggressive tax strategies are punished by

[6] As demonstrated by Graham et al. (2014), concerns about the negative effects of tax planning on firm reputation already existed prior to the 2008-2009 financial crisis.

consumers and reduce the latter's willingness to pay. The magnitude of this effect crucially depends on consumers' attitude towards tax avoidance, which is in line with our hypothesis with respect to employees. Consistent results are obtained by Austin and Wilson (2017), Bame-Aldred et al. (2013), and DeBacker et al. (2015). In the study of Austin and Wilson (2017), firms with valuable customer brands (and, therefore, high reputation cost) are found to be less tax aggressive. Bame-Aldred et al. (2013) and DeBacker et al. (2015) provide evidence that firms' tax compliance depends to a significant extent on moral values and social norms.[7]

Overall, these findings strongly suggest that firms take public concern and the potential reputation loss into account when deciding on tax avoidance. Nevertheless, some firms may (have) underestimate(d) this effect or overlook(ed) some of the associated consequences. It seems very likely that this is the case, given the sudden increase in reports and public concern about tax avoidance in recent years.[8] The results of O'Donovan et al. (2017) appear to support this notion. They show that the leak of the Panama Papers in 2016 had a significant negative effect on affected firms' stock returns that, on average, amounted to a 0.7% drop in firm value, compared to similar but unaffected firms. Likewise, Hanlon and Slemrod (2009), using media reports from 1990 to 2004, find stock prices to react negatively to news about a firm's involvement in tax shelters. This effect proves to be stronger for firms in the consumer-oriented retail sector. Gallemore et al. (2014) obtain similar results for observations from 1995–2005. This confirms the findings of Graham et al. (2014) indicating that tax planning was associated with reputation risk even prior to the 2008-2009 financial crisis.[9] However, as outlined above, it seems obvious that reputation risk has strongly increased in recent years.[10]

[7]Not surprisingly, the same is true for individuals' tax compliance. See, for example, Alm and Torgler (2011), Dulleck et al. (2016), and Hallsworth et al. (2017).

[8]In the survey conducted by PwC (2013), most CEOs express their concern about the reputation risk that goes along with tax planning. However, 46% of them expect no adjustments to their investment in managing corporate reputation for the following year, while 11% anticipate a major change.

[9]On a related note, Bowen et al. (2010) show that whistleblowing allegations can have lasting negative effects on a firm's stock return and operating performance.

[10]Supporting this notion, Gallemore et al. (2014) find no significant reputation effects on managers, customers, and tax authorities, which stands in sharp contrast to some of the studies mentioned above. While the latter rely on more recent (i.e., post-crisis) data, Gallemore et al. (2014) only use pre-crisis observations (in fact, more than 40% of their observations date back to 1995).

If not ignored completely by firms, the link between tax avoidance and workers' motivation supposed in our model not only affects a firm's future performance, but also its tax avoidance decision in the first place. Therefore, this chapter contributes to the literature on the determinants of tax avoidance, which we won't discuss in further detail.[11] Just additionally note that, while the impact of managerial incentives (Armstrong et al., 2012, 2015; Desai and Dharmapala, 2006; Rego and Wilson, 2012) and individual characteristics of firms' decision makers (Dyreng et al., 2010; Francis et al., 2015; Ge et. al, 2011) on tax avoidance and firm performance have been extensively investigated, the role of (lower-level) employees has, to the best of our knowledge, not been examined in this context so far.

As already mentioned, the role of employees also has been neglected by the literature that links tax avoidance and firm performance. Most studies dealing with this issue focus on stock prices, thereby highlighting the impact of shareholders, investors, and executives. Desai and Dharmapala (2006) propose a complementarity between tax avoidance and manager diversion of corporate resources. The underlying idea is that complex tax sheltering structures can be exploited by managers if corporate governance is rather weak. This notion is supported by Desai and Dharmapala (2009) and Wilson (2009), who find a positive effect of tax avoidance on firm value, but only for well-governed firms. Using data on Russian firms, Desai et al. (2007) find that stricter tax enforcement leads to higher company values and lower control premia. A similar result is obtained by Mironov (2013), who shows that increased enforcement has a positive effect on firms' growth rates and productivity, with the latter being measured by revenue per employee. In line with Desai and Dharmapala (2006), both Desai et al. (2007) and Mironov (2013) argue that reduced managerial diversion, rather than actual tax planning, is the main driver of this effect. Balakrishnan et al. (2012) stress that aggressive tax planning decreases the financial transparency of firms, which may hinder the communication with outside parties. Consistent with this reasoning, it seems that tax aggressive firms are considered more risky by stakeholders and business partners, which may also impair their performance. For instance, Kim et al. (2011) find a positive relationship between US firms' tax-planning activities and the future crash risk of their stock prices. Hasan et al. (2014) show that firms avoiding taxes face higher

[11] See Hanlon and Heitzman (2010) and Dyreng et al. (2017) for an overview on this topic.

bank loan cost. Examining data on UK companies, Brooks et al. (2016) demonstrate that corporations with lower effective tax rates are perceived to be more risky by investors. Nevertheless, they find the stock prices of these firms to be only affected temporarily, if at all.

These results suggest that firm performance can, under certain circumstances (like, e.g., good corporate governance), be positively associated with tax avoidance. However, managerial diversion and reputation risk have been identified to pose serious threats to avoiding firms' performance, and the theoretical model presented in the next section gives rise to an additional link through which tax avoidance may harm firm performance.

2.3 The model

We assume a two-period model with a risk-neutral firm using labor as only input in each period t ($t = 1, 2$) to produce a single good with price of unity. We may argue that (two-period) wage contracts are already in place and renegotiation or termination of a contract is prohibitively costly. This is consistent with assuming that wage w as well as the number of (homogeneous) workers $\overline{L}$ employed by the firm is fixed. Output f produced by each employee depends on effort e, which is unobserved by the firm, and is given as

$$f(e) = \phi e. \tag{2.1}$$

The parameter $\phi > 0$ denotes the marginal product of work effort. It is assumed to be constant and, due to homogeneity of workers, the same for all employees.

The firm faces the time-invariant statutory corporate tax rate $\tau \in [0, 1]$. However, the firm may engage in tax-planning activities and avoid taxes. Tax avoidance A is associated with cost $C(A) = \alpha A^2/2$, where $\alpha > 0$ is a constant cost parameter. We assume that the cost of tax planning is not deductible for tax purposes. The firm's net profit in period t is

$$\pi_t = (1 - \tau)\Pi_t + \tau A_t - \alpha A_t^2/2, \tag{2.2}$$

where

$$\Pi_t = (f(e_t) - w)\overline{L} \tag{2.3}$$

denotes gross profit of the firm in period t. Drawing on Delfgaauw and Dur (2003), the utility of a worker in period t when employed by the firm is given

by

$$U_t = w + \gamma_t e_t - \frac{1}{2}\Theta e_t^2. \tag{2.4}$$

Providing effort is costly for the worker and the parameter Θ determines the magnitude of this effect. In the following, however, we set $\Theta = 1$ for simplicity. The parameter γ_t captures a worker's utility from providing effort in period t.[12] Note that γ may not only be time- but also firm-specific (we focus on a single firm, though). In the following, we will interpret a high γ as high intrinsic motivation to work for a specific firm. The latter may be due to a specific job, but can also be related to the reputation of a firm and its products.

We suppose that γ depends on firm behavior and generally on the attitude of the employee towards the employer. In particular, building on the arguments from Sections 2.1 and 2.2, we assume that γ is determined by a firm's tax avoidance behavior:

$$\gamma_t = \overline{\gamma}\left(1 - \frac{\kappa_o \kappa_s (\tau - \tau_{t-1}^e)}{\tau}\right), \tag{2.5}$$

where $\overline{\gamma} \geq 0$ denotes the worker's initial intrinsic motivation. This motivation is negatively affected by tax avoidance; to be specific, if τ_t^e, the firm's effective tax rate, is lower than τ. The magnitude of this effect is determined by the parameters κ_o and κ_s, with $\kappa_o, \kappa_s \in [0, 1]$. We think of κ_o as the degree to which workers are able to observe the firm's tax avoidance; κ_s measures a worker's sensitivity towards avoidance.[13] The effective tax rate is defined as the ratio of actual tax payments to gross profit (cf. Ewert and Niemann, 2014) and given by

$$\tau_t^e = \frac{\tau(\Pi_t - A_t)}{\Pi_t}. \tag{2.6}$$

By definition, the effective tax rate cannot be negative, i.e. the avoided amount cannot exceed the firm's tax liability: $A_t \leq \Pi_t$. Using equation (2.6), the intrinsic motivation parameter can be expressed in terms of the tax avoidance level

$$\gamma_t = \overline{\gamma}\left(1 - \frac{\kappa_o \kappa_s A_{t-1}}{\Pi_{t-1}}\right). \tag{2.7}$$

[12] We can interpret γ very generally as fulfillment, satisfaction, or pleasure from providing effort.

[13] Accordingly, the growing public concern about firms' tax-planning activities in recent years should imply an increase of κ_s, while larger media attention and tax data leaks should imply an increase of κ_o.

Equation (2.7) suggests that γ_t is decreasing in the level of tax avoidance or, more precisely, in A_{t-1}/Π_{t-1}, the fraction of profits that has not been taxed in the previous period due to avoidance. Note that γ changes only due to observed tax avoidance. By contrast, a worker's expectations or beliefs concerning a firm's tax-planning behavior are captured by the initial intrinsic motivation parameter $\overline{\gamma}$, which we assume to be constant. Furthermore, workers' assessment of the firm's tax-planning behavior prior to the beginning of the game (i.e., in periods $t \leq 0$) is supposed to be fully captured by $\overline{\gamma}$. This implies that $\gamma_1 = \overline{\gamma}$.

The firm decides on tax avoidance at the end of each period, after employees have provided effort and the corresponding gross profit has been realized. Due to this order of events, there is a one-period lag between the firm's tax avoidance decision and the corresponding effect on effort, as employees are only able to observe a firm's past tax-planning behavior. In our two-period model, this implies that the firm optimally takes into account the effect of tax avoidance on workers' future (i.e., second-period) effort in the first period.

Let us, for a moment, assume that the firm is not fully aware of the mechanism described by equation (2.7).[14] In that case, the firm underestimates the negative impact of tax avoidance on workers' motivation. We refer to this firm behavior as *"myopic"*.

2.3.1 Myopic tax avoidance

In this subsection, we determine the outcome of our model when the firm is not aware of the mechanism described by equation (2.7). As the model is solved via backward induction, we start with the firm's avoidance decision at the end of the *second period*. The firm maximizes its second period net profit

$$\pi_2 = (1-\tau)\Pi_2 + \tau A_2 - \alpha A_2^2/2 \tag{2.8}$$

[14] Alternatively, we may suppose that the firm is aware of the mechanism described by equation (2.7) but underestimates the degree to which employees observe and despise tax avoidance. As both the recent disclosures of and the increase in public interest in firms' tax-planning activities were, at least to some degree, unexpected by firms, it seems reasonable to assume that firms underestimate κ_o and κ_s (or, at least, have done so in the past).

by choosing the avoidance level A_2. The corresponding optimality condition states that marginal tax savings equal the marginal avoidance cost

$$\tau = \alpha A_2 \quad \Leftrightarrow \quad A_2^* = \tau/\alpha. \tag{2.9}$$

Each unit of tax avoidance A is associated with a tax saving equal to τ. On the cost side, the firm takes into account the marginal cost of tax planning $C'(A_2) = \alpha A_2$. We will refer to this cost as the "*direct cost of tax avoidance*". Note that there is no future in period 2, which means that the tax avoidance decision in this period does not affect effort levels of employees.

The level of tax avoidance determined by equation (2.9) is independent of the gross profits of a firm. The reason is our assumption that the cost of tax planning depends on A, the difference between actual and reported gross profit, and not on the absolute levels thereof.[15]

At the beginning of the period, each worker chooses e_2 to maximize

$$U_2 = w + \gamma_2 e_2 - e_2^2/2. \tag{2.10}$$

The optimal effort level is given by

$$e_2^* = \gamma_2 = \overline{\gamma}\left(1 - \frac{\kappa_o \kappa_s A_1}{\Pi_1}\right). \tag{2.11}$$

Thus, employees' effort depends on the firm's tax avoidance. In particular, tax avoidance in the first period reduces effort in the second period. The effect of past tax avoidance on e_2^* is small if workers are rather insensitive to tax planning (κ_s small) or if they simply lack information about firm behavior (κ_o small).

We can now substitute A_2^* (2.9) in equation (2.8) to obtain

$$\pi_2 = (1 - \tau)\Pi_2 + \tau^2/2\alpha. \tag{2.12}$$

Following (2.1), (2.3), and (2.11), it is apparent that tax avoidance in period 1 has a negative impact on the firm's productivity and its gross profit in the second period, as well as on the corresponding net profit (2.12):

$$\frac{f(\gamma_2)}{\partial A_1}, \frac{\partial \Pi_2}{\partial A_1}, \frac{\partial \pi_2}{\partial A_1} \leq 0.$$

[15] This assumption implies that tax avoidance is not becoming cheaper when gross profits increase. In general, this could be the case if income is positively related to firm complexity and if the latter facilitates tax avoidance.

This effect is stronger if workers are sensitive and disapprove of tax avoidance behavior (κ_s high). It is also stronger if tax avoidance behavior can easily be observed by employees (κ_o high).

At the end of the *first period*, the firm chooses A_1 to maximize

$$\pi_1 + \delta\pi_2 = (1-\tau)\Pi_1 + \tau A_1 - \alpha A_1^2/2 + \delta\big[(1-\tau)\Pi_2 + \tau^2/2\alpha\big], \qquad (2.13)$$

where $\delta \in [0,1]$ denotes the intertemporal discount factor.

Since we have assumed that the firm is not aware of the negative impact tax avoidance has on employee effort, and thus on gross profit in the following period, the selected level of tax avoidance is

$$\tau = \alpha A_1 \quad \Leftrightarrow \quad A_1^* = \tau/\alpha. \qquad (2.14)$$

Again, the firm chooses the tax avoidance level such that marginal benefit (avoided tax payment τ) and current marginal cost of tax planning ($C'(A_1) = \alpha A_1$) are equalized.[16] However, it neglects the link between current tax avoidance and employee effort in the future.[17] Hence, it underestimates the total (i.e., current and future) marginal cost of tax planning and avoids too much.

At the first stage of the game, each employee selects the (first period) effort that maximizes its overall utility

$$U_1 + \delta U_2 = w + \gamma_1 e_1 - e_1^2/2 + \delta(w + \gamma_2 e_2 - e_2^2/2). \qquad (2.15)$$

This effort is given by $e_1^* = \gamma_1 = \overline{\gamma}$.

2.3.2 Optimal tax avoidance

If the firm knew about the negative consequences of tax avoidance on employee effort, its avoidance decision in the first period would satisfy

$$\tau = \alpha A_1 + \delta(1-\tau)\frac{\partial \Pi_2}{\partial A_1}. \qquad (2.16)$$

We can rewrite this equation to obtain

$$\tau = \alpha A_1 + \Delta \quad \Leftrightarrow \quad A_1^o = \frac{\tau - \Delta}{\alpha}. \qquad (2.17)$$

[16] If the statutory corporate tax rate and the (direct) avoidance cost function are the same in both periods, the level of tax avoidance is the same in both periods as well.

[17] Technically, the firm wrongly assumes $\frac{\partial \Pi_2}{\partial A_1} = 0$, although $\frac{\partial \Pi_2}{\partial A_1} \leq 0$ holds true.

As before, marginal tax savings equal marginal cost of avoidance. Compared to expression (2.14), however, the effect of tax avoidance on effort is now taken into account by the firm. We capture this effect by using the term Δ. This term, to which we refer to as the *indirect cost of tax avoidance*, is given by

$$\Delta \equiv \delta(1-\tau)\frac{\partial \Pi_2}{\partial A_1} = \frac{\delta(1-\tau)\overline{L}\phi\overline{\gamma}\kappa_o\kappa_s}{\Pi_1} = \frac{\delta(1-\tau)\phi\overline{\gamma}\kappa_o\kappa_s}{\phi\overline{\gamma}-w} \geq 0. \tag{2.18}$$

From equations (2.14), (2.17), and a non-negative Δ, it is obvious that

$$A_1^o \leq A_1^*. \tag{2.19}$$

That is, in the first period (or, more generally, in each period other than the last one), the firm optimally avoids less taxes than the myopic level A_1^*, as there is an additional indirect cost of tax avoidance. Thus, we may state that tax avoidance exerts a negative externality on future effort of employees and this reduces a firm's future profits. Accordingly, the tax avoidance level is too high if the firm does not take this effect into account. This is illustrated in Figure 2.1, in which A_1^* and A_1^o (the corresponding effective tax rates $\tau_1^{e,*}$ and $\tau_1^{e,o}$) are plotted against τ in the upper (lower) diagram.[18] Obviously, both avoidance levels are increasing in τ, as a higher tax rate implies a higher marginal benefit of avoidance. In particular, $A_1^* > 0$ and $\tau_1^{e,*} < \tau$ for all $\tau > 0$. By contrast, $A_1^o < 0$ and $\tau_1^{e,o} > \tau$ if $\Delta > \tau > 0$. That is, it may be optimal for a firm to make an additional tax payment if the associated (positive) effect on workers' effort is sufficiently strong.[19]

The difference between the myopic and the optimal avoidance level is increasing in the indirect cost of tax avoidance Δ and decreasing in the direct cost parameter α: $A_1^* - A_1^o = \Delta/\alpha$. Accordingly, given $\partial\Delta/\partial\tau < 0$, the gap between the two functions is largest for $\tau = 0$ and becomes smaller as τ is increased.

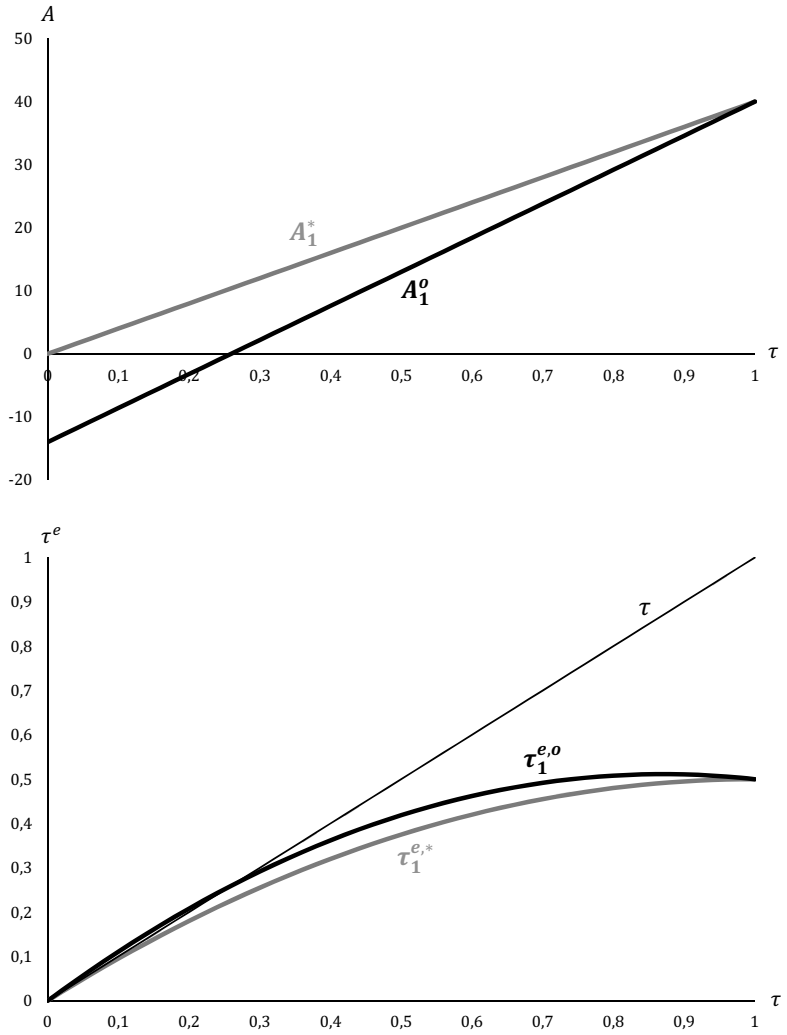
If workers cannot observe the firm's tax planning activities ($\kappa_o = 0$) or do not care about them ($\kappa_s = 0$), $\Delta = 0$ and the myopic tax avoidance level is optimal: $A^* = A^o$. Furthermore, the indirect cost of avoidance is less

[18] In the lower diagram, the statutory corporate tax rate τ is depicted for reference.

[19] As illustrated by the case of Starbucks mentioned above, voluntary tax payments for reputation purposes actually take place. It seems rather unlikely, however, that a potential link between avoidance and employee effort works identically in both directions. Therefore, our argumentation focuses on "positive tax avoidance" ($A \geq 0$) in the following.

important if α is high, as in such a case, the firm's tax avoidance is limited by the direct cost anyway.

Figure 2.1: Myopic and optimal tax avoidance level (upper diagram) and effective tax rate (lower diagram)



2.3.3 The indirect cost of tax avoidance

The indirect cost of tax avoidance, as defined in (2.18), depends on several parameters, all of which are assumed to be exogenous in our model. Their qualitative effects on the indirect cost of tax avoidance are summarized in Table 2.1. Obviously, tax avoidance is more costly for the firm if workers can easily observe it and have strong objections against it, i.e. if κ_o and κ_s are high, as the negative impact of avoidance on future profits is stronger.

Given the indirect cost of tax avoidance, firms face the following tradeoff: avoidance increases net profit in the current period but lowers profits in the future. Accordingly, the more important future profits are, which is measured by δ, the more the firm should care about the indirect cost of tax avoidance.

By contrast, a high (future) tax rate τ curbs future profits and reduces the indirect cost of tax avoidance. Therefore, an increase in the statutory corporate tax rate increases the optimal level of tax avoidance in two different ways. This can be seen from equation (2.17). First, the optimal avoidance level depends directly on the (current-period) tax rate, as a higher tax rate implies a higher marginal benefit of avoidance. Second, a higher (future) tax rate decreases future profits and, hence, Δ, making tax avoidance in the present less costly. Note, however, that firms possibly neglect the indirect cost of tax avoidance (at least to some degree) and are only fully aware of the direct effect. Consequently, as mentioned earlier and illustrated in Figure 2.1, the difference between A_1^* and A_1^o is decreasing in τ.

The indirect cost of tax avoidance is low if the firm's gross profit is high, i.e. if marginal productivity (ϕ) and initial intrinsic motivation ($\overline{\gamma}$) of employees are high, and the wage rate (w) is low. This result is driven by the assumption that workers relate the avoided amount to the firm's gross profit when evaluating the tax compliance behavior of the latter; it crucially depends on the specification of γ (2.7).

The parameters $\overline{\gamma}$ and ϕ are also positively related to the indirect cost of tax avoidance. It is obvious that a higher marginal productivity implies a higher cost of tax avoidance in terms of lost effort and output. Concerning employees' initial intrinsic motivation $\overline{\gamma}$, we may interpret equations (2.7) and (2.11) in the following way. An employee's potential effort is given by its initial intrinsic motivation level. Tax avoidance limits the extent to which an employee is willing (or able) to exploit this potential effort. Accordingly, the cost of tax avoidance in terms of unexploited effort is high if the potential effort level, measured by $\overline{\gamma}$, is high. However, these positive effects are

Table 2.1: *Determinants of the indirect cost of tax avoidance*

	κ_o	κ_s	δ	w	τ	$\overline{\gamma}$	ϕ
Δ	+	+	+	+	−	−	−

dominated by the aforementioned effects of $\overline{\gamma}$ and ϕ on a firm's gross profit. Thus, the indirect cost of tax avoidance is decreasing in $\overline{\gamma}$ and ϕ.[20]

It is worth noting that the indirect cost of tax avoidance is not affected by the number of employees ($\overline{L}$) in this basic setting with two periods and constant $\overline{L}$. In Section 2.4, however, we show that the indirect cost of tax avoidance is increasing in $\overline{L}$ if the time horizon is infinite.[21]

Given the optimal level of tax avoidance (2.17), we can calculate the optimal effort and profit levels in both periods. For comparison, we also determine the myopic outcome according to equation (2.14). The respective results are presented in Table 2.2. The only difference between the myopic and the optimal values in Table 2.2 is the presence of the indirect cost of tax avoidance Δ. When ignoring the future effects of tax avoidance, the firm can realize a higher net profit in period 1 – as tax payments are lower. However, this higher profit comes at the cost of lower future profit, as can be seen from the second-to-last row of Table 2.2. Employees' effort level and, as a consequence, firm profits are lower in the subsequent period than they would be in case of optimal tax avoidance ($\Pi_2^* \leq \Pi_2^o$ as $e_2^* \leq e_2^o$). Most important, a firm's overall profit is lower if it neglects the indirect cost of tax avoidance, as shown in the last row of Table 2.2. The respective difference in profit increases with the indirect cost and decreases with the direct marginal cost of tax avoidance.

Given these results, we can formulate the following hypotheses:

Hypothesis 1: The lower the effective tax rate of a firm, the lower is its output/total factor productivity and profit (per employee) in the long run. This effect is stronger if the indirect cost of tax avoidance is high, i.e. for high (low) values of κ_o, κ_s, δ, w (τ, $\overline{\gamma}$, ϕ).

[20] For $w = 0$, the two effects cancel out and Δ is independent of $\overline{\gamma}$ and ϕ.

[21] In the two-period case, Δ is increasing in L if $L_2 > L_1$.

Table 2.2: *Myopic view vs. optimality benchmark*

	myopic		optimal	difference ($^*-^o$)
e_1	$\overline{\gamma}$	$=$	$\overline{\gamma}$	0
A_1	$\frac{\tau}{\alpha}$	$\geq$	$\frac{\tau-\Delta}{\alpha}$	$\frac{\Delta}{\alpha}$
π_1	$(1-\tau)\Pi_1 + \frac{\tau^2}{2\alpha}$	$\geq$	$(1-\tau)\Pi_1 + \frac{\tau^2-\Delta^2}{2\alpha}$	$\frac{\Delta^2}{2\alpha}$
e_2	$\overline{\gamma}\left(1 - \frac{\kappa_o\kappa_s\tau}{\alpha\Pi_1}\right)$	$\leq$	$\overline{\gamma}\left(1 - \frac{\kappa_o\kappa_s(\tau-\Delta)}{\alpha\Pi_1}\right)$	$-\frac{\overline{\gamma}\kappa_o\kappa_s}{\alpha\Pi_1}\Delta$
A_2	$\frac{\tau}{\alpha}$	$=$	$\frac{\tau}{\alpha}$	0
π_2	$(1-\tau)\Pi_2^* + \frac{\tau^2}{2\alpha}$	$\leq$	$(1-\tau)\Pi_2^o + \frac{\tau^2}{2\alpha}$	$-\frac{\Delta^2}{\delta\alpha}$
$\pi_1 + \delta\pi_2$	$\pi_1^* + \delta\pi_2^*$	$\leq$	$\pi_1^o + \delta\pi_2^o$	$-\frac{\Delta^2}{2\alpha}$

Note: $\Pi_1 = (\phi\overline{\gamma} - w)\overline{L}$ and $\Pi_2^* = (\phi e_2^* - w)\overline{L} < \Pi_2^o = (\phi e_2^o - w)\overline{L}$.

Hypothesis 2: The higher the *direct cost of tax avoidance*, the higher the effective tax rate of a firm. The consequence is a higher output/total factor productivity and higher profit (per employee) in the long run (cf. **H1**).

Hypothesis 3: The higher the *indirect cost of tax avoidance*, the higher the effective tax rate of a firm (if the latter takes this cost into account). The consequence is a higher output/total factor productivity and higher profit (per employee) in the long run (cf. **H1**).

2.4 Model variations and robustness

In order to check the above results for robustness and to extend the scope of our model, three modifications of the basic framework are introduced in the following subsections.

2.4.1 Infinite time horizon

Extending the time horizon of our framework beyond two periods appears to be a natural and worthwhile modification of our model. Therefore, we assume an infinite time horizon in this subsection. To keep the analysis simple, we now suppose that workers are interested in whether the firm avoids taxes or

not, but do not care about the exact amount of tax that the firm avoids.[22] In particular, we assume

$$\gamma_t = \begin{cases} \underline{\gamma} & \text{if } A_{t-1}, \kappa_o, \kappa_s > 0 \\ \gamma_{t-1} & \text{otherwise,} \end{cases} \tag{2.20}$$

with $\gamma_1 = \overline{\gamma} > \underline{\gamma} \geq 0$. Thus, workers' initial intrinsic motivation $\overline{\gamma}$ is reduced to $\underline{\gamma}$ if they observe and despise tax avoidance by the firm. Once a worker's intrinsic motivation has been reduced, the initial level is never reached again. That is, part of workers' motivation, and potential effort, is irreversibly lost once they realize that the firm avoids taxes.

Accordingly, employees' effort equals $\overline{\gamma}$ if they have never observed or do not care about tax avoidance by the firm, and $\underline{\gamma}$ otherwise. This implies that the firm, once it starts to avoid taxes, will continue to do so in all subsequent periods. Furthermore, given the specification of γ_t (2.20), the indirect cost of tax avoidance does not affect avoidance at the intensive margin. Consequently, the selected level in case of tax avoidance is

$$A_t = A = \tau/\alpha, \tag{2.21}$$

which is the same as for myopic behavior (2.14). Intuitively, the indirect cost of tax avoidance is sunk once the firm engages in strategic tax planning and is, therefore, excluded from subsequent avoidance decisions.

As long as the firm does not avoid taxes (implying $A = 0$, $e = \overline{\gamma}$, and $\Pi = (\phi\overline{\gamma} - w)\overline{L}$), it realizes a net profit of

$$\pi^H = (1-\tau)(\phi\overline{\gamma} - w)\overline{L} \tag{2.22}$$

in each period. If the firm starts to avoid taxes, its net profit is

$$\pi^D = (1-\tau)(\phi\overline{\gamma} - w)\overline{L} + \tau^2/2\alpha \tag{2.23}$$

once (in the "deviation" period, where $A = \tau/\alpha$, $e = \overline{\gamma}$, and $\Pi = (\phi\overline{\gamma} - w)\overline{L}$) and

$$\pi^A = (1-\tau)(\phi\underline{\gamma} - w)\overline{L} + \tau^2/2\alpha \tag{2.24}$$

in all subsequent periods (where $A = \tau/\alpha$, $e = \underline{\gamma}$, and $\Pi = (\phi\underline{\gamma} - w)\overline{L}$). Accordingly, the firm will avoid taxes if and only if

$$\pi^D + \pi^A \frac{\delta}{1-\delta} > \pi^H \frac{1}{1-\delta}, \tag{2.25}$$

[22] We may argue that the firm is stigmatized as "tax avoider" for all levels of $A > 0$.

i.e., if the net present value of all (present and future) profits is higher in case of avoidance.[23] Given (2.22), (2.23), and (2.24), this inequality can be expressed as follows:

$$\frac{\tau^2}{2\alpha}\frac{1}{1-\delta} > (1-\tau)(\overline{\gamma}-\underline{\gamma})\phi\overline{L}\frac{\delta}{1-\delta}.^{24} \tag{2.26}$$

Similar to the two-period framework, the firm optimally trades off two opposing effects when deciding whether to engage in tax avoidance. For a given gross profit, the firm's net profit is obviously higher if it avoids taxes. For an infinite number of periods, the net present value of these tax savings is given by the left-hand side of inequality (2.26). However, yet again, there is the indirect cost of tax avoidance. In (2.26), this cost is captured by the the right-hand side of the equation. Accordingly, the firm only avoids taxes if the associated savings exceed the indirect cost of avoidance, i.e. if inequality (2.26) holds.

Hence, a firm is more likely to engage in tax avoidance if it underestimates the associated indirect cost (myopic view), and might even do so in a situation where it is not optimal.

As in the basic framework, tax avoidance is particularly worthwhile if the direct avoidance cost (α) is low and if the tax rate (τ) is high. It can be seen from inequality (2.26) that a high tax rate, once again, encourages tax avoidance in two different ways. First, tax savings are increasing quadratically in τ. Second, the (future) tax rate curbs future profits, making them less worthwhile to attain. That is, the indirect cost of tax avoidance is decreasing in τ. The latter argument also applies to the discount factor δ. Thus, tax avoidance is more attractive if the value of δ is low.

Moreover, the indirect cost of tax avoidance is small if the effort-related productivity shock is small or of minor importance. This is the case if the potential decline of effort ($\overline{\gamma}-\underline{\gamma}$), the number of employees ($\overline{L}$), or the marginal productivity of effort (ϕ) are small. Given the definition of γ_t (2.20), $\gamma_t = \overline{\gamma}$ if employees do not observe ($\kappa_o = 0$) or despise ($\kappa_s = 0$) avoidance. In such a case, the indirect cost of tax avoidance (i.e., the right-hand side of (2.26)) is zero and inequality (2.26) always holds, meaning that the firm avoids taxes.

Apparently, the qualitative influence of these parameters is, to a large extent, the same as in our basic setting. The only exception is the number of

[23] We assume that the firm does not avoid taxes in case of indifference.

[24] Further simplification leads to $\tau^2/2\alpha > \delta(1-\tau)(\overline{\gamma}-\underline{\gamma})\phi\overline{L}$.

employees, $\overline{L}$, which is positively related to the indirect cost of tax avoidance in the present specification with infinite time horizon.

Given inequality (2.26), the alternate modeling approach introduced in this subsection allows us to formulate two additional hypotheses.

Hypothesis 4: The higher the *direct cost of tax avoidance*, the lower the likelihood of avoidance by a firm (cf. **H2**).

Hypothesis 5: The higher the *indirect cost of tax avoidance*, the lower the likelihood of avoidance by a firm (if the latter takes this cost into account; cf. **H3**). Regarding this (and extending **H1**), the indirect cost of tax avoidance is high if the number of employees ($\overline{L}$) is high.

2.4.2 Time-variant wages

Given the model's feature that tax avoidance by a firm limits the motivation of its employees, it is straightforward to ask whether the wage claims of employees are affected by avoidance as well. In order to answer this question, we drop the assumption that wages are constant over time and suppose that employees' contracts end after each period.[25] Thus, a firm has to (re)hire workers, by offering a one-period contract, at the beginning of each period t. For convenience, we continue to assume that the optimal number of employees is constant and given by $\overline{L}$. Furthermore, we assume that the wage w_t takes the form of a fixed payment.[26] Workers only accept the job offer by the firm if their participation constraint is satisfied:

$$U_t = w_t + \gamma_t e_t - \frac{1}{2} e_t^2 \geq \underline{U}, \tag{2.27}$$

where $\underline{U}$ denotes workers' constant and exogenous reservation utility.

Given workers' utility-maximizing effort is $e_t = \gamma_t$, the participation constraint is satisfied if the offered wage is at least

$$w_t \geq \underline{U} - \frac{\gamma_t^2}{2}. \tag{2.28}$$

[25] Moreover, we return to our basic two-period framework.

[26] Recall that effort is unobservable, making it impossible for the firm to implement monetary incentives conditional on effort provision.

Following (2.7), we have $\gamma_1 = \overline{\gamma}$ and

$$w_1 \geq \underline{U} - \frac{\overline{\gamma}^2}{2} \tag{2.29}$$

in the first period and $\gamma_2 = \overline{\gamma}\big(1 - \frac{\kappa_o \kappa_s A_1}{\Pi_1}\big)$, implying

$$w_2(A_1) \geq \underline{U} - \frac{\overline{\gamma}^2}{2}\left(1 - \frac{\kappa_o \kappa_s A_1}{\Pi_1}\right)^2 \tag{2.30}$$

in the second period. We assume a perfectly competitive labor market, which means that the firm can set wages such that (2.29) and (2.30) hold with equity. Equation (2.30) shows that the second-period wage is increasing in A_1, the level of tax avoidance in the first period, if workers observe and despise avoidance ($\kappa_o, \kappa_s > 0$). Tax avoidance curbs workers' intrinsic motivation and the utility they derive from working for the respective firm. Consequently, avoiding firms must pay higher wages in order to satisfy workers' participation constraints. Furthermore, a comparison of (2.29) and (2.30) shows that tax avoidance leads to higher wage requests in future periods.

One may argue that a firm's employees ("insiders", indexed I) are better informed about their employer's tax-planning activities, implying a higher value of κ_o, compared to "outsiders" (indexed O): $\kappa_{o,I} > \kappa_{o,O}$. Given $\partial w_2(A_1)/\partial \kappa_o > 0$, this means that long-term employees claim higher wages than outsiders in case of tax avoidance, i.e. $w_{2,I}(A_1) > w_{2,O}(A_1)$ for $A_1 > 0$. As a consequence, an avoiding firm prefers hiring new workers over keeping the current employees if the turnover-related cost per employee, which we denote ψ, is lower than the wage differential between insiders and outsiders: $\psi < w_{2,I}(A_1) - w_{2,O}(A_1)$. Thus, there may be a negative relationship between the employee turnover rate and the effective tax rate of a firm.

Hypothesis 6: The lower the effective tax rate of a firm, the higher are (future) wages of this firm's employees. This effect is stronger if workers can easily observe (κ_o high) and despise tax avoidance (κ_s high). Moreover, the effect is stronger for long-term employees which have better information about the firm's tax-planning activities, compared to outsiders.

Hypothesis 7: The lower the effective tax rate of a firm, the higher its employee turnover rate.[27]

[27] In line with Hypotheses 6 and 7, Burbano (2016) shows that CSR investment can

Allowing for time-variant wages does not alter the myopic tax avoidance level (2.14).[28] By contrast, the optimal tax avoidance level is even lower in this case. In particular, tax avoidance harms the firm's future profit in two different ways: it leads to lower effort (as in the basic framework) and higher wages of employees. Maximizing the firm's profit function (2.13) with respect to A_1 now yields

$$\tau = \alpha A_1 + \Delta\left(1 + \frac{\gamma_2}{\phi}\right) \quad \Leftrightarrow \quad A_1^{o,w} = \frac{\tau - \Delta\left(1 + \frac{\gamma_2}{\phi}\right)}{\alpha}. \tag{2.31}$$

(2.31) is a modified version of equation (2.17), as it additionally contains the wage-increasing effect of tax avoidance. This effect is reflected by the non-negative second term in the round bracket, $\frac{\gamma_2}{\phi} \geq 0$.[29] Accordingly, the wage-increasing effect is present as long as workers still have some intrinsic motivation to work for the firm ($\gamma_2 > 0$).

A comparison of equations (2.14), (2.17), and (2.31) shows that the difference between the myopic and optimal level of tax avoidance becomes even larger if wages are not fixed. While the marginal benefit of avoidance is still given by τ, the marginal cost increases, due to the additional wage effect. Consequently, the optimal level of tax avoidance is lower if we allow for time-variant wages: $A_1^{o,w} \leq A_1^{o}$.[30] This finding is in line with our previous results, as we may interpret the wage effect as an additional part of the indirect cost of tax avoidance.

2.4.3 Alternate specification of γ

As a further robustness check, we want to examine how results change if we modify the specification of γ_t in our two-period framework. Instead of (2.7), we now suppose

$$\gamma_t = \overline{\gamma}\left(\frac{\tau_{t-1}^e}{\tau}\right)^{\kappa_o \kappa_s} = \overline{\gamma}\left(1 - \frac{A_{t-1}}{\Pi_{t-1}}\right)^{\kappa_o \kappa_s}. \tag{2.32}$$

reduce the wage demands of (prospective) workers and Hansen et al. (2011) demonstrate that employees who perceive their employer to be socially responsible are less likely to leave.

[28] Obviously, this only holds true if the firm is unaware of the link between tax avoidance and workers' wage claims.

[29] Recall that $\gamma_2 \geq 0$ per definition.

[30] The optimal tax avoidance level in this case can be explicitly determined as $A_1^{o,w} = \frac{\tau - \Delta(1+\overline{\gamma}/\phi)}{\alpha - \Delta\overline{\gamma}\kappa_o\kappa_s/\phi\Pi_1}$.

In the basic model, we assume a negative linear relationship between tax avoidance and employees' (future) intrinsic motivation (cf. (2.7)). This implies that the marginal effect of tax avoidance on workers' motivation, $\partial\gamma_t/\partial A_{t-1}$, is negative, constant, and independent of A_{t-1}. By contrast, the marginal effect is negative and decreasing in A_{t-1} for the alternate specification of γ_t assumed here. That is, γ_t decreases more than proportionally in tax avoidance A_{t-1}.[31] Given (2.32), maximization of the profit function (2.13) yields

$$\tau = \alpha A_1 + \Delta\left(1 - \frac{A_1}{\Pi_1}\right)^{\kappa_o\kappa_s - 1} = \alpha A_1 + \Delta\left(\frac{\tau_1^e}{\tau}\right)^{\kappa_o\kappa_s - 1}, \tag{2.33}$$

which is yet another modification of the optimality condition (2.17). The additional term in equation (2.33), $\left(\frac{\tau_1^e}{\tau}\right)^{\kappa_o\kappa_s-1}$, is greater than one in case of tax avoidance, i.e. for $\tau_1^e < \tau$.[32] Accordingly, the indirect cost of tax avoidance is larger than in the basic model, implying a lower optimal avoidance level. Besides this quantitative effect, however, the qualitative results are the same for both specifications of γ_t.

2.5 Conclusions

This chapter suggests a link between corporate tax avoidance, employee effort, and firm performance that has not been analyzed so far. In order to do so, we develop a theoretical framework in which workers' intrinsic motivation and, as a consequence, their provided effort are negatively affected by tax avoidance of their employer. Based on this assumption, we derive several hypotheses on the relationship between tax avoidance and (long-term) firm performance. In particular, our results suggest that tax avoidance leads to lower output, higher wages and employee turnover, and lower profits in the future. We refer to this effect as *indirect cost of tax avoidance*, as opposed to the *direct cost* that is caused by tax-planning activities straightaway. The higher the direct and indirect cost of tax avoidance, the lower the optimal avoidance level. Accordingly, a firm avoids too much taxes if it underestimates these

[31] In particular, $\partial\gamma_t/\partial A_{t-1} = -\overline{\gamma}\frac{\kappa_o\kappa_s}{\Pi_{t-1}}$ for the specification (2.7) in the basic model and $\partial\gamma_t/\partial A_{t-1} = -\overline{\gamma}\frac{\kappa_o\kappa_s}{\Pi_{t-1}}\left(1 - \frac{A_{t-1}}{\Pi_{t-1}}\right)^{\kappa_o\kappa_s-1}$ for the specification (2.32) assumed here.

[32] To be precise, the additional term equals one in a scenario where $\kappa_o = \kappa_s = 1$, as (2.7) and (2.32) are identical in this case.

costs. Given the strong increase in public concern about corporate tax planning in recent years, this finding seems to be particularly relevant regarding the *indirect cost of tax avoidance*. Both an unexpected disclosure of a firm's tax-planning activities as well as a change in employees' attitude towards avoidance may increase this cost and entail lasting negative effects on the firm's performance.

Chapter 3

Understanding the tax-setting behavior of developing countries [1]

3.1 Introduction

Functioning institutions as well as an efficient organization of the government seem to be important preconditions for growth and development. Particularly the activities of the public sector require an efficient system of collecting taxes. This, however, appears to be one of the major problems of poorer countries. Using data from Steinmüller et. al. (2018), the 25% poorest countries measured in terms of GDP per capita raise on average about 2.38% of GDP in corporate income tax revenue, whereas corporate income tax revenue amounts to about 3.68% of GDP, on average, in the 25% richest countries; the 10% richest countries even raise more than 4% revenue from taxing business profits. The fact that the average statutory tax rate is about 6-percentage points higher in the 10% poorest countries (an average tax of 32% compares to an average tax of 26%) may be interpreted in two ways. First, countries have implemented inefficiently high tax rates that lead to substantial tax avoidance activity. In other words, these countries are on the wrong side of the Laffer-curve, which raises the question of why governments of these countries do not cut taxes.[2] Second, institutions in these countries

[1] This chapter is joint work with Elias Steinmüller and Georg Wamser.

[2] The concept of the Laffer-curve implies the notion of an inverse-U-shaped relationship between statutory taxes and tax revenue. Thus, there exists a tax rate between 0% and 100% which maximizes tax revenue.

do not work, irrespective of the tax level, so that significant amounts of tax revenue are lost through different forms of tax evasion or informal market activity.[3]

It is the goal of this chapter to shed light on the corporate tax policy of countries operating under very different conditions with respect to a variety of aspects such as the level of corruption, the quality of fiscal institutions or location-specific rents (the latter may be high in resource-abundant countries). We particularly aim at understanding (i) why some (often it seems poor) countries set comparatively high corporate tax rates and do not cut taxes to reduce inefficiencies and raise more tax revenue; (ii) why countries do not take action and fix institutions to facilitate the collection of taxes.

As a possible explanation for this pattern, we propose a theory predicting that countries operate in one of three "tax-setting regimes". Tax-setting behavior is endogenously determined and crucially depends on the respective regime: under the first one, countries can ignore tax evasion; countries in the second regime will implement measures against tax evasion; countries operating in the third regime tolerate tax evasion. To which of these regimes a country is assigned to specifically depends on the level of corruption, the quality of fiscal institutions, and on country-specific rents (e.g., associated with natural resource abundance). To be more precise, our theory assumes a government whose objective it is to maximize revenue from taxing firm profits. Firms, on the other hand, have an incentive to avoid taxation by the government. For this purpose, two strategies are at their disposal: they can either evade taxes by paying a bribe to the tax agent in charge or refrain from investing in the country's (formal) economy entirely. Whether it is worthwhile for firms to opt for one of these activities depends on their tax burden. Thus, the government is limited in its tax setting by firms' implicit threats to evade taxes or to leave the formal economy. The extent to which the government is able, and willing, to prevent firms from evading taxes and leaving the economy by setting the tax rate sufficiently low, depends on a number of country characteristics. In particular, the government's ability to detect and punish tax evasion hinges on the corruption level and the quality of fiscal institutions, while country-specific rents determine firms' gross profits and, as a consequence, their incentives to enter the economy and to evade

[3] However, this argument suggests that tax revenue is lower at all potential tax levels (a downward-shift of the Laffer-curve). As highlighted by Abbas and Klemm (2013) and Abramovsky et al. (2014), generous special tax regimes and incentives may also play an important role in this regard.

taxes. Accordingly, these country characteristics affect optimal tax policy, suggesting that a country belongs to one of three possible country types and either (i) ignores, (ii) combats, or (iii) tolerates tax evasion. We demonstrate that countries characterized by widespread bureaucratic corruption, weak institutions, and high resource rents are very likely to be in the 'tolerating-tax-evasion' regime. In the latter regime, countries will set relatively high tax rates and tolerate evasion, as expected revenues come from fines on detected bribery. Several studies suggest that such bribes are relatively common in many countries, especially in less developed ones. In the countries included in the World Enterprise Survey, for example, 18% of the surveyed firms have experienced at least one bribe payment request, and 13.3% expect to make informal payments in meetings with tax officials.[4]

Our work relates to several strands of previous literature. Alm et al. (2016) identify corruption of tax officials as a significant determinant of tax evasion behavior of firms. Conducting a field experiment in Pakistan, Khan et al. (2015) demonstrate that tax collector compensation crucially affects the scope of tax evasion and the level of bribe payments. Using firm-level data from Uganda, Gauthier and Goyette (2014) find bribe and tax payments to be inversely related, and Gauthier and Reinikka (2006) find tax evasion (and tax exemptions) to be widespread in Uganda. Similarly, the study by Fisman and Svensson (2007) suggests a negative impact of both taxation and bribery on the growth levels of Ugandan firms. On a related note, Knutsen et al. (2017) show that mining fosters local corruption and increases bribe payments in African countries. Anecdotal evidence on the topic is provided by Besley and McLaren (1993) and Cheung et al. (2012).

Apart from the literature mentioned above, our work is related to previous work on optimal taxation that highlights the differences between developed and developing countries (e.g., Auriol and Warlters, 2005; Best et al., 2015; Carrillo et al., 2017; Dharmapala et al., 2011; Emran and Stiglitz, 2005; Gordon and Li, 2009). These differences are, to a large extent, driven by the lower fiscal capacity of developing economies.[5] Often, a low fiscal capacity is associated with widespread tax evasion and the persistence of substantial

[4]Data available at http://www.enterprisesurveys.org/data/exploretopics/corruption (accessed 06/21/2018).

[5]The concept of fiscal capacity refers to a government's capability to generate tax revenue, which depends on the structure and the effectiveness of the tax system, as well as on the enforcement power of tax authorities and the expertise of tax agents (cf. Besley and Persson, 2013).

informal sectors and, thus, has a significant impact on the affected countries' optimal tax policies.[6] General analyses of (optimal) tax policies for developing countries are provided by Besley and Persson (2014) and Tanzi and Zee (2000), while Abbas and Klemm (2013) and Abramovsky et al. (2014) discuss corporate taxation in this context.

Bureaucratic corruption and weak institutions have been identified as main reasons why the fiscal capacity of less developed countries is low. For instance, Bird et al. (2008) suggest that tax revenue in developing and even in high-income countries could be significantly higher if corruption was reduced and 'voice and accountability' were improved. Besley and Persson (2014) highlight that a mere adjustment of the tax system is usually insufficient for developing countries to increase their revenue. Instead, such an adjustment should be accompanied by, and be part of, a broader economic development. Aizenman and Jinjarak (2009) stress that the process of globalization, by reducing trade and financial barriers, forces countries to rely more on 'hard-to-collect' taxes, like value added and income taxes, instead of 'easy-to-collect' taxes such as tariffs. They find countries with low institutional quality to struggle more doing so. Similarly, Besley and Persson (2013) argue that such a change in the pattern of taxation accompanies a country's overall development, while La Porta and Shleifer (2014) find that economic development is associated with a decline of the informal sector, which should make it easier to raise tax revenue. Gokalp et al. (2017) demonstrate that competition from the informal sector may induce formal firms to evade taxes, especially if institutions and regulations are inefficient and burdensome. In a similar context, Dreher et al. (2009) provide evidence that institutional quality reduces both the size of the shadow economy and the corruption level. Similarily, Torgler and Schneider (2007) identify governance and institutional quality as well as tax morale as limiting factors of informal activity. Acemoglu et al. (2005) argue that institutions are a fundamental cause of

[6] In particular, Emran and Stiglitz (2005) analyze the effectiveness of a VAT in presence of an informal economy. Auriol and Warlters (2005) suggest that high market entry barriers, implying a large informal sector, may positively affect tax revenue by creating larger rents for (fewer) formal firms. Carrillo et al. (2017) stress the limited influence of third-party reporting on tax compliance in developing countries. Best et al. (2015) and Dharmapala et al. (2011) examine the trade-off between production and revenue efficiency that arises when tax enforcement is imperfect. Gordon and Li (2009) identify the smaller value of financial intermediation as a possible reason why developing countries' optimal tax policy may differ from the one of developed countries.

economic growth. Mehlum et al. (2006) show that countries suffer from natural resources, in terms of lower growth rates, if institutions are weak and bureaucratic corruption is widespread. By contrast, resource-rich countries with good institutions experience higher growth rates than countries with less resources.[7] Jensen (2011) argues that natural resource abundance reduces a country's non-resource tax effort and, as a consequence, its investment in fiscal capacity. This notion is supported by Crivelli and Gupta (2014), who estimate that each additional percentage point of GDP in resource revenue is associated with a reduction of about 0.3 percentage points of GDP in domestic (non-resource) revenues. As these studies highlight the impact of corruption, institutional quality, and natural resource abundance on (optimal) tax policy of countries, they strongly motivate the model we propose in the following.

We add to this literature by (i) providing a rich theory that can explain numerous empirical patterns very well; (ii) demonstrating that the corporate tax-setting behavior of less developed countries is in line with countries maximizing expected revenue; (iii) establishing three tax-setting regimes in which countries may operate. We show that countries' tax policies, in particular the way how to deal with bureaucratic corruption and tax evasion, crucially depends on the respective regime and may differ fundamentally across countries. The main policy implication we can derive from this chapter is that functioning institutions and an efficient tax system are the basis for adequate revenue collection. Our findings show that a corrupt and structurally weak fiscal environment tends to undermine countries' incentives to combat tax evasion and to improve the setting in which tax collection takes place. However, doing so proves to be an indispensable step in poor countries' economic development. Finally, our theory suggests that particulary resource-rich countries may be stuck in the bad 'tolerating-tax-evasion' regime. In this sense, our findings provide an optimal tax perspective on the resource curse.

The remainder of the chapter is organized as follows. Section 3.2 empirically motivates several determinants of corporate tax policy. Based on

[7] The negative relationship between natural resource abundance and economic performance observed for many countries is referred to as 'resource curse' in the literature (cf. Sachs and Warner, 2001, and Mehlum et al., 2006, among others). In line with Mehlum et al. (2006), several studies (e.g., Kolstad and Søreide, 2009; Leite and Weidmann, 1999; van der Ploeg, 2011) identify corruption and weak institutions as driving forces behind this pattern.

the empirical regularities suggested in Section 3.2, we propose a theory of optimal tax policy for different country types in Section 3.3. Section 3.4 analyzes the relationship between tax enforcement, revenue collection, and country development, while Section 3.5 concludes.

3.2 Determinants of corporate tax policy

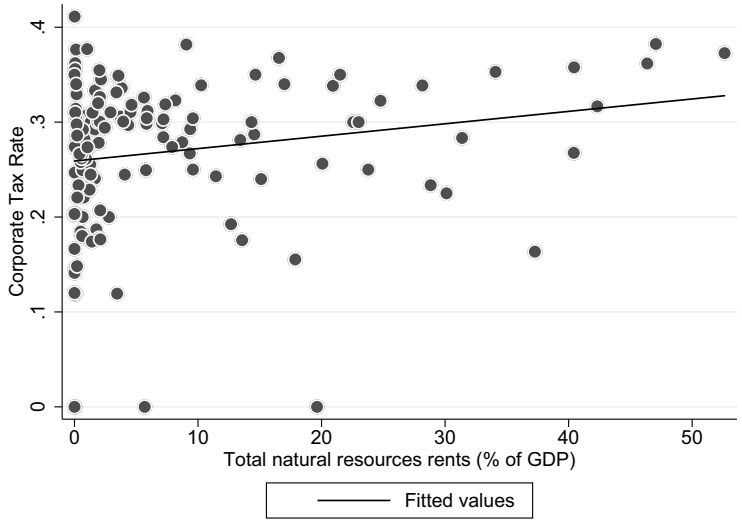
Note that common economic reasoning would suggest some straightforward answers for the descriptive finding "poor countries set high taxes but raise only little tax revenue". For example, we could argue that poor countries are often those where rents from natural resources are high and therefore relatively high corporate income taxes are implemented as to tax some of these rents. Why "high rents times high taxes" does not translate into high tax revenue seems to be perfectly obvious: there is plenty of evidence that it is the poor countries where institutions are unfavorable and public corruption is pervasive. The latter issues facilitate all forms of tax evasion with the consequence of tax base erosion and meager tax revenue. This reasoning, however, may be too simplistic when the objective is to explain the tax policy of different countries.

The following theoretical analysis argues that the tax-setting behavior of countries is specific to one of three regimes. These regimes depend on country characteristics which appear to be fundamental determinants of optimal corporate taxes. We will therefore first identify possible candidates (country characteristics) which may have an effect on optimal tax setting. In particular, the following five measures are proxies for the key determinants of the theory model we introduce in the next section: (i) natural resource rents (denoted by Π in the theory model); (ii) natural resource rents of neighboring countries to capture a firm's outside option (denoted by π^0 in the theory model); (iii) the 'share of steadfast agents' to capture corruption (denoted by s in the theory model); (iv) number of double taxation treaties concluded by a country to capture strictness of tax law (denoted by p, i.e. the probability of detection of tax evasion, in the theory model); and (v) expected penalty, captured by an indicator for 'rule of law', when tax fraud is detected (denoted by λ, i.e., the penalty rate, in our theory model).

One central insight of optimal tax theory is that economic rents can be taxed without efficiency cost. At the level of countries, such rents may be related to the specific attractiveness of a location, as for instance the avail-

ability of natural resources. We could argue that especially poor countries are regularly those where rents from natural resources are high and therefore relatively high corporate income taxes are implemented to tax these rents. We measure rents by using the variable "Total natural resources rents (% of GDP)" provided by the World Bank.[8] Figure 3.1 displays the relationship between the statutory tax rate of a country (vertical axis) and the total natural resource rents in % of GDP (horizontal axis). The statutory tax rate, which we denote by t in our theory model, is taken from Steinmüller et al. (2018). The average rate across all countries included in our sample equals 27%. The positive correlation confirms that high-rent countries are able to tax location rents by setting relatively high corporate tax rates.[9]

Figure 3.1: Rents from natural resources and statutory tax rates



Notes: This figure is based on 134 observations (134 countries) on which we have data. The statistic is based on mean values of the statutory corporate tax rate and the total natural resources rents (% of GDP) over all available years in our data. On average, the latter variable equals 7.83 (minimum value: 0; maximum value: 52.63).

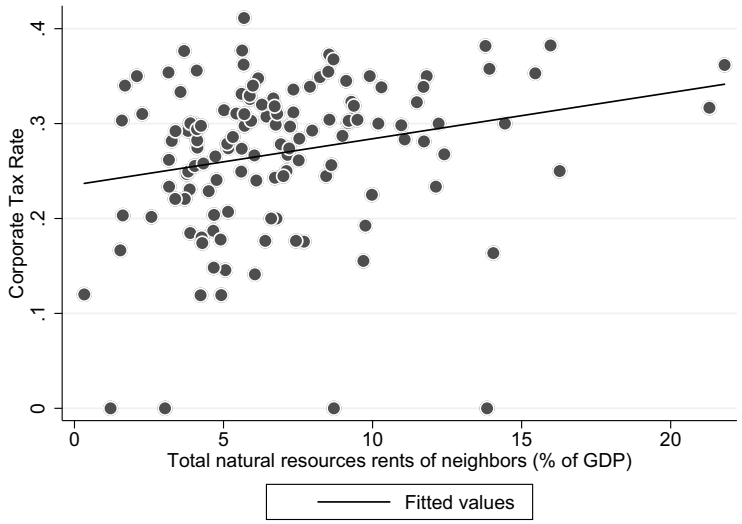
If investors are mobile, the total natural resource rents of the neighboring

[8] Estimates are based on sources and methods described in "The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium" (World Bank, 2011).

[9] Note that for the purpose of the following figures, we always calculate the (country-specific) means of the variables over all years available in our data.

countries may be interpreted as an outside option. Hence, for a given country, we use the total natural resource rents in % of GDP of neighboring countries, where we weight the neighbors' rents by the inverse distance between the most populated cities. Figure 3.2 suggests that high rents of the neighbors allows a given country to keep its corporate tax rate high. At first sight, this finding seems a bit counterintuitive, as high rents in neighboring countries may force a government to set rather low corporate taxes in order to attract investment. However, high location rents and correspondingly high tax rates in a country may mitigate tax competition and allow neighboring countries to set a relatively high tax rate as well. Furthermore, location rents may imply agglomeration effects that spill over to neighboring countries in terms of higher rents and tax rates.[10]

Figure 3.2: Rents from natural resources of neighbors and statutory tax rates

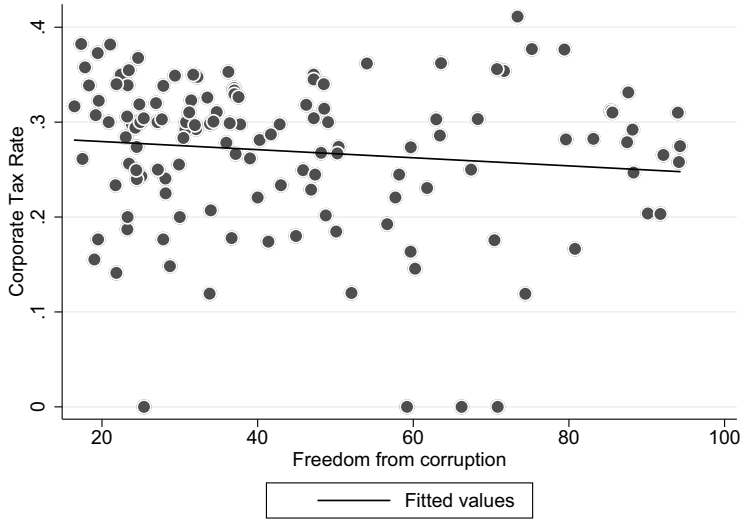


Notes: This figure is based on 134 observations (134 countries). The statistic is based on mean values of the statutory corporate tax rate and the total natural resource rents (in % of GDP) of the neighboring countries weighted by inverse distance over all available years in our data. On average, the latter variable equals 6.97 (minimum value: 0.33; maximum value: 21.81).

[10]Note, though, that in our theoretical model, we do not model tax competition between countries explicitly and abstract from potential agglomeration effects. Chapter 4 provides a modification of the model that incorporates tax competition. Similarly, Mardan (2018) and Mardan and Stimmelmayr (2018) analyze tax competition between countries which are at different stages of development.

The theory we present in the next section acknowledges that firms may attempt to bribe the tax agent in charge, with the aim of saving tax payments. It seems that agents in countries with high levels of corruption are more tempted to accept bribes. We therefore use the variable "freedom from corruption" provided by the Heritage foundation. This index variable takes values between 0 (country is totally corrupt) and 100 (country is virtually free from corruption). Following the points made in the introduction, we may argue that raising tax revenue in countries where public corruption is pervasive is particularly difficult. Thus, we expect to find a negative relationship between "freedom from corruption" and the corporate tax rate. Figure 3.3 suggests, however, that this relationship is not very strong.

Figure 3.3: Freedom from corruption and statutory tax rates

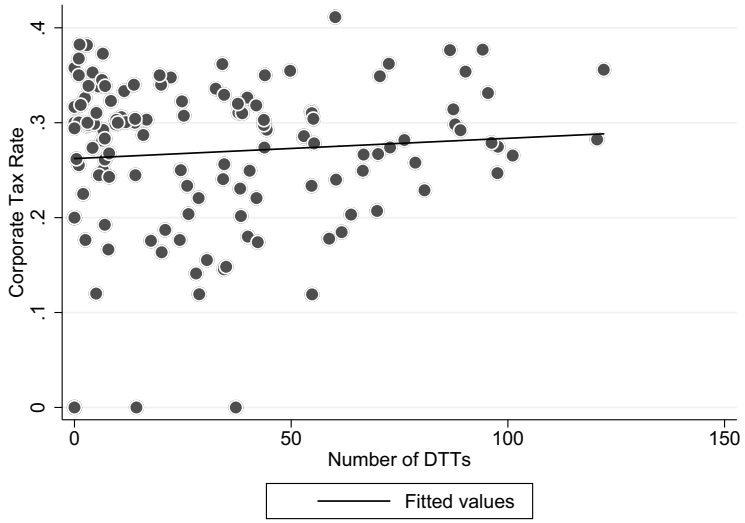


Notes: This figure is based on 134 observations (134 countries). The statistic is based on mean values of the statutory corporate tax rate and the index for freedom from corruption over all available years in our data. On average, the latter variable equals 44.05 (minimum value: 16.47; maximum value: 94.28).

Another variable we consider as being an important determinant of tax setting is the probability of detecting evasive behavior. We expect that the number of double taxation treaties (DTTs) in a given country is a good proxy for the strictness of the tax law. The DTT data is taken from the IBFD's Global Tax Treaty Information database. We expect that the number of DTTs should be strongly correlated with the probability of detection.

A higher probability of detection should make tax evasion more difficult. Accordingly, we may reason that a low probability of detection makes the tax base more elastic. Optimal tax behavior would then call for a relatively low tax rate in this case. Figure 3.4 confirms this behavior by suggesting a positive relationship between number of DTTs and statutory tax rate. The positive correlation may also reflect that, by using DTTs, high-tax countries try to implement regulations to prevent international tax avoidance activities.[11]

Figure 3.4: Number of double taxation agreements and statutory tax rates



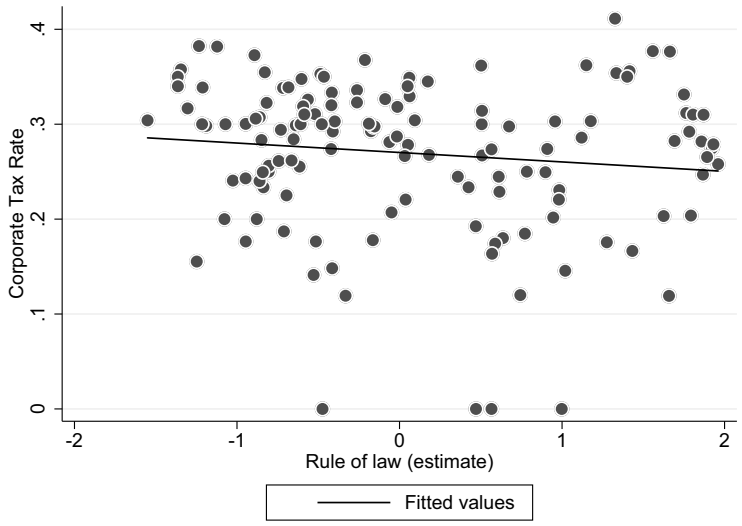
Notes: This figure is based on 134 observations (134 countries). The statistic is based on mean values of the statutory corporate tax rate and the number of double taxation treaties (DTTs) over all available years in our data. On average, the latter variable equals 33.04 (minimum value: 0; maximum value: 122).

The strength of taxpayers' incentives to evade depend on the expected penalty, rather than the detection probability alone. Empirically, we may capture the expected penalty (or the penalty rate) by using an index measuring a country's rule of law provided by the World Bank (Worldwide Governance Indicators database). According to the World Bank, the variable

[11]Note that, in principle, there may be arguments that this correlation should be negative. For example, more integrated countries competing for international investors may have many DTTs and a low corporate tax rate. A DTT, in this argument, is a strategic instrument to attract mobile investors.

'rule of law' captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. The variable can take values between -3 and +3, where higher values indicate more confidence in a country's law. We may argue that good institutions should reduce taxpayers' possibilities to evade and allow countries to charge higher taxes without inducing efficiency losses. By contrast, Figure 3.5 suggests a clear negative correlation between corporate tax rates and rule of law.

Figure 3.5: Rule of law and statutory tax rates



Notes: This figure is based on 134 observations (134 countries) on which we have data for the time. The statistic is based on mean values of the statutory corporate tax rate (STR) and the index for 'Rule of Law' over all available years in our data. On average, the latter variable equals .094 (minimum value: −1.55; maximum value: 1.96).

The bi-variate correlations illustrate that the single arguments made above are too simplistic if the goal is to explain the tax-setting behavior of countries. Many questions remain: Why are poor countries with high corruption and bad institutions not trying to set lower tax rates? Why are the correlations (e.g., between corruption and statutory corporate tax rates) not stronger? Can countries increase tax revenue through tax policy reform? The following theoretical analysis has the goal of addressing these questions. It turns out that it may be optimal for some countries to implement high

taxes, even though we would expect them to cut corporate tax rates when focussing on single characteristics.

3.3 Theoretical model

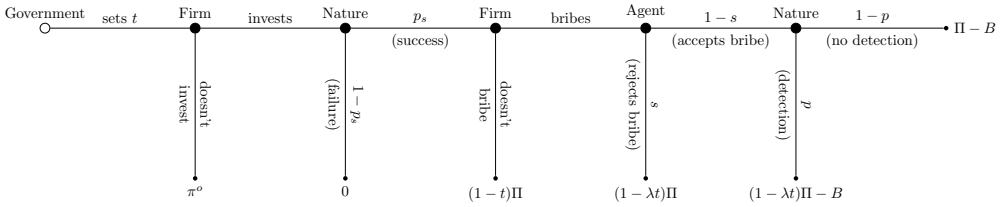
Let us consider a country hosting a continuum of identical, risk-neutral firms of mass one. Each firm can initiate an investment project generating payoff $\Pi \geq 0$ if successful (with probability p_s). In case of failure (with probability $1-p_s$), the payoff is zero. Thus, a firm's expected gross profit when realizing the project is $E[\Pi] = p_s\Pi$. Alternatively, firms can settle for the exogenously given outside option $\pi^o \geq 0$. We assume that π^o cannot be taxed by the country.[12] The probability of success p_s as well as the respective profit levels are assumed to be common knowledge. By contrast, the outcome of the investment project (i.e., whether the firm is successful or not) is private information to the firm and the respective tax agent in charge, while it remains unknown to the government of the country. Profits that arise from the investment project are taxed at rate t. However, a firm can try to evade the tax by paying a bribe B to the assigned tax agent. The latter reports a failure of the firm's investment, and hence profits of zero, to the government if he accepts the bribe. Thus, a firm does not have to pay taxes at all if the bribe payment B is accepted by the tax agent (with probability $1-s$) and not detected by the government afterwards (with probability $1-p$). If the bribe attempt is rejected by the agent (with probability s) or detected by the government (with probability p), however, the tax burden of the firm increases by factor $\lambda > 1$, instead of being reduced.[13]

[12] We can think of π^o as a firm's net profit after relocation to a neighboring country, for example. The outside option π^o may also represent a firm's payoff when operating in the informal sector.

[13] While our study focuses on tax evasion, it should be noted that both legal tax avoidance and illegal evasion pose serious problems to revenue collection in developing countries, as shown by Cobham (2005). Similar to our model, several papers (Besley and McLaren, 1993, Gauthier and Goyette, 2014, 2016, and Sanyal et al., 2000, among others) analyze a government's optimal behavior when it has to deal with corrupt tax agents that may allow firms or individuals to cheat on their tax payments in exchange for bribes. While these models differ with respect to the government's main policy instrument, which may be the optimal public sector wage scheme (Besley and McLaren, 1993), degree of monitoring activity (Gauthier and Goyette, 2016), auditing (Sanyal et al., 2000), or tax rate (the present work), they all share the common finding that it may be optimal for a government to tolerate tax evasion, at least to some extent. Hindriks et al. (1999) examine optimal

The structure of the game, which we depict in more detail in Figure 3.6, is as follows. In the first stage, the government decides about the corporate tax rate t. Afterwards, firms make their choices about investment projects. The gross profits of investing firms are realized in the third stage. Subsequently, firms attempt bribery or they behave tax-compliant. After that, tax agents account for a potential bribe offer and report firm profits to the government. Finally, tax revenue (government) as well as (net) payoffs (agents and firms) are realized. The model is solved via backward induction.

Figure 3.6: Game structure



3.3.1 Tax agents

In the last stage before outcomes are realized, tax agents, who are randomly assigned to firms, decide on whether or not to accept a bribe. We assume two types of risk-neutral agents. The first type is susceptible to bribery, whereas the second type is not. Accordingly, we call agents of the first type *pliable* and agents of the second type *steadfast*. An agent's type is his private information. Firms and the government only know that a fraction s of all agents is steadfast. Bribery is detected afterwards with probability p, in which case the agent loses his job and the associated wage payment w, but nevertheless gets the bribe B.[14] For simplicity, we set the opportunity wage of the agents to zero. Furthermore, corrupt behavior is associated with personal cost $m > 0$ for a tax agent.[15] This cost is assumed to be the same

private income taxation in the presence of corrupt inspectors and evasion. A more general analysis of the interaction between governmental policy and bureaucratic corruption is provided by Acemoglu and Verdier (2000).

[14]The results of the model are qualitatively the same if bribe payments accrue to the government and become tax revenue in case of detection.

[15]We may interpret m as moral concerns or remorse associated with corrupt behavior. As a consequence, we assume m to arise even in case of non-detection. Note, however, that

for all pliable agents who accept the bribe if

$$B + (1-p)w - m \geq w \quad \Leftrightarrow \quad B \geq B^* = pw + m.^{16} \tag{3.1}$$

Thus, bribe payments are accepted if the net payoff exceeds opportunity cost w. B^* defines the lowest bribe offer that is accepted by a pliable agent. The existence of steadfast agents may represent the fact that the personal cost m is infinitely high for a fraction s of all agents. For these agents, inequality (3.1) is never satisfied. We assume p, w, m, and, consequently B^*, to be common knowledge.

3.3.2 Firms

The behavior of firms is determined in the second, third, and fourth stage of the game.[17] In the fourth stage, firms decide whether to attempt bribery.

in some contributions (like, e.g., Ades and Di Tella, 1999), corrupt agents incur personal cost only in case of detection. Adopting this premise does not alter the qualitative results.

[16] For convenience, we assume that agents accept the bribe in case of indifference, while firms prefer honest behavior over evasion, as well as initiating the project over their outside option in case of indifference. Moreover, we suppose that no (further) bargaining between agent and firm takes place. Cheung et al. (2012) provide empirical evidence that supports this notion. Their findings suggest that lower-level government officials are far less able to expropriate bribery-related rents from firms, as opposed to high-ranked officials. In line with inequality (3.1), Khan et al. (2015) show that the scope of tax evasion and the level of bribe payments crucially depend on tax collector pay. However, as demonstrated by Fjeldstad (2003), higher public wages may simply improve the bargaining power of corrupt agents and lead to higher bribes instead of lower corruption if control mechanisms and sanctions are weak.

[17] Our model primarily applies to small- and medium-sized firms. Large multinational companies tend to rely on profit shifting in order to reduce their tax burden, and the associated losses in revenue seem to be even larger in developing countries, compared to advanced ones (Cobham and Janský, 2017; Crivelli et al., 2016; Johannesen et al., 2017). By contrast, smaller firms often lack the possibility to legally avoid taxes and may, therefore, engage in tax evasion or migrate into informality (Djankov et al., 2010; Slemrod et al., 2015; Waseem, 2018). Consistently, Gokalp et al. (2017) find a negative relationship between firm size and tax evasion. Using data on Ugandan firms, Gauthier and Reinikka (2006) provide evidence that large companies benefit from tax exemptions, while smaller firms tend to evade taxes. In line with these findings, Campos and Giovannoni (2007) and Harstad and Svensson (2011) argue that lobbying and bribery are substitutes, with bribery being far more common for rather small firms (Campos and Giovannoni, 2007) and in less developed countries (Harstad and Svensson, 2011). Supporting this notion, Ayyagari et al. (2007) report that small- and medium-sized firms constitute most of the private sector in these countries.

If the responsible tax agent accepts the bribe, he reports a failure and zero profits of the firm to the government, implying that the firm does not have to pay taxes at all. Accordingly, failed firms, as well as firms which reject the investment project and choose the outside option, have no incentive to bribe as they do not pay taxes. Given the distribution of tax agents and the fact that firms know B^*, a bribe attempt fails and is reported with probability s. Even in case of a successful bribe attempt, tax evasion and the associated bribery are discovered with probability p. The corresponding penalty on the firm is assumed to be the same in both cases. In particular, we assume that a firm's payment to the tax authorities (i.e., the government) is increased by a factor of λ if attempted or accomplished bribery is exposed. We assume p and λ to be exogenous.[18] Accordingly, a bribe attempt is associated with the following expected net profit $\hat{\pi}^e$ for an $e$vading firm:[19]

$$\hat{\pi}^e = (1 - q\lambda t)\Pi - (1 - s)B^*, \tag{3.2}$$

where $q \equiv (1 - s)p + s$ denotes the overall probability of detection.[20] In case of compliant (or $h$onest) behavior, a firm's net profit is

$$\pi^h = (1 - t)\Pi. \tag{3.3}$$

Consequently, a firm attempts bribery if

$$\hat{\pi}^e > \pi^h \quad \Leftrightarrow \quad t > t^{eh} \geq 0, \tag{3.4}$$

where

$$t^{eh} \equiv \frac{(1 - s)B^*}{(1 - q\lambda)\Pi} \tag{3.5}$$

[18] Allowing for endogenous p and λ should not alter the qualitative results of the model. Even if the government was able to choose these variables optimally, it is reasonable (and common in the literature) to assume that it would be limited in doing so by monitoring or auditing cost (regarding p) and legal and political obstacles (regarding λ). Consequently, firms may have an incentive to evade taxes, at least in some countries, even if p and λ are optimally chosen.

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

[20] Note that tax evasion is never worthwhile if the expected penalty is at least one: $q\lambda \geq 1$. Therefore, $q\lambda < 1$, is often assumed in the literature. By contrast, we generally allow for $q\lambda \geq 1$. Thus, the expected penalty may be sufficiently high in some (but not all) countries to fully deter tax evasion.

defines the tax rate for which a firm is indifferent between *e*vading and *h*onest behavior.[21]

When deciding on the investment project in the second stage, firms anticipate their subsequent compliance behavior in case of success. The necessary condition for initiating the project is given by

$$p_s\hat{\pi}^e \geq \pi^o \Leftrightarrow t \leq t^{oe} = \frac{1}{q\lambda}\left(1 - \frac{\pi^o + p_s(1-s)B^*}{p_s\Pi}\right) \tag{3.6}$$

for evading firms and

$$p_s\pi^h \geq \pi^o \quad \Leftrightarrow \quad t \leq t^{oh} = 1 - \frac{\pi^o}{p_s\Pi} \tag{3.7}$$

for honest firms. t^{oe} (t^{oh}) defines the maximum tax rate for which an *e*vading (*h*onest) firm just prefers the investment project over its *o*utside option.[22]

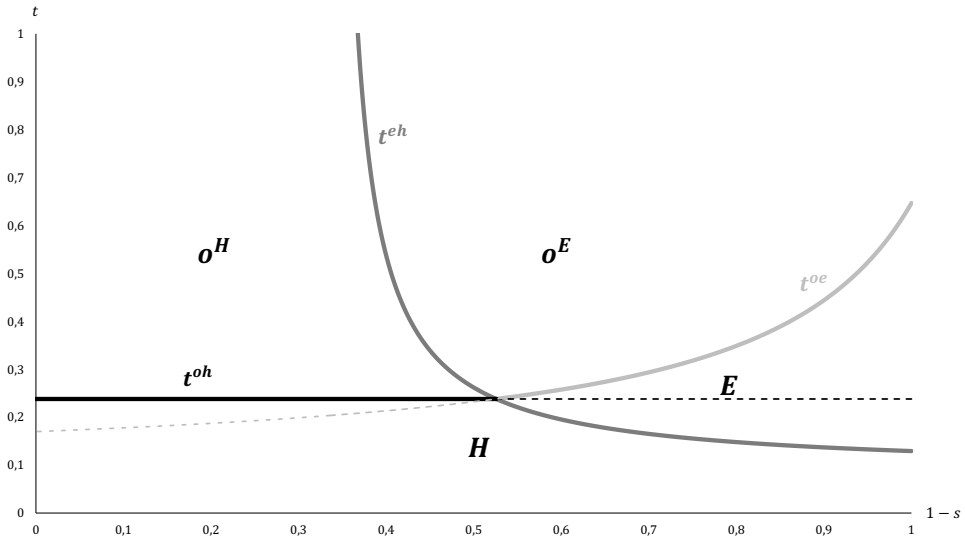
3.3.3 Government behavior

At the first stage of the game, the government sets the tax rate to maximize expected revenue. It is limited by firms' alternatives, which are evasion and the outside option. The attractiveness of these alternatives and the corresponding threshold values of the tax rate are defined by inequalities (3.4), (3.6), and (3.7). In order to understand the dynamics of the model, it proves helpful to depict t^{eh}, t^{oe}, and t^{oh} as functions of $1-s$, the share of pliable agents. Recall that t^{eh} corresponds to the tax rate for which a firm is indifferent between evading and honest behavior, t^{oe} is the maximum tax rate for which an evading firm just prefers the investment project over its outside option, and t^{oh} is the maximum tax rate for which an honest firm just prefers the investment project over its outside option. Let us map firms' optimal behavior for different combinations of $1-s$ and t in Figure 3.7. We may think of $1-s$ as a proxy for corruption and, thus, interpret a high value of this variable as a high corruption level in the following.

[21] Note that the threshold t^{eh} only constitutes an upper limit to taxation of compliant firms if its value is positive, i.e. for $q\lambda < 1$. If $q\lambda > 1$ (implying $t^{eh} < 0$), tax evasion is never worthwhile for firms.

[22] If t^{oe} (t^{oh}) is negative, $t < 0$ (i.e., a subsidy) is necessary to induce evading (honest) firms to start the investment project. However, $t < 0$ cannot be optimal in our model for a revenue-maximizing government. The latter then simply refrains from taxing the respective firms.

Figure 3.7: Threshold tax rates and possible firm behavior



From the perspective of the government, we can distinguish between four different areas in Figure 3.7, each representing a certain behavior of firms.

The lower area denoted by H captures all combinations of $1-s$ and t for which it is optimal for firms to initiate the project and behave compliant in case of success. Formally, $t \leq t^{oh}, t^{eh}$ holds in this area.

The right area denoted by E captures all combinations of $1-s$ and t for which it is optimal for firms to initiate the project, but attempt bribery in case of success. Formally, $t^{eh} < t \leq t^{oe}$ and $t^{eh} < t^{oh}$ hold in this area.

The upper left (o^H) and upper right area (o^E) capture combinations of $1-s$ and t for which it is optimal for firms not to pursue a project and resort to their outside option instead. More precisely, the o^H-area depicts combinations for which firms would prefer paying taxes over attempting bribery if they successfully undertook the project. 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 successfully undertook the project. Formally, $t > t^{eh}, t^{oe}$ holds in that case.

As the considered firms are homogeneous, they all behave in the same way. The government can influence firm behavior through its tax setting. Firms invest and behave compliant in the country if t is set sufficiently low,

i.e. for $t \leq t^{oh}, t^{eh}$. Graphically, the black t^{oh}- and the dark grey t^{eh}-curves determine the upper boundary of the H-area in Figure 3.7.

Depending on the value of $1-s$ (and on the other determinants of t^{eh} (3.5) and t^{oh} (3.7)), either the outside option or the possibility to evade is more attractive to firms. Thus, either the t^{oh}- or the t^{eh}-threshold defines the maximum tax rate the country can implement while still inducing firms to initiate the investment project and subsequently behave compliant. In particular, firms prefer evasion over the outside option if $t^{oh} > t^{eh}$, which holds if $1-s$ is sufficiently high. In Figure 3.7, this applies to all points lying to the right of the intersection of the t^{oh}- and the t^{eh}-curve. The reason is obvious: the higher the corruption level $1-s$, the higher the expected profit in case of evasion $\hat{\pi}^e$ (3.2). That is, a high value of $1-s$ makes investment with subsequent tax evasion in the country more attractive to firms. Accordingly, t^{eh} is decreasing in $1-s$, while t^{oh} is independent of this parameter. As a consequence, the E-area in Figure 3.7 emerges once $t^{oh} > t^{eh}$ holds and (then) becomes larger for higher values of $1-s$.

A key result of our analysis is the following. If $t^{oh} > t^{eh}$ holds, it may be optimal for a country (the government) to *tolerate evasion* if the expected revenue from fines on detected bribery is sufficiently high. Accordingly, we may distinguish between three different tax policies, or country types. The first type refers to all cases where $t^{oh} \leq t^{eh}$. Then, tax evasion is no relevant alternative for firms and, hence, can be *ignored* by the country's government when setting the tax rate. Instead, the maximum attainable tax rate depends on firms' outside option and equals t^{oh}.[23] By contrast, firms' possibility to evade affects the tax setting of the second and third country type, for which $t^{oh} > t^{eh}$ holds. In such countries, firms will engage in evasion if the tax rate is too high. A country's government may implement a maximum tax rate equal to t^{eh}, making evasion unprofitable and, thus, inducing firms to behave compliant (cf. equation (3.4)). We refer to such a country that *combats* evasion as type 2. Alternatively, a country's government can *tolerate* tax evasion and settle for revenue from fines on detected bribery. When doing so, it is able to set a tax rate higher than t^{eh}. However, it has to make sure that firms' expected profit from attempted bribery in the country is at least as high as their outside option (cf. equation (3.6)). Therefore, the tax rate

[23] Suppose that firms are internationally mobile. Then, their outside option is determined by other countries' tax rates and we may state that type 1 countries engage in "ordinary" tax competition. See Chapter 4 for more details.

in a type 3 country must not exceed the threshold value t^{oe}. To summarize, the three country types are

1. **Ignoring tax evasion** (since it is not a serious problem): Outside option of compliant firms as limiting factor ($t^{oh} \leq t^{eh}$). The (limit) tax rate is t^{oh} (3.7) and increasing (decreasing) in Π, p_s (π^o), and independent of w, m, s, p, λ.

2. **Combating tax evasion**: Tax evasion as limiting factor. (Limit) tax rate is t^{eh} (3.5) and increasing (decreasing) in w, m, s, p, λ (Π), and independent of p_s, π^o.

3. **Tolerating tax evasion**: Outside option of evading (!) firms as limiting factor. Government tolerates evasion, (expected) revenue stems from fines on detected evaders. (Limit) tax rate is t^{oe} (3.6), and increasing (decreasing) in Π, p_s ($\pi^o, w, m, s, p, \lambda$).

It is worthwhile for a country to combat evasion if

$$E[R]^{eh} \geq E[R]^{oe}, \tag{3.8}$$

where $E[R]^{eh}$ ($E[R]^{oe}$) denotes the expected tax revenue of a type 2 (3) country. As mentioned above, tax revenue stems from fines on detected bribery in type 3 countries. Thus, tax revenue depends directly on the expected penalty $q\lambda$. In particular, the expected tax revenue is

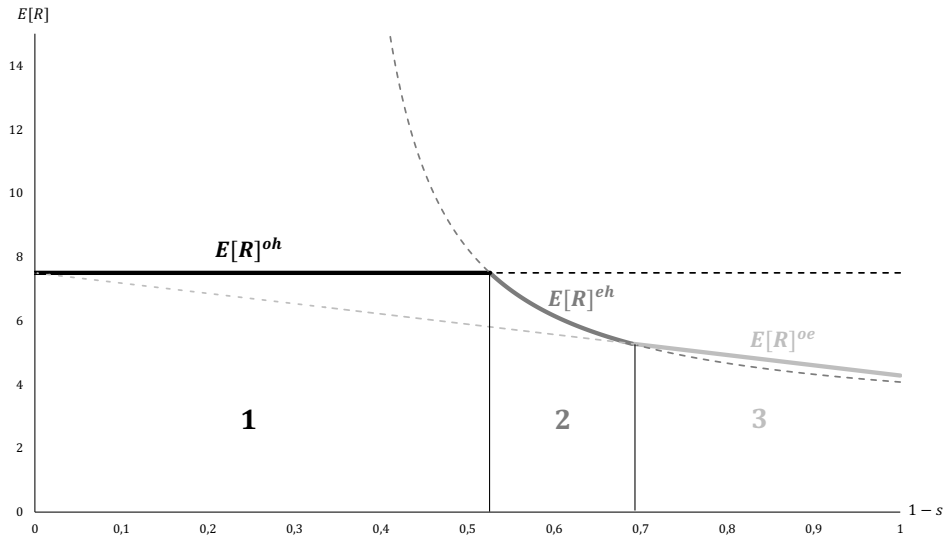
$$E[R] = \begin{cases} E[R]^{oh} = \max\{t^{oh}E[\Pi], 0\} = \max\{p_s\Pi - \pi^o, 0\} & \text{for type 1} \\ E[R]^{eh} = t^{eh}E[\Pi] = \frac{p_s(1-s)B^*}{1-q\lambda} & \text{for type 2} \\ E[R]^{oe} = q\lambda t^{oe}E[\Pi] = p_s(\Pi - (1-s)B^*) - \pi^o & \text{for type 3.}^{24} \end{cases} \tag{3.9}$$

Figure 3.8 plots $E[R]$ against $1-s$ and illustrates, together with Figure 3.7, how corruption influences tax rate, expected revenue, and type of a country.

The expected tax revenue is, c.p., lower and decreasing in $1-s$ for country types 2 and 3. This can be seen from equation (3.9) and Figure 3.8. In such countries, evasion constitutes an obstacle to tax policy and limits governments' ability to raise revenue. This problem is more severe, the more widespread corruption is.

[24] Given the definition of the three country types, $q\lambda t^{oe}E[\Pi] > 0$ always holds for country type 3.

Figure 3.8: Country types and corresponding expected tax revenue



Note, however, that the optimal tax policies of type 2 and type 3 countries differ fundamentally. As argued above, type 2 countries combat evasion by setting their tax rate low enough to induce compliant behavior by firms. By contrast, type 3 countries tolerate evasion to some extent, which allows them to charge a relatively high tax rate. Consequently, as tax evasion is more attractive to firms if the corruption level is high ($\partial\hat{\pi}^e/\partial(1-s) > 0$), the tax rate t^{eh} (t^{oe}) is decreasing (increasing) in $1-s$ in type 2 (3) countries (cf. Table 3.1).

3.3.4 Tax-setting behavior of different countries in light of empirical regularities and the theory

Table 3.1 summarizes the influence of all tax determinants discussed in Section 3.2 for each country type. Our results suggest that assuming a linear relationship between these variables and the tax rate seems to be too simplistic. By contrast, the impact of each variable on the tax rate depends on the specific tax-setting regime and, thus, may differ across countries.

Given our model setup, investment in a country is more attractive to firms if the associated gross profit Π is relatively large, compared to the

Table 3.1: *Tax rate determinants*

	1. ignore t^{oh}	2. combat t^{eh}	3. tolerate t^{oe}
Π	+	-	+
π^o	-	o	-
s	o	+	-
p	o	+	-
λ	o	+	-

outside option π^o. Thus, t^{oh} (3.7) and t^{oe} (3.6), the maximum tax rates that can be charged in regimes 1 and 3 (under which the government is limited by firms' outside option), respectively, are increasing (decreasing) in Π (π^o). By contrast, firms' incentives to evade limits the tax rate t^{eh} (3.5) in the 'combating-tax-evasion' regime. Accordingly, we find a positive relationship between country-specific rents Π and the tax rate for regimes 1 and 3, which is in line with Figure 3.1. The opposite holds true for the second regime, however, as a higher rent implies larger tax savings in case of evasion and a lower threshold t^{eh}.

Figure 3.2 suggests a positive link between a country's tax rate and natural resource abundance in neighboring countries, which we use as proxy for firms' outside option π^o. By contrast, following our theory and the above reasoning, we would expect the impact of π^o on the tax rate to be negative (for country types 1 and 3) or zero (for country type 2). As argued in Section 3.2, this discrepancy may be due to the fact that we abstract from tax competition and agglomeration effects in our model.

The remaining parameters in Table 3.1, s, p, and λ, affect the expected net profit $\hat{\pi}^e$ (3.2) in case of tax evasion and, thus, firms' incentives to attempt bribery. High values of s and p mean that a bribe attempt is very likely to be rejected by a steadfast agent (with probability s) or discovered by the government (with probability p), and a high value of λ implies a harsh penalty in both cases. Accordingly, $\hat{\pi}^e$ (3.2) is decreasing in s, p, and λ. The associated effect on the tax rate is different for each tax-setting regime. Tax evasion and, consequently, (small) changes in $\hat{\pi}^e$ can be ignored by countries operating under the first regime. By contrast, countries in the second regime

combat tax evasion. This means that they have to adjust their tax rate whenever firms' incentives to evade changes. If $\hat{\pi}^e$ is reduced (due to an increase of s, p, or λ), the threshold tax rate t^{eh} (3.5), for which firms still behave compliant, becomes higher and the government can charge a higher tax. In sharp contrast to the first and, in particular, the second regime, the third one is characterized by a tax policy that tolerates evasion. Countries operating in this regime are limited in their tax setting by evading firms' outside option π^0. Thus, an increase of s, p, or λ, implying that tax evasion becomes less worthwhile as $\hat{\pi}^e$ is reduced, forces such countries to reduce their tax rate t^{oe} (3.6) in order to prevent evading firms from choosing the outside option.

In sum, our theory indicates that the influence of s, p, and λ on the tax rate differs fundamentally across the three tax-setting regimes. Thus, a linear relationship as assumed in Figures 3.3, 3.4, and 3.5 seems to be too crude to illustrate the impact of these determinants on a country's tax rate properly. Instead, our results strongly suggest that country characteristics and, eventually, the tax-setting regime a country operates in should be taken into consideration when conducting tax-policy analysis.

3.4 The role of tax enforcement in revenue collection and country development

We have just argued that countries operating under the 'tolerating-tax-evasion' regime are forced to reduce their tax rate if s, p, or λ increase, in order to induce firms to invest (and evade taxes later on). The tax rate is given by t^{oe} (3.6) in this case. Nevertheless, as can be seen from Figure 3.8 and equation (3.9), the expected revenue $E[R]^{oe}$ of these countries depends negatively on the corruption level $1-s$ (i.e., $E[R]^{oe}$ is increasing in s). Thus, if the goal of the government is to maximize $E[R]^{oe}$, it has an incentive to reduce the corruption level $1-s$. However, doing so seems to be a challenging long-term task (at least if we think of s as being determined by moral values towards corruption within society, as suggested in Section 3.3). Instead, it seems more natural and promising for countries whose goal it is to increase revenue to make tax collection more efficient by, e.g., improving tax enforcement. Moreover, functioning institutions and strict law enforcement usually prove to be essential preconditions for successfully fighting corruption.

In our model, the detection probability p and the penalty rate λ determine the strength of tax enforcement and, therefore, should be the variables of interest in this context. Following (3.9) and the definition of B^* in (3.1), it becomes apparent that the effects of p and λ on a country's expected revenue $E[R]$ are different for each country type. Most notably, expected revenue of a country operating in the third regime, $E[R]^{oe}$, is decreasing in p and independent of λ. This means that such a country has no incentive to increase p or λ by, for example, taking measures to improve tax enforcement, unless these improvements allow the country to switch the tax-setting regime it operates in.[25] By changing its tax-setting regime from 3 to 1 or 2, a country may be able to reach a higher expected revenue level $E[R]$ (3.9).

To see how an increase of p or λ may allow a country of type 2 or 3 (for which $t^{oh} > t^{eh}$) to switch regime, recall that a firm's expected net profit in case of evasion, $\hat{\pi}^e$, is reduced as p or λ rise. Thus, tax evasion becomes less attractive and it may no longer be the limiting factor of the country's tax setting. Formally, t^{eh} (3.5) rises if p or λ are increased and it may be that $t^{oh} > t^{eh}$ no longer holds. If this is the case, the country switches from regime 2 or 3 to 1.

Furthermore, for a country of type 2 or 3, tax enforcement becomes stricter if p or λ are increased, allowing the country to charge a higher tax and generate more revenue under the 'combating-tax-evasion' regime (t^{eh} (3.5) and $E[R]^{eh}$ (3.9) both increase). As a consequence, the condition for a country to operate in the second (instead of the third) regime, $E[R]^{eh} \geq E[R]^{oe}$ (3.8), may then be satisfied and a type 3 country may switch to the second regime and start to combat tax evasion.

Figures 3.9 and 3.10 illustrate the effect of an increase in p and λ on $E[R]$, respectively. Both figures can be interpreted quite similarly. For low values of p or λ, tax enforcement is too weak to make combating evasion worthwhile: the country is in the 'tolerating-tax-evasion' regime. As argued above, $E[R]$ (3.9) is decreasing in p and independent of λ for this part of the function, i.e. for countries in the third regime. Better tax enforcement (higher levels of p or λ) does not translate into higher expected revenue for these countries because they are forced to reduce their tax rate as the threshold t^{oe} (3.6) declines (cf. Table 3.1). For p, the corresponding effect on $E[R]^{oe}$ is even negative.[26]

[25] Mardan (2018) obtains a similar result in the context of corporate profit shifting.

[26] An increase in p reduces t^{oe} (3.6) in two ways: by increasing the expected penalty $q\lambda$

Figure 3.9: Probability of detection and expected revenue

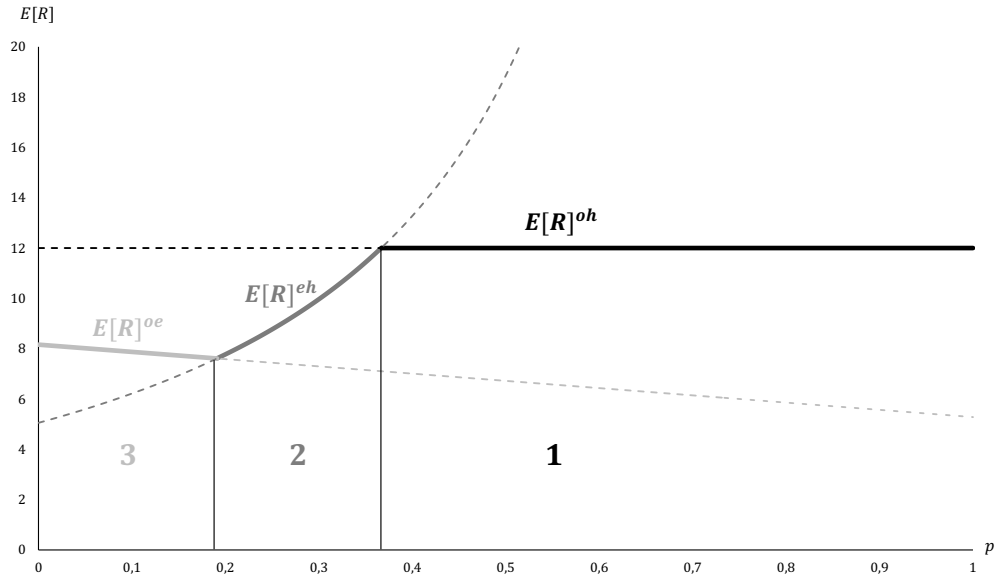
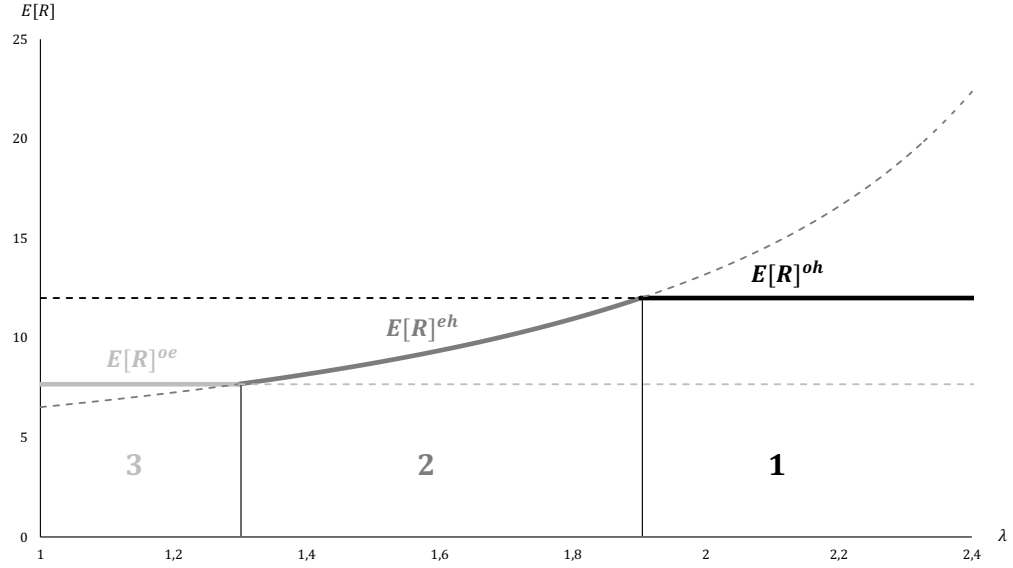


Figure 3.10: Penalty rate and expected revenue



While $E[R]^{oe}$ is decreasing in p and independent of λ, t^{eh} (3.5) and $E[R]^{eh}$ (3.9) are increasing in both of these variables. That is, combating evasion becomes more rewarding as tax enforcement becomes stricter. Once p (λ) is sufficiently high for $E[R]^{eh} \geq E[R]^{oe}$ (3.8) to hold, the country switches from tolerating to combating evasion, i.e. from regime 3 to 2. This is illustrated by the first kink of the $E[R]$-function in Figures 3.9 and 3.10.

Unlike countries operating under the 'tolerating-tax-evasion' regime, countries in the 'combating-tax-evasion' regime have a clear incentive to take measures in order to improve tax enforcement, as t^{eh} and $E[R]^{eh}$ are increasing in p and λ. Accordingly, the second, dark grey part of the $E[R]$-function, which captures all values of p (λ) for which the country operates in regime 2, is upward-sloping in Figure 3.9 (3.10).

The second kink point of the $E[R]$-function in Figure 3.9 (3.10) describes the level of p (λ) for which

$$E[R]^{eh} = E[R]^{oh} \;\Leftrightarrow\; t^{eh}E[\Pi] = t^{oh}E[\Pi] \;\Leftrightarrow\; t^{eh} = t^{oh} \tag{3.10}$$

holds. From this point, evasion is no longer the limiting factor of taxation and the country switches from regime 2 to 1, i.e. from combating to ignoring tax evasion.[27]

Under the 'ignoring-tax-evasion' regime, the country's tax rate t^{oh} (3.7) and expected revenue $E[R]^{oh}$ (3.9) are independent of the tax enforcement variables p and λ. Therefore, the third, black part of the $E[R]$-function is parallel to the x-axis in Figures 3.9 and 3.10. The figures also show that expected revenue $E[R]$ is always higher under regime 1, compared to regime 3. The same holds true, to a large extent, for regime 2 (compared to regime 3). This highlights the importance of strict tax enforcement for raising adequate revenue.

Furthermore, it shows that establishing a system of efficient tax collection is an essential part of a country's economic development. However, the above findings suggest a lack of incentive for countries operating under the 'tolerating-tax-evasion' regime to increase tax enforcement. The reason is

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and the bribe payment B^*. By contrast, an increase in λ raises the expected penalty $q\lambda$ but leaves B^* unchanged. Given that the expected revenue of type 3 countries $E[R]^{oe} = q\lambda t^{oe}E[\Pi]$ is proportional to both $q\lambda$ and t^{oe}, the direct increase of $E[R]^{oe}$ and the indirect reduction via t^{oe} that are induced by a raise of $q\lambda$ offset each other, implying that $E[R]^{oe}$ declines (remains unchanged) as p (λ) increases.

[27] As p (λ) rises, t^{eh} and $E[R]^{eh}$ rise as well, while t^{oh} and $E[R]^{oh}$ remain constant (cf. Table 3.1 and equation (3.9)). Thus, eventually, $E[R]^{eh} = E[R]^{oh}$ (3.10) is satisfied.

that, for these countries, improvements on tax enforcement (implying an increase in p or λ) do not translate into higher expected tax revenue $E[R]$ (3.9), unless they are associated with a change of the tax-setting regime (from regime 3 to 2). It may take several steps, and costly investments into better tax enforcement, until a country benefits from such a change (that is, until (3.8) holds). Thus, countries operating under the third regime may be unwilling to adjust their current system of tax collection and, therefore, are in danger of never being able to effectively combat tax evasion, raise sufficient revenue, and limit bureaucratic corruption. Such an outcome seems to be particularly likely for resource-abundant developing countries, as the latter are often characterized by weak institutions, widespread corruption, and high location-specific rents, making them very likely to be, and get stuck, in the 'tolerating-tax-evasion' regime. In this sense, our analysis provides an optimal tax perspective to look at the resource curse of developing countries.

3.5 Conclusions

Bureaucratic corruption and weak fiscal institutions may encourage firms to evade taxes and limit countries' ability to raise revenue. We examine how the threat of corporate tax evasion affects governments' tax-setting behavior and demonstrate that there may be fundamental differences across countries. More precisely, we develop a theoretical model which suggests the existence of three country types, or tax-setting regimes. Depending on the corruption level, institutional quality, and location-specific rents, a country will follow a tax policy that either (i) ignores, (ii) combats, or (iii) tolerates tax evasion. In particular, we expect countries which are characterized by widespread corruption, weak institutions, and high location-specific rents (e.g., due to natural resource abundance) to charge a relatively high tax and to tolerate tax evasion (to some degree).

Furthermore, our findings demonstrate that functioning institutions and powerful tax enforcement are essential preconditions not only for raising adequate tax revenue, but also for country development as a whole. Countries characterized by widespread corruption and tax evasion may never be able to overcome these problems, unless they fix the setting in which tax collection takes place. This seems to be particularly important for developing countries, especially for those with high location-specific rents, as these countries are suggested to be in the 'tolerating-tax-evasion' regime. Countries oper-

ating in this regime may have no incentive to increase the efficiency of tax collection, as small (but costly) improvements on tax enforcement usually do not translate into higher revenue. Thus, our model can explain why some, often resource-rich, developing countries are stuck in a regime of inefficient tax collection, widespread evasion, and a high corruption level. We may therefore interpret our theory as an optimal tax perspective on the resource curse. Although these countries may hardly be able, or even unwilling, to overcome these problems, doing so proves to be an indispensable step in a country's economic development.

Chapter 4

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

4.1 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 chapter 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

[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).

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 reasons. 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, this chapter 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 work.

The present chapter 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 chapter, 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 in-

efficient 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 work 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 chapter is as follows. Section 4.2 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 4.3. Section 4.4 provides some further analysis, while Section 4.5 concludes.

4.2 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 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-

[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.

[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 Chapter 3. 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).

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.

4.2.1 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] Thus, a pliable agent accepts a bribe offer if

$$B^j + (1 - p_d^j)w^j - \mu^j \geq w^j \quad \Leftrightarrow \quad B^j \geq \tilde{B}^j \equiv p_d^j w^j + \mu^j.^7 \tag{4.1}$$

$\tilde{B}^j$ 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

[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. Chapter 3).

[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 government 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 (4.1), 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.

personal cost μ^j is infinitely high for a fraction s^j of all agents. For these agents, inequality (4.1) never holds. We assume p_d^j, w^j, μ^j, and, consequently, $\tilde{B}^j$ to be common knowledge.

4.2.2 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 of

$$\hat{\pi}_e^j = (1 - q^j \lambda^j t^j)\Pi^j - (1 - s^j)\tilde{B}^j \tag{4.2}$$

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

$$\pi_h^j = (1 - t^j)\Pi^j \tag{4.3}$$

[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 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*.

in country j. Consequently, a firm attempts bribery if

$$\hat{\pi}_e^j > \pi_h^j \quad \Leftrightarrow \quad t^j > t_{eh}^j \geq 0, \tag{4.4}$$

where

$$t_{eh}^j \equiv \frac{(1-s^j)\tilde{B}^j}{(1-q^j\lambda^j)\Pi^j} \tag{4.5}$$

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

$$p_s^j\hat{\pi}_e^j \geq \pi^{o,j} \Leftrightarrow t^j \leq t_{oe}^j \equiv \frac{1}{q^j\lambda^j}\left(1 - \frac{\pi^{o,j} + p_s^j(1-s^j)\tilde{B}^j}{p_s^j\Pi^j}\right) \tag{4.6}$$

for evading firms and

$$p_s^j\pi_h^j \geq \pi^{o,j} \quad \Leftrightarrow \quad t^j \leq t_{oh}^j \equiv 1 - \frac{\pi^{o,j}}{p_s^j\Pi^j} \tag{4.7}$$

for honest firms. t_{oe}^j and t_{oh}^j 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

[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.

[11] If t_{oe}^j (t_{oh}^j) 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_{oe}^j (t_{oh}^j) is negative.

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

$$\pi^{o,j} = \begin{cases} \pi_m^{o,j} = \max\{E[\pi]^k, \underline{\pi}\} & \text{for } m\text{obile firms} \\ \pi_i^{o,j} = \underline{\pi} & \text{for } i\text{mmobile firms,} \end{cases} \tag{4.8}$$

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_{oe}^j (4.6) and t_{oh}^j (4.7), may be lower for mobile firms, compared to immobile ones, since mobile firms have a weakly higher outside option: $\pi_m^{o,j} \geq \pi_i^{o,j}$, implying $t_{oe,m}^j \leq t_{oe,i}^j$ and $t_{oh,m}^j \leq t_{oh,i}^j$. 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_{eh}^j (4.5) 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.

4.2.3 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 and the possibility of tax evasion. The attractiveness of firms' alternatives is captured by the threshold tax rates t_{eh} (4.5), t_{oe} (4.6), and t_{oh} (4.7).[14] In Figure 4.1, 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 4.1 can be divided into four areas, each representing a certain firm behavior.

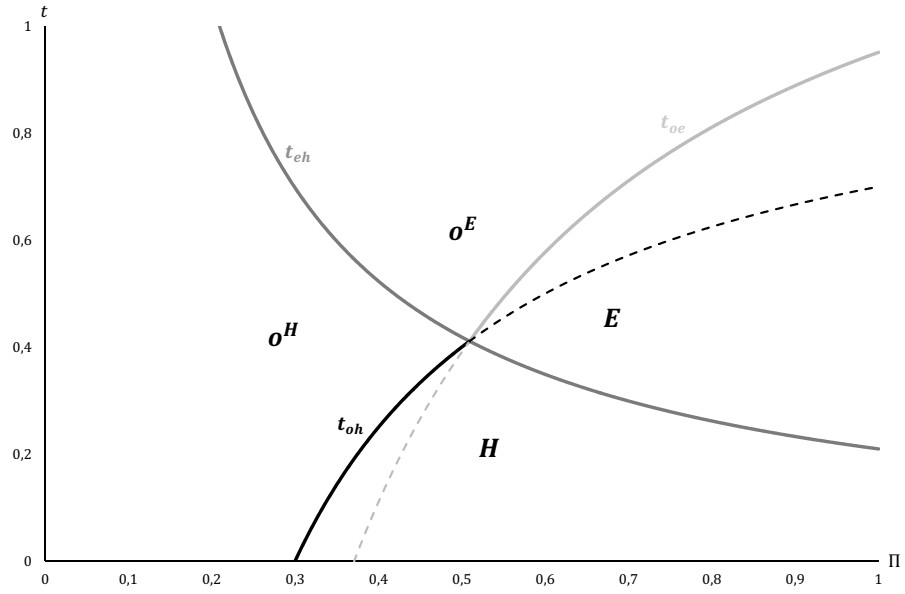
The lower right area denoted by H captures all combinations of Π and t for which it is optimal for firms to enter the country's market and behave compliant in case of success. Formally, $t \leq t_{oh}, t_{eh}$ holds in this area.

[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.

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

Figure 4.1: Threshold tax rates and possible firm behavior



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

The 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 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.

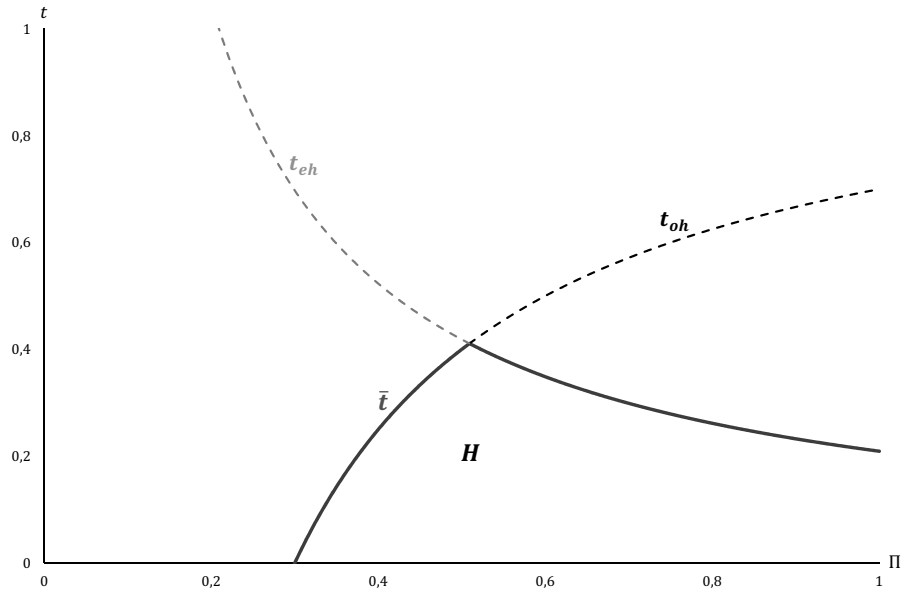
Following this distinction and by inspection of Figure 4.1, it becomes clear that governments face a well-known tradeoff. For a given tax base, revenue is increasing in the tax rate t. However, raising t may lead to a decline of the tax base. More precisely, a higher tax rate might induce firms to change 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 4.1, 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

$$\bar{t} = \min\{t_{oh}, t_{eh}\}. \tag{4.9}$$

Figure 4.2 shows $\bar{t}$ (4.9) as a function of Π. Depending on the value of Π (and on the other determinants of t_{eh} (4.5) and t_{oh} (4.7)), 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 4.2 follows directly from the upper boundary of the H-area in Figure 4.1, which is jointly determined by the black t_{oh}- and the dark grey t_{eh}-curves. The former (latter) curve is upward- (downward-)sloping, as the threshold tax rate t_{oh} (4.7) (t_{eh} (4.5)) is increasing (decreasing) in Π.

Figure 4.2: Maximum attainable tax rate



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

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 4.1. 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 4.1, 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 4.2) 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 4.2 is downward-sloping) with increasing Π, as evasion becomes more attractive (compared to both compliance and non-entry).

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 Chapter 3 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]

4.3 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. (4.8)). As mentioned above, a higher outside option implies lower threshold

[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. Chapter 3). 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.

tax rates t^j_{oe} (4.6) and t^j_{oh} (4.7).[16] In Figure 4.1, a higher outside option is associated with rightward-shifts of the black t_{oh}- and the light grey 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 $\overline{t}^j$ (4.9) country j can charge tends to be lower if it wants to attract mobile firms, as opposed to taxing the resident immobile ones only: $\overline{t}^j_m \leq \overline{t}^j_i$.

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 $\pi^{o,j}$ (4.8) and their possibility to evade, as captured by t^j_{eh} (4.5), t^j_{oh} (4.7), and $\overline{t}^j$ (4.9).

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 (4.8) is then given by

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

4.3.1 Benchmark

If only immobile firms are taxed in country j, the maximum attainable tax rate (4.9) that follows from substitution of $t^j_{eh,i}$ (4.5), $t^j_{oh,i}$ (4.7), and $\pi^{o,j}_i$ (4.8) is given by

$$\overline{t}^j_i = \min\{t^j_{oh,i}, t^j_{eh}\} = \min\left\{1, \frac{(1-s^j)\tilde{B}^j}{(1-q^j\lambda^j)\Pi^j}\right\}, \tag{4.10}$$

implying the expected tax revenue

$$E[R]^j_i = \overline{t}^j_i \alpha^j_i E[\Pi]^j = \alpha^j_i p^j_s * \min\left\{\Pi^j, \frac{(1-s^j)\tilde{B}^j}{1-q^j\lambda^j}\right\}. \tag{4.11}$$

Note that taxation is such that firms are induced to behave compliantly. Thus, firms' net profit in case of success is $\pi^j_h = (1-t^j)\Pi^j$ (4.3). Accordingly,

[16] We reintroduce country superscripts at this point.

the expected net profit of immobile firms in country j is

$$E[\pi]_i^j = p_s^j(1-\bar{t}_i^j)\Pi^j = \max\left\{0, p_s^j\left(\Pi^j - \frac{(1-s^j)\tilde{B}^j}{1-q^j\lambda^j}\right)\right\} \tag{4.12}$$

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 (4.10) is binding, i.e. if

$$t_{oh,i}^j \leq t_{eh}^j \quad \Leftrightarrow \quad \Pi^j \leq \overline{\Pi}_i^j \equiv \frac{(1-s^j)\tilde{B}^j}{1-q^j\lambda^j}. \tag{4.13}$$

$\overline{\Pi}_i^j$ 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 (4.10) becomes binding. Given this threshold value, we can specify equations (4.10), (4.11), and (4.12) to obtain

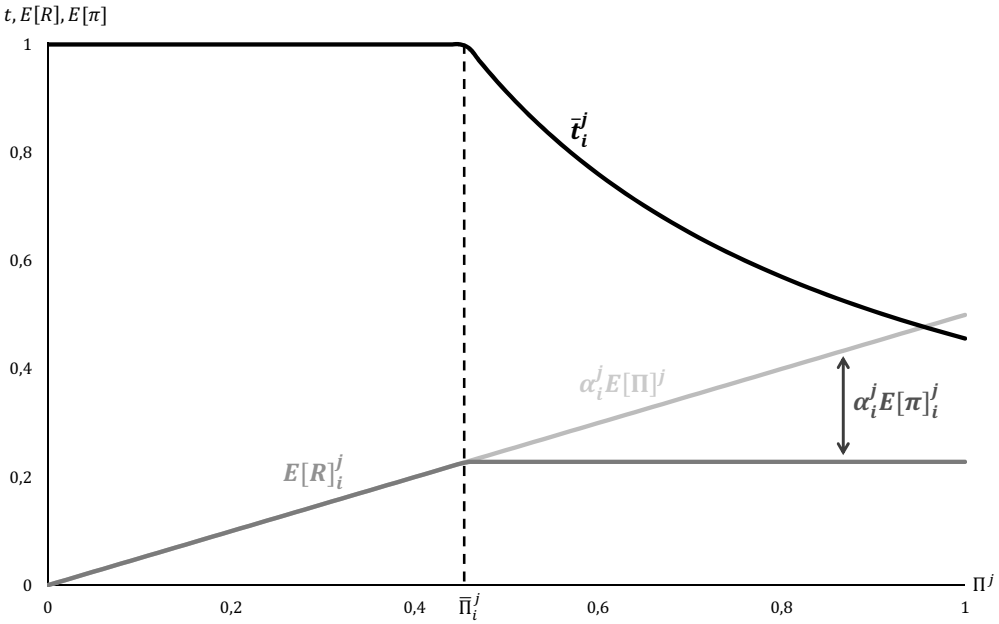
$$\left\langle \bar{t}_i^j,\, E[R]_i^j,\, E[\pi]_i^j \right\rangle = \begin{cases} \left\langle 1,\, \alpha_i^j E[\Pi]^j,\, 0 \right\rangle & \text{if } \Pi^j \leq \overline{\Pi}_i^j \\ \left\langle \frac{(1-s^j)\tilde{B}^j}{(1-q^j\lambda^j)\Pi^j},\, \alpha_i^j p_s^j \frac{(1-s^j)\tilde{B}^j}{1-q^j\lambda^j},\, E[\Pi]^j - \frac{p_s^j(1-s^j)\tilde{B}^j}{1-q^j\lambda^j} \right\rangle & \text{if } \Pi^j > \overline{\Pi}_i^j. \end{cases} \tag{4.14}$$

The obtained results for $\bar{t}_i^j$, $E[R]_i^j$, and $E[\pi]_i^j$ are illustrated in Figure 4.3 (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 $t_{eh}^j = \frac{(1-s^j)\tilde{B}^j}{(1-q^j\lambda^j)\Pi^j}$. This is illustrated by the downward-sloping part of the black $\bar{t}_i^j$-curve in Figure 4.3. As a consequence, country j is unable to additionally benefit from gross profits that exceed $\overline{\Pi}_i^j$ and expected revenue is limited to $\alpha_i^j p_s^j \frac{(1-s^j)\tilde{B}^j}{1-q^j\lambda^j}$ (cf. (4.14)). Accordingly, a firm's expected net profit $E[\pi]_i^j$ is zero for $\Pi^j \leq \overline{\Pi}_i^j$ and increases linearly in Π^j once the threshold value $\overline{\Pi}_i^j$ is reached. In Figure 4.3, the expected net profits of all immobile firms in

country j, $\alpha_i^j E[\pi]_i^j$, are given by the distance between the light grey curve and the dark grey $E[R]_i^j$-curve. The light grey curve depicts the expected gross profits of all immobile firms in country j, $\alpha_i^j E[\Pi]^j$. Through taxation, $\alpha_i^j E[\Pi]^j$ is divided into the sum of firms' expected net profits $\alpha_i^j E[\pi]_i^j$ and country j's expected tax revenue $E[R]_i^j$. As already stated above, country j can reap firm profits entirely until $\Pi^j = \overline{\Pi}_i^j$, but does not benefit from rents that exceed $\overline{\Pi}_i^j$.

Figure 4.3: 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 (4.5), inequality (4.13), and Figure 4.1, high

country-specific gross profits Π^j make country j more vulnerable to tax evasion. Taking a closer look at the threshold levels t^j_{eh} (4.5) and $\overline{\Pi}^j_i$ (4.13) 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

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

High values of w^j, μ^j, s^j, p^j_d, and λ^j make tax evasion less profitable and imply higher threshold levels t^j_{eh} and $\overline{\Pi}^j_i$, 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^j_d 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.

4.3.2 Determinants of tax competition

Instead of taxing only the resident immobile firms, at rate $\bar{t}^j_i$ (4.10), a country can attract the mass α_m of mobile firms by setting $t^j = \bar{t}^j_m \leq \bar{t}^j_i$. Doing so is optimal for country j if

$$\bar{t}^j_m(\alpha^j_i + \alpha_m)E[\Pi]^j \geq \bar{t}^j_i \alpha^j_i E[\Pi]^j \quad \Leftrightarrow \quad \bar{t}^j_m \geq t^j_{min} \equiv \frac{\alpha^j_i}{\alpha^j_i + \alpha_m}\bar{t}^j_i. \qquad (4.15)$$

The country has to trade off a possible increase in the tax base (by $\alpha_m E[\Pi]^j$) against a lower tax rate ($\bar{t}^j_m \leq \bar{t}^j_i$) and, hence, revenue per firm. t^j_{min} 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^j_{min}. The relative size of a country, in terms of resident immobile firms α^j_i, and the attractiveness of tax evasion in the country, which is captured by $\bar{t}^j_i$. α^j_i and $\bar{t}^j_i$ (4.10) 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^j_i and $\bar{t}^j_i$ imply low opportunity cost and, as a consequence, a low minimum tax rate t^j_{min} (4.15) of country j, representing a high *aggressiveness* in tax competition.

To explain this finding in more detail, we substitute $\bar{t}_i^j$ (4.10) in (4.15) to obtain

$$t_{min}^j = \frac{\alpha_i^j}{\alpha_i^j + \alpha_m} * \min\{t_{oh,i}^j, t_{eh}^j\} = \frac{\alpha_i^j}{\alpha_i^j + \alpha_m} * \min\left\{1, \frac{(1-s^j)\tilde{B}^j}{(1-q^j\lambda^j)\Pi^j}\right\}. \quad (4.16)$$

The first term in equation (4.16), $\frac{\alpha_i^j}{\alpha_i^j+\alpha_m}$, 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. (4.15)). Accordingly, t_{min}^j (4.16) is affected by Π^j, w^j, μ^j, s^j, p_d^j, and λ^j in the same way as $\bar{t}_i^j$ (4.10).

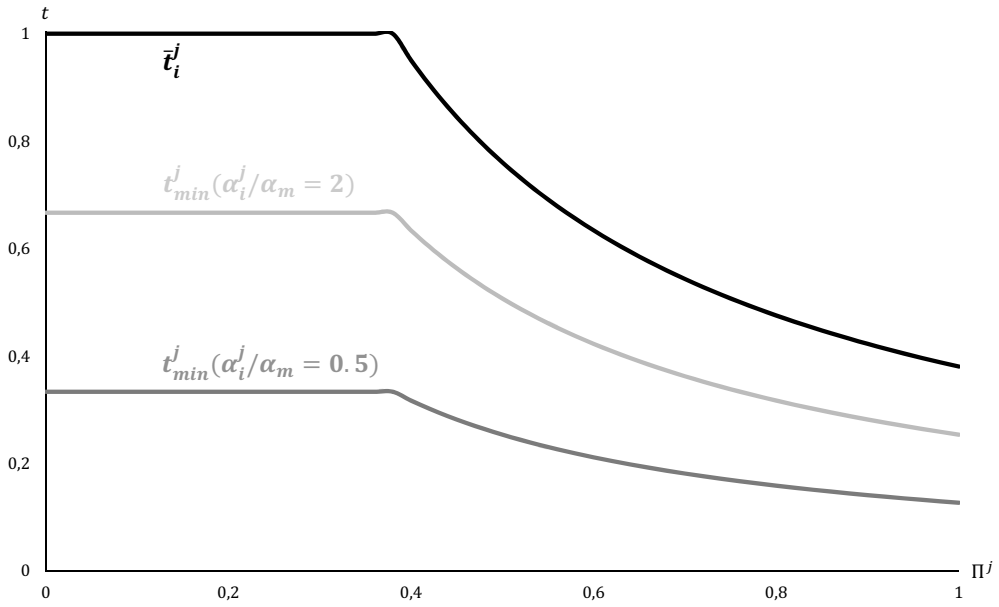
Unsurprisingly, governments are more inclined to cut their tax rate if the mass of mobile (immobile) firms is high (low), since attracting the mobile firms is associated with a relatively large increase of the tax base in this case: $\partial t_{min}^j/\partial\alpha_m < 0 < \partial t_{min}^j/\partial\alpha_i^j$. This is illustrated in Figure 4.4, where a country's benchmark tax rate $\bar{t}_i^j$ (4.10) and the corresponding t_{min}^j (4.16) in case that firms are rather mobile (dark grey curve) or immobile (light grey 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 (4.16). 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 4.4 can be interpreted in this context, too, as the dark grey and the light grey curves may represent the minimum tax rates of a small (dark grey) and a large (light grey) country which differ in size but not in their benchmark tax rate.

Remarkably, a country's competitive tax setting further depends on the attractiveness of tax evasion in that country, as the latter affects $\bar{t}_i^j$ (4.10) and, consequently, t_{min}^j (4.16) via the threshold tax rate t_{eh}^j (4.5). 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

[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 $t^x = t^y = 0$).

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 (4.5)), tend to limit a country's ability to raise revenue (cf. Subsection 4.3.1), and may induce the country to be more aggressive in tax competition (as indicated by a lower t_{min}^j (4.16)). We refer to the latter outcome as *evasion effect*.

Figure 4.4: Benchmark and minimum tax rates in case of high (dark grey curve) and low (light grey 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 (4.3) and is given by

$$E[\pi]^j = p_s^j \pi_h^j = (1 - t^j) E[\Pi]^j \tag{4.17}$$

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

$$\big(1-t^x\big)E[\Pi]^x \geq \big(1-t^y\big)E[\Pi]^y.^{18} \tag{4.18}$$

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 4.2 and 4.3). 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.

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.

(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 (4.5) and $\overline{\Pi}_i^j$ (4.13)), due to, e.g.,

[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).

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 4.2.3 and shown in Chapter 3, 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.[20] 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).[21]

4.3.3 Optimal tax policy

When analyzing countries' optimal tax policy in the following, we assume $E[\Pi]^x = E[\Pi]^y$ for convenience. Equation (4.18) then simplifies and all mobile firms locate in country x if

$$(1 - t^x) \geq (1 - t^y) \quad \Leftrightarrow \quad t^x \leq t^y. \tag{4.19}$$

This means that the country with the lower t^j_{min} (4.16) 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.

[20] 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.

[21] 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.

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 4.3.1 (benchmark case) and given by $\bar{t}^j_i$ (4.10) and $E[R]^j_i$ (4.11).

In order to attract the mass of 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.[22] 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.[23]

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

$$t^x_{opt} = \begin{cases} \tilde{t}^x & \text{if} \quad t^x_{min} \leq t^y_{min} < \bar{t}^x_i \\ \bar{t}^x_i & \text{otherwise} \end{cases} \tag{4.20}$$

and yields an expected tax revenue of

$$E[R]^x_{opt} = \begin{cases} \tilde{t}^x(\alpha^x_i + \alpha_m)E[\Pi]^x & \text{if} \quad t^x_{min} \leq t^y_{min} < \bar{t}^x_i \\ \bar{t}^x_i(\alpha^x_i + \alpha_m)E[\Pi]^x & \text{if} \quad t^x_{min} \leq \bar{t}^x_i \leq t^y_{min} \\ \bar{t}^x_i \alpha^x_i E[\Pi]^x & \text{if} \quad t^x_{min} > t^y_{min}, \end{cases} \tag{4.21}$$

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

$$\tilde{t}^x = \begin{cases} t^y_{min} & \text{if country } x \text{ moves first} \\ \min\{\bar{t}^x_i, \bar{t}^y_i\} & \text{if country } x \text{ moves second.}[24] \end{cases} \tag{4.22}$$

[22] 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 $\bar{t}^x_i = t^x_{eh} < 1$.

[23] 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 ($\bar{t}^x_i = t^x_{eh}$).

[24] The results derived in this subsection remain qualitatively unchanged if we allow for 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 $t^x_{min} \leq t^y_{min} < \bar{t}^x_i$ if governments set their taxes simultaneously. Instead, both countries play mixed strategies in equilibrium.

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 $\bar{t}_i^x$ (4.10). By contrast, country x is forced (and willing) to cut its tax rate to $\tilde{t}^x$ (4.22) 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 (4.3) and t_{opt}^x (4.20) and is given by

$$E[\pi]_{opt}^x = \begin{cases} (1-\tilde{t}^x)E[\Pi]^x & \text{if} \quad t_{min}^x \leq t_{min}^y < \bar{t}_i^x \\ (1-\bar{t}_i^x)E[\Pi]^x & \text{otherwise.} \end{cases} \tag{4.23}$$

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.[25] 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. (4.8)).

[25] 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.

4.4 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 (4.15), we can state that country x attracts the mobile firms if

$$t^x_{min} \leq t^y_{min} \quad \Leftrightarrow \quad \frac{\overline{t}^x_i}{\overline{t}^y_i} \leq \frac{\alpha^y_i}{\alpha^y_i + \alpha_m} \left(\frac{\alpha^x_i}{\alpha^x_i + \alpha_m} \right)^{-1}. \tag{4.24}$$

The fraction on the left-hand side of inequality (4.24) 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 (4.24) 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 $\alpha^x_i < \alpha^y_i$.

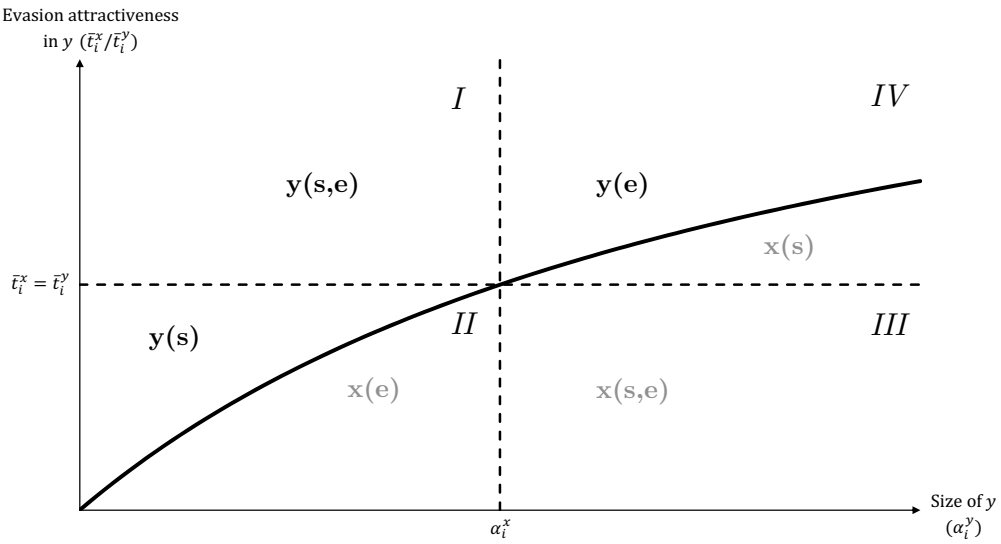
Figure 4.5 illustrates how both factors, country size and evasion attractiveness, jointly determine the outcome of tax competition. For that purpose, the relative attractiveness of tax evasion in country y, as measured by $\overline{t}^x_i/\overline{t}^y_i$, is plotted against the size of country y, α^y_i, while constant values are assumed for α^x_i and α_m. The black curve depicts all combinations of α^y_i and $\overline{t}^x_i/\overline{t}^y_i$ for which (4.24) 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 4.5.

Figure 4.5: Size (s) and evasion (e) effect as determinants of tax competition



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

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 (4.16). 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 4.5. 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 black curve, in the x(e) (x(s)) area.

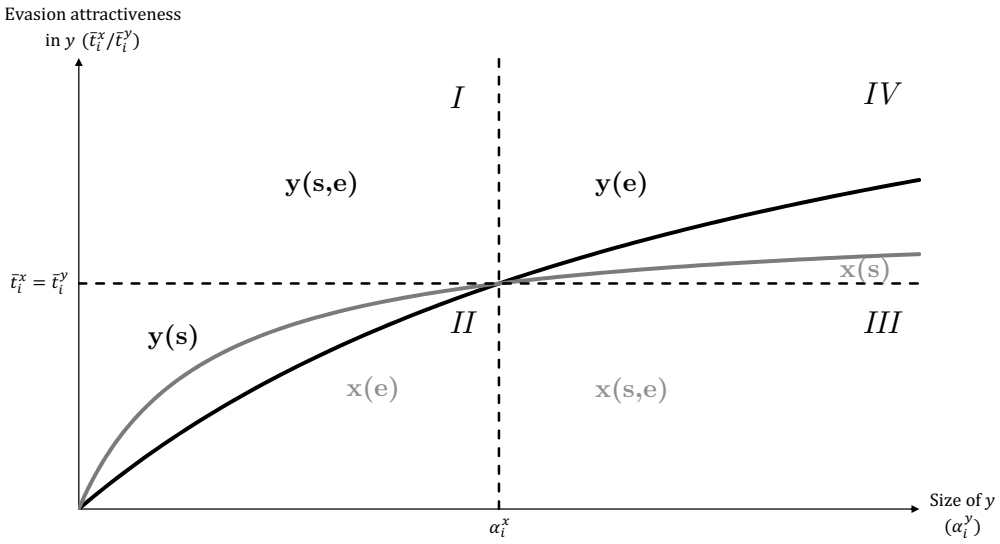
In earlier models of asymmetric tax competition, like Bucovetsky (1991) and Wilson (1991), only the *size effect* is present, implying that larger countries always set higher tax rates and act as capital exporters in equilibrium. As argued above, this does not necessarily apply if countries differ with 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.[26] 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 4.6, which is identical to Figure 4.5 except for the addition of the grey curve. The latter depicts a scenario with a lower share of mobile firms, compared to the black curve stemming from Figure 4.5.

In Figure 4.6, the grey curve is more concave than the black 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

[26] 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.

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

Figure 4.6: 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 4.5). 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 (4.10) 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 $\overline{\Pi}_i^j$ (4.13). 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^j_{eh} (4.5) and $\overline{\Pi}^j_i$ (4.13)), as shown by Regimes I and III in Figure 4.5.

Figure 4.7 illustrates the two different cases. It is divided into two columns, with each column showing one case.[27] The two cases only differ with respect to the size of country y, α^y_i. In particular, the left (right) column of Figure 4.7 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 4.5. Each of the two columns consists of two diagrams. In both columns, the upper diagram depicts the benchmark ($\overline{t}^x_i, \overline{t}^y_i$ (4.10), solid lines) and minimum tax rates (t^x_{min}, t^y_{min} (4.16), dashed lines) of countries x (grey curves) and y (black 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^x_{opt} and t^y_{opt} (4.20), which are depicted in the lower diagram. At the point where $\Pi = \overline{\Pi}^x_i$ ($\Pi = \overline{\Pi}^y_i$), evasion becomes the limiting factor of taxation in country x (y) in the benchmark case. Thus, the $\overline{t}^x_i$ ($\overline{t}^y_i$)- and t^x_{min} (t^y_{min})-curves feature a kink at this point (cf. Figures 4.3 and 4.4).

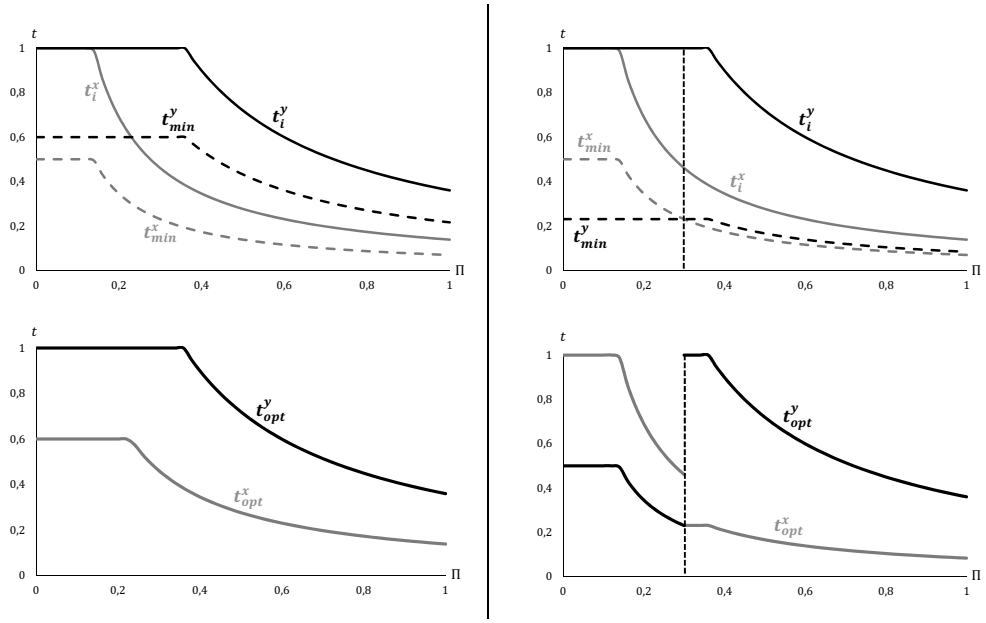
If country x is smaller and characterized by a higher attractiveness of evasion than country y (left column of Figure 4.7, where $\alpha^x_i \leq \alpha^y_i$ and $\overline{\Pi}^x_i \leq \overline{\Pi}^y_i$), $t^x_{min} < t^y_{min}$ holds for all values of Π. Thus, country x unambiguously attracts the mobile firms in this case. As argued above, $\overline{t}^j_i$ and t^j_{min} are decreasing in Π for $\Pi \geq \overline{\Pi}^j_i$ (cf. Figure 4.4). Accordingly, $t^x_{opt} = t^y_{min}$ ($t^x_{opt} = \overline{t}^x_i$) if Π is sufficiently low (high), meaning that country x's tax rate is limited by firms' outside option (threat of evasion). Furthermore, $t^y_{opt} = \overline{t}^y_i$ 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 4.7, where $\alpha^x_i > \alpha^y_i$ and $\overline{\Pi}^x_i \leq \overline{\Pi}^y_i$), both countries may, in principle, attract the mobile firms. In particular, $t^x_{min} > t^y_{min}$ 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

[27] In principle, four different regimes are possible, as described in the context of Figure 4.5: (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 $\tilde{t}^j = t^k_{min}$ (cf. (4.22)).

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 ($t^x_{min} < t^y_{min}$). Thus, the larger country x sets a lower tax rate and attracts the mobile firms, due to a higher attractiveness of evasion, if Π is sufficiently high. Accordingly, the t^x_{opt}- and t^y_{opt}-curves in the right column of Figure 4.7 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 4.7: 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.

4.5 Conclusions

In this chapter, 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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