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# International Taxation and Productivity Effects of M&As


## Abstract

We investigate how changes in firm productivity after M&As are affected by differences in profit taxation between the target and the acquirer. We argue that tax differentials distort the efficient allocation of productive factors following an M&A and thus inhibit the realization of productivity improvements. Using firm-level data on inputs and outputs of production as well as on corporate M&As, we show that the absolute tax differential between the locations of two merging firms reduces the subsequent total factor productivity gain. This effect is concentrated in horizontal M&As and less pronounced when firms can use international profit shifting to attenuate effective differences in taxation.


JEL-Codes: F230, H250.

Keywords: M&A, productivity, international taxation.

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# 1 Introduction

A theoretically well-established fact in international economics is that tax differentials between jurisdictions can distort the location choice of productive factors. Capital is allocated to the location with the lower tax rate, driving down its marginal productivity there until *after-tax returns* in high and low-tax locations are equalized (e.g. Musgrave, 1969). Hence, global production is not on the production possibility frontier since the marginal productivity (i.e. *before-tax returns*) of the mobile input factor is different between locations. While there is ample evidence about the attraction of mobile input factors to low-tax locations[1], little is known about the extent to which productivity of multinational firms is affected by the distortive impact of tax differentials. Our paper aims to fill this gap using firm-level data to investigate the effect of tax differentials on productivity gains in firms after mergers and acquisitions (M&As).

Corporate M&As are an important device in the international allocation of productive factors and a key vehicle for transferring technologies and innovation as they provide direct inter-regional links between firms and open up channels for technology transfers (Jovanovic & Rousseau, 2008). In this paper, we investigate how firm-level adjustment after M&As is affected by differences in profit taxation between the target and the acquirer. As these differences occur regularly in cross-border acquisitions they are likely to influence productivity improvements in the firms involved in these deals. In the light of the recent move by the United States towards a territorial tax system for corporate profits, which further amplifies international tax differentials, this has become a highly relevant issue in the design of an efficient international tax system.

We argue and find empirically that tax differentials between the target and the acquirer location reduce post-acquisition productivity gains by distorting the reallocation of tasks within the combined firm. Since the firm's objective is to maximize its net profit, it takes into account both the productivity and the corporate tax implications of a potential task allocation. If the more productive unit resides in the location with the more favorable tax regime, the resulting allocation choice assigns productive tasks to the most productive units

[1] E.g. Akcigit *et al.* (2016), Moretti & Wilson (2017), Giroud & Rauh (2019), Goldbach *et al.* (2019), Egger *et al.* (2020) to provide a non-exhaustive list of recent examples.

irrespective of the actual tax rate differential. However, if the more efficient unit happens to reside in a location with a higher tax burden, firms face a trade-off. Shifting activity to the high-tax location raises overall productivity but also increases the tax burden on the resulting profits. For large enough tax differences, the firm allocates activity to the less productive but more profitable unit. With regard to the overall productivity of the merged firm, this decision is inefficient and leads to a lower gain in productivity resulting from the M&A. This effect applies in particular to horizontal M&As within the same industry for which the tasks are very similar across the two firms such that they are easily bundled at one or the other location while it is likely to be absent for M&As of firms from different industries for which the tasks are dissimilar and cannot be bundled (Devos *et al.*, 2009; Li, 2013; Sheen, 2014).[2]

We investigate the impact of tax differentials on acquisition-induced productivity gains empirically by combining financial reporting information with data on mergers and acquisitions. We first derive measures for total factor productivity (TFP) from full samples of country and industry peers using the estimation method of Levinsohn & Petrin (2003) as augmented by Wooldridge (2009). We then compute the TFP in the combined firm before and after the actual M&A is completed from unconsolidated financial information of the target and acquiring firm and relate this dependent variable to the absolute tax difference between the target and the acquirer. Our estimations, which control for a large set of country, deal, and firm specific effects, suggest that an increase in the absolute tax differential by 1 percentage point lowers the acquisition-induced productivity gain by 0.8% for horizontal M&As. Since firms may anticipate the distortions of tax differentials on the allocation of tasks after deal completion, part of this effect might be related to sample selection whereby M&As with low productivity gains and small tax rate differentials are less likely to be observed. We test this notion in a Heckman selection model and find no evidence for deal selection based on tax rate differentials. Hence, the negative effect of tax rate differentials on post-M&A productivity gains is mainly driven by distortions in the post-M&A allocation of tasks. This is consistent with earlier evidence that taxation rarely serves as the main

[2]Devos *et al.* (2009) argue that mergers within the same industry offer greater opportunities to realize synergies through elimination of duplicate investments, while mergers across different industries may be undertaken for reasons other than synergies such as empire building or the managers' desire to protect their human capital (Morck *et al.*, 1990).

motivation to complete an M&A deal (e.g. Auerbach & Reishus, 1987) but plays an import role in the structuring of the modalities of the deal (e.g. Erickson, 1998; Brown & Ryngaert, 1991).[3]

We exclude alternative explanations for our finding by investigating corollary predictions of our model. The geographic distortion in production factor employment and the subsequent reduction in productivity only occur when firms cannot separate the location of productive activity from the location of its taxation. If firms were able to assign profits to the location with the lowest tax rate, for example through transfer mispricing, tax differences would not be relevant. In practice, such profit shifting activity is limited by domestic and international regulation that imposes shifting costs on firms. We test empirically whether the magnitude of the negative effect of the tax rate differentials varies with the cost of profit shifting. In particular, we show that the impact of tax differentials is significantly mitigated if transfer pricing risk decreases, making transfer price manipulations less costly. This result is also consistent with the negative effect of tax rate differentials on post-acquisition productivity not being driven by sample selection because lower cost of profit shifting would amplify - and not mitigate - the coefficient size of the absolute tax differential in the presence of sample selection.

Our paper provides empirical evidence to advance the debate on whether and how foreign profits should be taxed in the presence of international M&As. In contrast to the "old view" that tax regimes which neutralize tax rate differentials by tax credits are optimal from a global perspective (Richman, 1963; Feldstein & Hartman, 1979), Desai & Hines (2004, 2003) argue that, with M&As as the increasingly dominant form of FDI, the exemption of foreign income may in fact be optimal if foreign acquisitions do not come at the cost of domestic activities or if they are even complements. The empirical evidence on this topic is mixed. Relying on aggregate data, Feldstein (1995) finds that FDI substitutes for domestic investment one for one, while Desai *et al.* (2005, 2009) point out that focusing on multinational firms gives the opposite pattern: domestic investment appears to be a complement to FDI. However, more recently Becker & Fuest (2010) and Devereux *et al.* (2015) have provided

[3] A prominent exception to this are corporate inversions (see, e.g., Desai & Hines, 2002; Voget, 2011) which represent, however, only a very small and infrequent share of overall M&A activity.

a general theoretical model incorporating M&As as a mode of FDI where cross-border tax differentials distort the allocation mechanisms of scarce resources within the firm resulting in sub-optimal outcomes if the tax differential is not neutralized by the home country's international taxation regime. Our empirical findings show that the violation of capital export neutrality is not just a potentially negligible theoretical concern but that it indeed results in substantial distortions as the productivity of merging firms markedly decreases in the tax differential between acquirer and target. This is particularly relevant as by now there is no developed economy left which attempts to establish capital export neutrality in its international tax regime. Japan, the United Kingdom, and the United States all have given up on this concept in their recent tax reforms. As a result, virtually all major capital exporting countries now exempt foreign income from taxation.[4]

Our focus on productivity also links this paper to the literature that investigates the effect of FDI on firm performance. Theoretical models of multinational firms which exploit cross-border differences in relative factor prices and economies of scale predict a positive effect of FDI on domestic productivity (Helpman, 1984, 1985; Markusen & Venables, 1998; Grossman & Rossi-Hansberg, 2008) for which Navaretti *et al.* (2010) find some empirical support. For offshoring events, however, Monarch *et al.* (2017) report a substantial decline in domestic employment and output with no significant effect on firm productivity. Goldbach *et al.* (2019) also do not find any effect of establishing a new foreign affiliate on the domestic productivity of German firms. Similar to the research on the effects of greenfield FDI, the evidence for cross-border takeovers is mixed. Foreign firms usually acquire the most productive firms in a country (Criscuolo & Martin, 2009) but the integration of these firms into the multinational group is more complex such that productivity improvements are realized only after a longer period of adjustment (Harris & Robinson, 2002). Indeed, a recent study by Wang & Wang (2015) finds no difference in the productivity effect of domestic and foreign acquisitions in a large sample of M&As in China. In contrast, Guadalupe *et al.* (2012) find substantial improvements of productivity and an increase of innovative activity following an acquisition by a foreign firm.[5] International acquisitions are also shown to increase patenting (Stiebale,

[4] Most countries legislate some backstops in form of controlled foreign corporation rules in an attempt to prevent tax evading firms from abusing these exemptions (e.g., see Haufler *et al.*, 2018)

[5] Not only the acquired firms are affected. Javorcik (2004), Haskel *et al.* (2007) and Balsvik & Haller

2016) and stipulate knowledge transfers (Bresman *et al.*, 1999). The impact of cross-border acquisitions on productivity may be modulated by several country-pair characteristics. In our analysis, we identify cross-border tax differentials as a decisive factor in this regard. We thus provide an important determinant of the realization of post-acquisition productivity gains which may help in explaining the heterogeneous evidence from prior studies on M&As and productivity. In a domestic setting instead of an international one, Fajgelbaum *et al.* (2019) show in a spatial general equilibrium framework that even differences in taxation within a country generate welfare losses due to inefficient allocation of production factors. We provide corresponding empirical evidence on the distortion of post-acquisition allocation of corporate activity and the foregone productivity gains from M&As due to cross-border tax differentials.

Finally, various studies have investigated the role of tax policy as a determinant of M&A activity or location choices (e.g. Di Giovanni, 2005; Erel *et al.*, 2012; Todtenhaupt *et al.*, 2020; Feld *et al.*, 2016; Arulampalam *et al.*, 2019; Huizinga & Voget, 2009). A robust common finding is that firms are attracted to the lower tax locations by acquiring more targets and by allocating more input factors there. We instead focus on taxation as a determinant of post-acquisition allocation of productive input factors and therefore reveal new insights into how tax differences affect the productive process and the evolution of productivity within the firm.

The paper is structured as follows. In Section 2 we develop a theoretical model to formally analyze the relationship between acquisition-induced productivity changes and tax differentials. We explain our empirical strategy in Section 3 and describe the data in Section 4. Results are presented in Section 5. Section 6 concludes.

(2010) also find evidence for spillover effects of foreign activity on domestic firm productivity.

# 2 Theoretical framework

## 2.1 Tax differentials and productivity change after M&As

In this section we develop a theoretical framework to illustrate how tax rate differentials affect the realization of productivity gains in M&As. There is a continuum of potential M&A deals which differ in the potential productivity gain they might generate. In each deal two firms $i = a, b$ are joined to form a new combined entity $j$, either in a merger of equals or in an acquisition of one of the firms by the other. In the following, we use the term M&A for any such combination. The M&A process has two stages. In the first stage, the management decides on whether to complete an M&A between a particular pair of firms (selection). To complete an M&A, firms have to incur a fixed cost $c$ and only M&As with a profit increase, denoted by $\hat{\pi}$, that exceeds the fixed cost are profitable and will be completed.

One way to increase the profit in the combined firm is to raise productivity by allocating tasks between the two firms to realize synergy gains in the second stage (allocation). There is a continuum of tasks, indicated by $f$, that are carried out by both firms before the M&A and can be concentrated in either $a$ or $b$ after the M&A. They can be thought of as a set of headquarter tasks such as management, human resources, accounting, or R&D. The total number of tasks is normalized to 1. Where a particular task is allocated determines the productivity increase of the combined entity $j$ after the M&A. We denote the initial productivity (i.e. without any relocation of tasks between the individual firms) of the combined entity by $\varphi$. Allocating task $f$ to location $i$ changes $\varphi$ by a factor $\theta_f^i$. Without loss of generality, we normalize $\theta_f^a = 1$ and $\theta_f^b = \theta_f$ with $\theta_f$ being uniformly distributed across the interval $\left(0, \bar{\theta}\right]$. Taxes also affect the after-tax profit changes and thus the allocation of tasks. In particular, we denote by $\tau_a$ and $\tau_b$ the profit tax rates in location $a$ and $b$, respectively. Initially (i.e. before the relocation of tasks), the combined profit of $a$ and $b$ would be taxed at $\bar{\tau}$ which is a weighted average of the effective corporate income tax rates in $a$ and $b$, $\tau_a$ and $\tau_b$, where the weights can reflect the relative size of the two firms, an allocation of profits that results from arms-length transfer pricing of transactions between $a$ and $b$ or a combination of both. If a task is allocated to a particular location, this increases the share of the combined firm's profit that is taxed at that location's tax rate by $\epsilon$ and decreases the share of the combined firm's profit that is taxed at the other location's tax rate by the same amount. For simplicity, we assume that $\epsilon$ is the same for all tasks.

We solve the model by backward induction and begin by modeling the second stage (allocation). We define the pre-tax profit as a function of firm productivity, $g(\varphi) = \gamma\varphi$. A micro-foundation for this simplified expression is provided in the appendix. As a baseline scenario, we assume that no synergies between the two firms are realized and they merely exist under joint ownership. The baseline consolidated after-tax profit of the combined firm without relocation of tasks is $\pi = (1 - \bar{\tau})\, g(\varphi)$. This also represents the final profit for M&As without scope for bundling of activities.[6] Prior studies suggest that these include non-horizontal M&As across industries due to a lack of overlap in tasks between target and acquirer (e.g., Devos *et al.*, 2009; Li, 2013; Sheen, 2014).[7] In the empirical analysis we thus differentiate between horizontal and non-horizontal M&As. When deciding where to allocate tasks, the management is eventually interested in the resulting after-tax profit change $\hat{\pi}$ relative to the baseline scenario and chooses the location $a$ or $b$ that leads to the largest after-tax profit increase $\hat{\pi}$. We denote by $\hat{\pi}(f,i) = (\tau_{-i} - \tau_i)\,\epsilon\gamma\theta_f^i\varphi + (1-\bar{\tau})\,\gamma\left(\theta_f^i - 1\right)\varphi,\ i = a, b$ the profit change if task $f$ is allocated to $i$. The first term in $\hat{\pi}(f,i)$ captures how taxation distorts allocation while the second term captures the change in after-tax profits that is due to the change in productivity when task $f$ is allocated to location $i$. Comparing $\hat{\pi}(f,a)$ and $\hat{\pi}(f,b)$, we obtain that task $f$ is allocated to $b$ instead of $a$ if

$$\hat{\pi}(f,a) < \hat{\pi}(f,b) \Longleftrightarrow \theta_f > \tilde{\theta} \equiv \frac{1 - \bar{\tau} - \epsilon(\tau_a - \tau_b)}{1 - \bar{\tau} + \epsilon(\tau_a - \tau_b)} \tag{1}$$

where $\tilde{\theta}$ is the cut-off productivity advantage such that for a task $f$ with $\theta_f = \tilde{\theta}$ we have

[6] In a generalization of the model, one could allow for a firm-pair-specific share of tasks which cannot be bundled across firms such that post-deal productivity is solely determined by $\varphi$. The further considerations in this section with respect to profit-increasing relocations only apply to the remaining share of tasks which can be bundled at either of the two firm-locations. The latter share should be particularly large for horizontal M&As while it should be small for non-horizontal M&As.

[7] Non-horizontal M&As (e.g. diversifying M&As) may have less scope for synergies for several reasons. Acquisitions can arise from agency conflicts (Jensen, 1986; Hart & Moore, 1995) and in particular diversifying acquisitions appear to reflect empire building or the managers' desire to protect their human capital (Morck *et al.*, 1990). Furthermore, investment distortions may also be endemic within diversified firms due to agency conflicts between division managers and the CEO (Rajan *et al.*, 2000; Scharfstein & Stein, 2000; Hart & Holmstrom, 2010).

$\hat{\pi}(f,a) = \hat{\pi}(f,b)$. Inequality (1) shows the trade-off in the allocation decision between the productivity advantage or disadvantage ($\theta_f$) and the potential tax advantage or disadvantage of a particular location captured by the tax differential $\tau_a - \tau_b$. The resulting productivity change is $\hat{\varphi} = \int_{\tilde{\theta}}^{\bar{\theta}} (\theta_f - 1)\,\varphi d\theta_f = \int_1^{\bar{\theta}} \theta_f d\theta_f - \int_{\tilde{\theta}}^{1} (1-\theta_f)\,d\theta_f$. The first term denotes the potential productivity change if taxation is ignored in the allocation of tasks and hence any task is allocated to $a$ if $\theta_f < 1$ and to $b$ if $\theta_f > 1$. This is the maximum productivity gain from the M&A, which is obtained in our stylized model when $\tau_a = \tau_b$. The last term denotes the productivity loss from allocating some tasks with $\theta_f < 1$ to $b$ because their productivity advantage does not outweigh the tax disadvantage. Note that the last term is always negative irrespective of the direction of the tax differential. This implies that any tax difference between the locations of the two firms leads to a distorted allocation of tasks and thus reduces productivity gains resulting from the M&A.

Next, we model the first stage (selection) of the M&A process where potential M&As are selected for completion according to their potential profit increases. We distinguish individual M&As by their maximum productivity gain ($\int_1^{\bar{\theta}} \theta_f d\theta_f$). Since $\theta_f$ is uniformly distributed within a combined firm, the maximum productivity gain is characterized by the parameter $\bar{\theta}$ and we assign an index $j$ and a specific productivity parameter $\bar{\theta}_j$, which is distributed uniformly across the interval $\left(\bar{\theta}_{min}, \bar{\theta}_{max}\right)$, to each potential deal. Note that the consolidated profit change of a particular M&A that results from the optimal allocation of tasks, $\hat{\pi}_j = \hat{\pi}_j\left(\bar{\theta}_j\right) = \int_0^{\tilde{\theta}} \hat{\pi}(f,a)\,d\theta_f + \int_{\tilde{\theta}}^{\bar{\theta}} \hat{\pi}(f,b)\,d\theta_f$, is a function of the productivity parameter. We define a cut-off productivity parameter $\tilde{\bar{\theta}}$ such that $\hat{\pi}_j\left(\tilde{\bar{\theta}}\right) = c$. Since $\hat{\pi}_j$ is strictly increasing in $\bar{\theta}_j$, any deal with $\bar{\theta}_j > \tilde{\bar{\theta}}$ is completed. How does $\tilde{\bar{\theta}}$ change when the tax differential increases? For illustrative purposes, let us assume that $\tau_a > \tau_b$ such that $\tilde{\theta} < 1$ and consider an increase in $\tau_a - \tau_b$ that would not affect the initial average weighted tax rate $\bar{\tau}$, $\frac{d\bar{\tau}}{d(\tau_a - \tau_b)} = 0$. This allows us to theoretically isolate the effect of the tax differential on the selection and reallocation process of the M&A from the impact of a general change in the level of taxation that has been analyzed in prior studies (e.g. Di Giovanni, 2005; Voget, 2011; Erel *et al.*, 2012; Feld *et al.*, 2016; Arulampalam *et al.*, 2019). We control for tax levels in our empirical analysis. In the appendix, we show that

$$\frac{d\tilde{\bar{\theta}}}{d\left(\tau_a-\tau_b\right)}=\underbrace{-2\phi\left(1+\frac{\left(1-\bar{\tau}\right)}{1-\bar{\tau}+\left(\tau_a-\tau_b\right)\epsilon}\right)\left(1-\tilde{\theta}\right)}_{\text{behavioral selection effect}}\quad\underbrace{-\phi\left(\tilde{\bar{\theta}}^2-3\right)}_{\text{mechanical selection effect}} \tag{2}$$

$$\text{with } \phi=\frac{1}{2}\epsilon\left(\left(1-\bar{\tau}\right)\left(\tilde{\bar{\theta}}-1\right)+\tilde{\bar{\theta}}\left(\tau_a-\tau_b\right)\epsilon\right)^{-1}>0$$

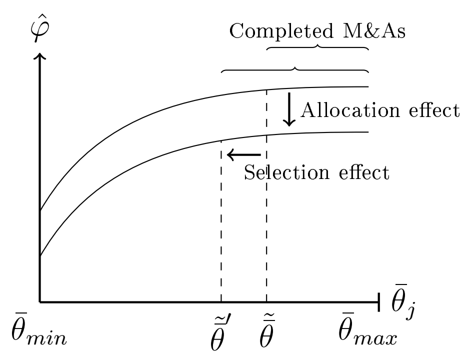
The first term captures the behavioral selection effect of the tax rate differential and is unambiguously negative. The intuition behind this is that a larger tax rate differential allows the management to create more tax benefits in the allocation of tasks which increases expected profits net of potential productivity losses due to the inefficient allocation of tasks. As a consequence, the required productivity gain potential (measured by $\tilde{\bar{\theta}}$) decreases. The second term is a mechanical selection effect implied by the change in the tax rate differential. Conditional on an allocation of tasks based on the relative productivity advantages, a tax rate differential means that part of the profit is taxed at a different level which may generate additional benefits or losses in terms of after-tax profits. With sufficiently large productivity gain potential (i.e. the number of tasks that increase productivity when allocated to $b$, $\bar{\theta}_{min}>\sqrt{3}$), this term is always negative with $\tau_a>\tau_b$ as a sufficiently large number of tasks is allocated to the low-tax location $b$.

Taken together, the average productivity gain in the sample of realized (i.e. empirically observed) M&As is $\hat{\varphi}_{avg}=\frac{1}{\bar{\theta}_{max}-\tilde{\bar{\theta}}}\int_{\tilde{\bar{\theta}}}^{\bar{\theta}_{max}}\hat{\varphi}d\bar{\theta}$. We analyze the change in the average productivity gain with respect to a change in the tax rate differential $\tau_a-\tau_b$ that again does not affect the average tax rate $\bar{\tau}$. It is given by

$$\frac{d\hat{\varphi}_{avg}}{d\left(\tau_a-\tau_b\right)}=\underbrace{\left(1-\tilde{\theta}\right)\varphi\frac{\partial\tilde{\theta}}{\partial\left(\tau_a-\tau_b\right)}}_{\text{allocation effect}}+\underbrace{\frac{\hat{\varphi}_{avg}-\hat{\varphi}\left(\tilde{\bar{\theta}}\right)}{\bar{\theta}_{max}-\tilde{\bar{\theta}}}\frac{d\tilde{\bar{\theta}}}{d\left(\tau_a-\tau_b\right)}}_{\text{selection effect}} \tag{3}$$

Intuitively, there are two ways in which tax differentials affect the average productivity gain of M&As. We illustrate these in Figure 1 which plots the distribution of potential productivity gain $\hat{\varphi}$ for M&As with various productivity parameters $\bar{\theta}_j$. First, larger tax rate differentials induce the management of combined firms to allocate some headquarter tasks to the less productive but also less taxed location, thereby not realizing the full productivity gain potential of the M&A. This *allocation effect* on the average productivity gain is captured by the first term in (3) and is unambiguously negative. It is illustrated in Figure 1 by a downward shift in the overall distribution of potential productivity gains $\hat{\varphi}$. Second, tax rate differentials may lead to firm combinations with different levels of potential productivity gain selecting into the set of completed M&As. This *selection effect* is captured by the second term in (3). As shown in expression (2), it has a behavioral component that is unambiguously negative and a mechanical component that can be either positive or negative. For instance, if larger tax rate differentials lead to higher expected profits because of behavioral responses in the allocation or because of a mechanical effect, M&A deals with lower productivity gain potential but larger tax rate differentials will also be completed which leads to a lower average productivity gain in the set of completed M&A deals. In Figure 1 we illustrate a negative selection effect (i.e. the mechanical selection effect is negative or the behavioral selection effect dominates) by a shift in the cut-off productivity parameter from $\tilde{\bar{\theta}}$ to $\tilde{\bar{\theta}}'$ as the set of completed M&As expands towards deals with lower productivity gains.

Figure 1: Average productivity and tax differentials




The Figure plots the distribution of potential productivity gain $\hat{\varphi}$ for M&As with various productivity parameters $\bar{\theta}_j$.

Eventually, the overall magnitude of (3) and the relative importance of the allocation and the selection effect are empirical questions that we analyze in this paper using firm-level data. In particular, the magnitudes of the selection effect and the allocation effect depend on the extent to which managers take into account tax rate differentials before or after the completion of M&A deals, respectively. In our empirical analysis, we first estimate the magnitude of the full effect (3) and then use a Heckman selection model to gauge the magnitude of the selection effect which allows us to draw inferences about the relative importance of allocation and selection in determining the impact of tax rate differentials on post-merger productivity gains.

## 2.2 Profit shifting

So far, we have assumed that the profits of the combined firm are taxed where productive activity is carried out (e.g. through adequate transfer pricing). In practice, however, the management may be able to shift profits between locations independently of the underlying productive activity. Such profit shifting can take various forms with the manipulation in transfer prices being one of the most prominent methods (Dharmapala, 2014). In the context of our framework above, this implies that the presence of profit shifting leads to a decoupling of the location of production and the location of taxation. Thus, when allocating tasks within the combined firm, the management no longer faces the trade-off between maximizing productivity advantages and tax benefits in particular locations. In our theoretical framework, we model this by introducing a third stage in which the management decides on the share of profits that is allocated to a particular location following the assignment of a task. Assigning a task to a location $i$ increases the share of the profit that is taxed at $i's$ tax rate by $\epsilon + s_i$ where $s_i$ is chosen by the management and may be both positive and negative. Consistent with prior literature we assume that profit shifting is costly and apply a convex cost function that increases proportionally with the amount of profit shifted (see Hines & Rice, 1994), $\psi \frac{(s_i)^2 \gamma \theta_f^i \varphi}{2}$, where $\psi$ is a parameter that measures profit shifting costs that reflect, for example, risks in transfer pricing manipulation. In the appendix we show that this implies that the cut-off productivity advantage is modified to

$$\hat{\pi}(f,a) < \hat{\pi}(f,b) \Longleftrightarrow \theta_f > \tilde{\theta}' \equiv \frac{(1-\bar{\tau}) - (\tau_b - \tau_a)\epsilon + \frac{(\tau_b - \tau_a)^2}{2\psi}}{(1-\bar{\tau}) + (\tau_a - \tau_b)\epsilon + \frac{(\tau_a - \tau_b)^2}{2\psi}}. \tag{4}$$

Note that $\lim_{\psi \to 0} \tilde{\theta}' = 1$, that is, tax rate differentials become less important as profit shifting costs decrease. In the extreme case that $\tilde{\theta}' = 1$ we have $\hat{\varphi} = \int_1^{\bar{\theta}} \theta_f d\theta_f$ such that the full productivity gain would be realized in each deal and both the allocation effect and the behavioral selection effect in 2 are zero such that the full effect of the tax rate differential on average productivity gains among realized M&As, captured by (3), would be smaller. Empirically, we thus expect the negative effect of tax rate differentials on post-merger productivity gains to be mitigated by profit shifting (e.g. when manipulating transfer prices is less risky).

# 3 Empirical strategy

In our empirical analysis, we investigate how tax differentials between the acquirer and the target firm affect the impact of the acquisition on the total factor productivity of the combined firm. We first focus on the dynamics of the effect relative to the completion of M&As by estimating an event study of the following form by linear regression:

$$
\begin{aligned}
ln\left(TFP_{lkt}\right) \; &= \sum_{n=-4}^{4} \alpha_n D_{lkt}^{n} \times \Delta\tau_{lkt} + \sum_{n=-4}^{4} \gamma_n D_{lkt}^{n} \\
+\beta_0 POST_{jt} \times \text{Cross-border}_j &+ \beta_1 \Delta\tau_{lkt} + \boldsymbol{\phi_{lk}} + \boldsymbol{\phi_t} + \epsilon_{lkt}
\end{aligned}
$$

$TFP_{lkt}$ is the estimated total factor productivity (TFP) in year $t$ of the combined firm that consists of target $l$ and acquirer $k$. In section 4.2 and in more detail in the Online Appendix, we explain how TFP is estimated. On the right hand side, the absolute tax differential is given by $\Delta\tau_{lkt} = |\tau_{lt} - \tau_{kt}|$ where $\tau_{kt}$ is the top statutory tax rate on corporate profits realized in the acquirer location in year $t$ and $\tau_{lt}$ is the effective tax rate from the perspective of the acquirer on profits realized by the target firm. The absolute tax differential is fully interacted with a set of event time dummy variables, which indicate that a data point is $n$ years apart from the M&A event.The coefficients with respect to the last year prior to the M&A are normalized to zero. To mitigate collinearity with the year fixed effects $\boldsymbol{\phi_t}$, we limit the event window to the four years before and after the M&A with open bracket endpoints. Hence, $D_{lkt}^{4}$ indicates that the M&A has taken place four or more years ago and $D_{lkt}^{-4}$ similarly indicates that the M&A takes place four or more years later. The specification is further augmented by accounting for year fixed effects $\boldsymbol{\phi_t}$ and acquirer-target-firm fixed effects $\boldsymbol{\phi_{lk}}$ which also subsume any acquirer or target location fixed effects. This implies we are only exploiting within-firm-pair variation for identification. An additional differential effect of the M&A event on cross-border deals is allowed for by interacting an indicator for post-acquisition periods, $POST_{jt}$, with a cross-border dummy variable. While the coefficients of the event time dummies $\gamma_n$ capture the general effect of the acquisition on productivity, we are particularly interested in the distortive impact of the tax differentials captured by the coefficients $\alpha_n$. These coefficients measure how a tax differential of one percentage point modulates the dynamic impact of an acquisition on productivity in the years around the event. The pattern of coefficients thereby describes how the tax-induced distortions to productivity evolve during the post-acquisition process. Furthermore, we can also check for pre-acquisition trends. Ruling out such trends increases our confidence in estimating the causal effects of the tax differential on the productivity of merging firms. If tax differentials only affect the adjustment process after the two firms have merged, we should not find an effect for pre-acquisition years, i.e. $\alpha_n = 0 \; \forall n < 0$.

In our theoretical model we show that the effect of tax differentials on post-merger productivity is related to distortions in the allocation of tasks within the combined firm which leads to unrealized synergy gains in production. Hence, the effect of tax differentials is conditional on the existence of such substitutable tasks and the underlying synergy potential from allocating them efficiently. As prior literature finds that M&As between firms that produce similar products and operate in the same industry are more likely to exhibit potential productivity gains through the reallocation of tasks (e.g., Sheen, 2014; Li, 2013; Conyon *et al.*, 2002; Harrison & McMillan, 2011; Monarch *et al.*, 2017), we expect the effect of tax differentials on post-merger productivity gains to be concentrated in horizontal M&As. Following Li (2013), we define horizontal M&As as deals where the target and the acquirer firm have the same primary two-digit SIC and all other deals as non-horizontal. We allow for heterogeneity between the different types of M&As by estimating separate sets of parameters.

For obtaining a comprehensive average measure of the impact of tax differentials on productivity, we subsequently switch to a panel regression framework which closely resembles the event study approach. In particular,we estimate the following two-way fixed effects difference-in-differences model:

$$\ln\left(TFP_{lkt}\right) = \alpha_0 POST_{jt} + \alpha_1 \Delta\tau_{lkt} \times POST_{jt} + \boldsymbol{\beta_1 X_j} \times POST_{jt}$$
$$+ \boldsymbol{\beta_2 Z_{lkt}} + \boldsymbol{\phi_{lk}} + \boldsymbol{\phi_t} + \epsilon_{lkt} \quad (5)$$

$\boldsymbol{\phi_t}$ and $\boldsymbol{\phi_{lk}}$ capture year and acquirer-target-firm fixed effects. As before, $\Delta\tau_{lkt}$ denotes the absolute tax differential between target and acquirer location in year $t$ and $POST_{jt}$ is a dummy variable which indicates post-acquisition periods. $\alpha_0$ thus captures the general impact of the acquisition on the total factor productivity while $\alpha_1$ measures the heterogeneity in this effect that is attributed to the tax differential. The coefficient of interest is $\alpha_1$ which measures the effect of one percentage point of absolute difference in target and acquirer tax rates on the post-acquisition productivity change. Following the theoretical derivation in Section 2, a negative $\alpha_1$ would reflect the behavioral allocation and selection effect on post-M&A productivity gains.

A major advantage of analyzing the TFP of the combined firm rather than focusing on the effect in the acquirer or target firm is that we avoid tax-driven measurement errors in the input variables. These may occur if firms engage in fictitious relocation of economic activity after the acquisition. For example, a firm may use transfer pricing to transfer profits to the low-tax location in the merged firm. This would seemingly induce an increase in value-added and hence in the productivity of the low-tax affiliate while total factor productivity would appear to decrease in the high-tax affiliate. Hence, considering target and acquirer productivity separately is misleading because it does not only reflect real productivity effects but also the result of tax-optimizing financial accounting. Analyzing the TFP of the combined firm avoids this problem because the artificial transfer of profits nets out when consolidating acquirer and target firm. The data requirements of TFP estimation, however, imposes some limitations on our sample.We therefore also employ several raw alternative performance indicators such as sales, revenue, or earnings over assets as dependent variable in a sensitivity analysis.

In our estimation, we control for various deal-, firm- and location-specific variables that might affect the productivity change and post-acquisition performance more generally in line with the previous literature (e.g. Harris & Robinson, 2002; Herman & Lowenstein, 1988; Fu *et al.*, 2013; Fee & Thomas, 2004; Stiebale, 2016). $\boldsymbol{X_j}$ is a vector of constant deal characteristics. We include a dummy that indicates whether a deal involves two firms located in different countries which may have different implications for post-acquisition productivity growth. Furthermore, we include a measure for the distance between acquirer and target firm, and dummies that are equal to one when the take-over was hostile and when the acquirer firm already had a toehold in the target firm before the acquisition was announced.

$\boldsymbol{Z_{lkt}}$ is a vector of characteristics of the target as well as the acquirer location. It includes $\Delta\tau_{lkt}$ and the target's statutory corporate tax rate to control for general tax effects on productivity.[8] Economic growth in the acquirer and target location and the wage difference between the locations represent further country level controls. Total assets of the acquirer and the target firm control for firm size effects.

In the theoretical framework, the sign of the tax differential (i.e. whether profits are taxed more if generated in the acquirer or in the target) does not play a role for its effect on productivity as it is the absolute tax rate differential that leads to distortions. We test this feature empirically by disaggregating $\Delta\tau_{lkt}$ into positive and negative differentials, $\Delta\tau_{lkt}^{+}$ and $\Delta\tau_{lkt}^{-}$ with

$$\Delta\tau_{lkt}^{+} = \begin{cases} |\tau_{lt} - \tau_{kt}| & \text{if } \tau_{lt} > \tau_{kt} \\ 0 & \text{else} \end{cases} \tag{6}$$
$$\Delta\tau_{lkt}^{-} = \begin{cases} |\tau_{lt} - \tau_{kt}| & \text{if } \tau_{lt} < \tau_{kt} \\ 0 & \text{else.} \end{cases}$$

According to the theoretical predictions, the negative effect of tax rate differentials on post-merger productivity gains may be mitigated through the use of profit shifting. Since transfer pricing has been identified as one of the major channels of profit shifting (Bartelsman & Beetsma, 2003; Clausing, 2003; Heckemeyer & Overesch, 2017; Davies *et al.*, 2018) we

[8] As the tax rate measures are interrelated, we also run regressions without the target's statutory tax rate as control variable to check whether collinearity drives our findings. In these estimations we obtain very similar results.

test this prediction by exploring heterogeneity in the coefficient of interest with respect to transfer pricing risk. This is achieved by means of fully interacting the term $\Delta\tau_{lkt} \times POST_{jt}$ with a time-varying indicator of transfer pricing risk, which has been developed and validated by Mescall & Klassen (2018). We include the interaction terms with respect to the acquirer's and the target's transfer pricing risk simultaneously as the institutional framework of both locations may be relevant. Since strongly enforced transfer pricing rules inhibit profit shifting, which might induce the combined firm to allocate real assets inefficiently, we expect the marginal effect of $\Delta\tau_{lkt} \times POST_{jt}$ to be stronger for larger values of the transfer pricing risk indicators. This is the case when the coefficients of the triple interaction terms - $\Delta\tau_{lkt} \times POST_{jt} \times TPR_{lt}$ and $\Delta\tau_{lkt} \times POST_{jt} \times TPR_{kt}$ - are negative. A validation of this prediction also addresses a potential sample selection concern with respect to profit shifting. In particular, low transfer pricing risk environments may entice badly matched firms to engage in M&As based on profit shifting opportunities and observed productivity would therefore drop. This would imply that the estimated coefficient is more negative for cross-border deals subject to very weak profit shifting regulation (i.e. we would expect positive coefficients for $\Delta\tau_{lkt} \times POST_{jt} \times TPR_{lt}$ and $\Delta\tau_{lkt} \times POST_{jt} \times TPR_{kt}$). The described selection effect would thus be exactly contrary to the theoretical prediction described in Section 2.2. There, we predict that the effect of the tax differential is less pronounced when firms are able to easily allocate profits to the location with the more favorable tax rate. Hence, testing the heterogeneity in the effect of tax rate differentials with respect to transfer pricing risk also verifies that the negative effect of the absolute tax differential on post-acquisition productivity is not driven by sample selection due to profit shifting.

So far, our estimations capture the full effect of tax rate differentials on post-M&A productivity gains. As derived in our theoretical model, the full effect might consist of an allocation effect and a selection effect. In the final part of the analysis, we gauge the relative magnitude of these two effects using a Heckman selection model that takes into account that acquirers and target firms are not randomly selected but enter the sample by the fact that an M&A takes place which may itself reflect expectations about future productivity gains. To allow for a Heckman estimation approach, we run the regression model at the deal level and analyze the difference in productivity averaged over the years after the acquisition and the years before the acquisition, $\Delta \ln(TFP_{lks}) = ln(TFP_{lks,Post}) - ln(TFP_{lks,Pre})$. The index $s$ equals the year in which the M&A takes place. The differencing across time not only eliminates the acquirer-target-firm specific effects $\boldsymbol{\phi_{lk}}$ but also any potential selection problem which operates through $\boldsymbol{\phi_{lk}}$ (Dustmann & Rochina-Barrachina, 2007). The corresponding specification of a regression in differences is given by

$$\begin{aligned}\Delta \ln(TFP_{lks}) =& \alpha_0 \Delta POST_j + \alpha_1 \Delta(\Delta\tau_{lk} \times POST_j) + \boldsymbol{\beta_1}\Delta(\boldsymbol{X_j} \times POST_j) \\ &+ \boldsymbol{\beta_2 \Delta Z_{lk}} + \boldsymbol{\phi_s} + \epsilon_{lks}\end{aligned} \tag{7}$$

in which the right hand side variables also represent differences in average values after and before the acquisition. Time-specific effects are controlled for by dummy variables. Given a suitable set of hypothetical firm combinations for which no M&A is observed, this specification can be extended to a Heckman selection model, the first stage of which specifies the probability of an M&A taking place between acquirer $k$ and target firm $l$

$$Prob(D = 1|\boldsymbol{W}_{lk}) = \Phi(\boldsymbol{\gamma}\boldsymbol{W}_{lk})$$

$\Phi$ is the cumulative distribution function of the standard normal distribution and $\boldsymbol{W}_{lk}$ is a vector of control variables, which includes the regressors from expression (7) and, as an additional instrument, a measure for regulatory restrictions on M&As specific to the country of the acquirer or the target firm. Based on the maximum likelihood estimates of $\gamma$, one can construct predicted values of the inverse Mills ratio $\hat{\lambda} = \phi(\hat{\boldsymbol{\gamma}}\boldsymbol{W})/\Phi(\hat{\boldsymbol{\gamma}}\boldsymbol{W})$, which is added as an additional regressor to specification (7) in order to correct (and test) for sample selection effects (Greene, 2018; Heckman, 1979). In the absence of sample selectivity, the coefficient of the inverse Mills ratio is zero. With sample selectivity, the coefficient of the tax differential may, for example, be weaker than in the linear regression, while the inverse Mills ratio may exhibit a positive coefficient. The required set of hypothetical firm combinations is arrived at either by considering the five or ten alternative target firms which are most similar to the actual target firm or by considering the five or ten alternative acquirers which are most similar to the actual acquirer. The degree of similarity is determined by nearest neighbor matching with respect to operating revenue within the same two-digit industry.

# 4 Data

## 4.1 M&A deals

The data requirements implied by the research question are demanding: unconsolidated data for the target's and the acquirer's input and output factors must be available before and after the acquisition event. For this purpose, we combine M&A deals from the Zephyr database to internationally comparable firm-level data provided by Orbis. Both databases are provided by Bureau van Dijk such that they can be linked via a common Bureau van Dijk identifier for each firm. A further advantage of Zephyr is that it includes information on a large number of deals involving private firms (Erel *et al.*, 2015).

From Zephyr, we select all domestic and cross-border M&As in OECD and EU member states during the sample period 2000-2015 in which the management obtains full control over both firms after the deal completion (i.e. one firm owns more than 50% of another firm). We also exclude deals involving financial and insurance firms[9] and privatizations of state-owned enterprises. This yields 128,408 deals with acquirers and targets in 41 different countries. The distribution across countries is similar to that obtained in prior studies on global M&A (e.g. Erel *et al.*, 2012). For the empirical analysis, we require information on total factor productivity for both the acquirer and the target firm. This implies that we include deals in which (i) both the target and the acquirer firm operate in a country or industry for which we can consistently estimate production factor elasticities using Orbis data and (ii) Orbis provides for both the target and the acquirer sufficient financial information to compute TFP using the estimated factor elasticities. This leaves us with 10,972 deals in our final sample. 51% of these are horizontal deals where target and acquirer operate in the same industry sector.[10]

[9] These are defined as firms with US SIC codes 60-67.

[10] This is similar to the share of horizontal deals in the full sample of deals (41%) and consistent with the

Table 1: Location of targets and acquirers in the estimation sample

| Acquirer country | | Target Country | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AT | BE | BG | CZ | DE | EE | ES | FI | FR | HR | HU | KR | LU | LV | NL | NO | PL | PT | RO | SE | SI | SK | Total |
| Austria | AT | 20 | 7 | 1 | | 29 | | 1 | | 7 | | 6 | | | | | 2 | 3 | | 4 | | 3 | | 83 |
| Belgium | BE | | 522 | 2 | 3 | 19 | | 12 | 4 | 72 | | 2 | 1 | 2 | 1 | 8 | 4 | 7 | 3 | 1 | 6 | | 1 | 670 |
| Bulgaria | BG | | | 139 | 1 | | | | | | | 1 | | | | | | | | 1 | | | | 142 |
| Czechia | CZ | | | 4 | 174 | | | | | 4 | | 3 | | | | | | 2 | | 1 | | | 11 | 199 |
| Germany | DE | 15 | 22 | | 18 | 423 | 2 | 28 | 7 | 45 | | 10 | 3 | | | 6 | 14 | 11 | 8 | 9 | 11 | 2 | 3 | 637 |
| Estonia | EE | | | | | | 16 | | 1 | | | | | | | | | 1 | | | | | | 18 |
| Spain | ES | 2 | 8 | 1 | 7 | 12 | | 2,568 | 1 | 48 | | | | | | 1 | 6 | 3 | 46 | | 2 | | 1 | 2,706 |
| Finland | FI | 1 | 2 | 1 | 2 | 11 | 15 | 3 | 1,444 | 2 | | 2 | | | 2 | | 26 | 10 | 1 | 1 | 57 | | 2 | 1,582 |
| France | FR | 1 | 65 | 1 | 18 | 38 | 1 | 68 | 7 | 1,647 | | 3 | 4 | 3 | | 6 | 10 | 15 | 10 | 6 | 17 | 2 | 2 | 1,924 |
| Croatia | HR | | | | | | | | | | 1 | | | | | | | | | | | | | 1 |
| Hungary | HU | | | | 1 | | | | | 1 | | 81 | | | | | | 1 | | 1 | | | 1 | 86 |
| Korea | KR | | 2 | | 3 | 5 | | 3 | | 2 | | 1 | 436 | | | | 2 | 1 | 1 | 1 | | | | 457 |
| Luxembourg | LU | | 2 | | | 1 | | | | 5 | | | | | | | | | | | | 1 | | 9 |
| Netherlands | NL | 1 | 8 | | | 2 | | | | 2 | | | | | | 14 | 2 | | | | | | | 29 |
| Norway | NO | | | 1 | 1 | 6 | 1 | 7 | 14 | 2 | | 2 | | | 1 | 1 | 976 | 1 | 1 | 1 | 76 | 1 | 1 | 1,093 |
| Poland | PL | | | 1 | 4 | 2 | | 1 | | | | 2 | | | | 1 | | 184 | | 1 | | | 1 | 197 |
| Portugal | PT | | 1 | | 1 | | | 26 | | 3 | | | | | | | | 1 | 135 | | | | | 167 |
| Romania | RO | 1 | | 1 | | | | | | | | | | | | | | | | | | | | 2 |
| Sweden | SE | | 5 | 1 | 4 | 3 | 6 | 5 | 56 | 12 | | | | | | 2 | 73 | 7 | 2 | | 724 | | 3 | 903 |
| Slovenia | SI | 1 | | 1 | 1 | | | | | | 2 | | | | | | | 1 | | | 1 | 18 | | 25 |
| Slovakia | SK | 1 | | | 5 | 1 | | 1 | | | | 2 | | | | | | 2 | | 1 | | | 29 | 42 |
| Total | | 43 | 644 | 154 | 243 | 552 | 41 | 2,723 | 1,534 | 1,852 | 3 | 115 | 444 | 5 | 4 | 39 | 1,115 | 250 | 207 | 28 | 894 | 27 | 55 | 10,972 |

This table reports number of mergers and acquisitions in the baseline estimation sample per acquirer-target country pair. Information on the deals is obtained from Bureau van Dijk's Zephyr Database.

In Table 1 we present the distribution of these deals across target and acquirer countries.[11] The sample reduction is driven by the fact that Orbis sources its financial data from national registries and annual reports. The availability of specific data items which are necessary for the TFP estimation thus depends on national reporting requirements. For instance, in some countries the cost of employees and the cost of materials do not have to be reported and are thus missing for the large majority of firms. While this puts some limitations on the data with regard to the coverage of individual countries, we note that recent evaluations of the Orbis database found that it is quite representative for the population of firms within developed countries (Gopinath *et al.*, 2017; Cravino & Levchenko, 2017; Kalemli-Özcan *et al.*, 2019). Moreover, we find no substantial correlation between the share of deals with missing financial data for a particular acquirer-target-country pair and our main variable of interest, the absolute tax rate differential between the target and the acquirer country.[12] In Figure 2 we further validate the representativeness of our sample by comparing the across industry

prevalence of within-industry M&As in recent years (Andrade *et al.*, 2001).

[11] In the Online Appendix we provide a detailed account of this sampling process that also shows the number of selected deals by acquirer and target country.

[12] The correlation coefficient is 0.0934. The correlation coefficient for the correlation between the *number* of deals with missing financial data for a particular acquirer-target-country pair and the absolute tax rate differential between the target and the acquirer country is -0.1063.

Figure 2: Distribution of M&As across industries


This figure displays the distribution of acquiring and target firms across industry sectors. Panels (a) and (b) present the distribution of acquiring and target firms, respectively, in the full population of M&As among firms in OECD or EU member states obtained from Zephyr (without restrictions on financial data availability, blue bars) and in the M&As in the estimation sample (with restrictions on financial data availability, red bars). Panels (c) and (d) present the distribution of acquiring and target firms, respectively, in M&As recorded in the official UNCTAD statistics (blue bars) and in the M&As in the estimation sample (with restrictions on financial data availability, red bars).

distribution of firms in our sample to the distribution in the full Zephyr population (without restrictions on financial data availability, see panels (a) and (b)), as well as to official UNCTAD statistics on cross-border M&As (World Investment Report, see panels (c) and (d)). While there is some under-representation of deals in the primary sector in our sample, the share of manufacturing and services is quite similar. To empirically explore whether potential sample selection drives our results, we conduct additional regression analyses using several alternative proxies for productivity with broader coverage as well as weighted regressions.

## 4.2 Firm-level data and productivity estimation

We obtain firm-level information on outputs, inputs and ownership structure from the Orbis historical vintages which provide the most comprehensive access to historical data on the universe of firms contained in the Bureau van Dijk databases.[13] In our analysis, we use Orbis data in two steps. First, we employ the universe of firms to estimate input elasticities that allow us to compute TFP. Second, we match the estimated input elasticities and information on annual inputs from Orbis to the firms involved in M&A deals during the sample period using unique identifiers from Bureau van Dijk. Before analyzing the data, we apply the cleaning and adjustment steps described by Kalemli-Özcan *et al.* (2019) to obtain a reliable set of firm-level data with financial information that is comparable both over time and across countries. This includes the correction of reporting mistakes and dropping observations with implausible data. All variables are deflated by country and industry sector specific price deflators. Both the data preparation and the TFP estimation process are described in more detail in the Online Appendix.

For the TFP computation we estimate input elasticities using the Levinsohn & Petrin (2003) method as augmented by Wooldridge (2009). In the Levinsohn & Petrin (2003) approach, input elasticities are estimated as the parameters of a Cobb-Douglas production function by regressing firm output on the main input factors labor and capital while using intermediate inputs as an instrument for the unobserved potential productivity shocks to avoid a simultaneity bias in the estimation. The adjustment by Wooldridge (2009) solves the functional dependence problem highlighted by Ackerberg *et al.* (2015) (i.e. labor input chosen as a function of unobserved productivity shocks). Following recent empirical approaches (e.g. Gopinath *et al.*, 2017; Fons-Rosen *et al.*, 2019), we measure labor input by cost of employees, capital by the book value of fixed assets, output by value added[14] and intermediate inputs by the cost of materials. We estimate specific labor and capital input elasticities for each industry sector (2-digit SIC) and country combination. Table 2 reports the estimated input elasticities for the target and acquirer firms used in our sample. They are based on productivity estimations using 8,760,379 firms. The estimated average labor elasticity is about 0.700 for target firms and 0.698 for acquirer firms while the capital elasticity is 0.184 for target firms and 0.187 for acquirer firms.

[13] Currently 365 million firms worldwide according to Bureau van Dijk's website (retrieved on April 23, 2020).

[14] This avoids potential identification problems arising when using gross output instead Gandhi *et al.* (2020).

Table 2: Location of targets and acquirers in the estimation sample

| | | Mean | Median | Standard deviation |
|---|---|---|---|---|
| Target firms | Labor elasticity | 0.700 | 0.714 | 0.107 |
| | Capital elasticity | 0.184 | 0.178 | 0.090 |
| Acquirer Firms | Labor elasticity | 0.698 | 0.712 | 0.106 |
| | Capital elasticity | 0.187 | 0.181 | 0.090 |

This table reports number of estimated labor and capital elasticities for the acquirer and target firms in the sample.

Using these country-industry specific elasticities as well as firm-level data on capital (fixed assets), labor (cost of employees) and value added, we compute TFP for the combined acquirer and target firm. When acquirer and target operate in a different industry or country, we apply a weighted average of the estimated input elasticities in the corresponding country and sector (weighted by total assets). In total, we compute TFP for 94,936 combined-firm-year observations for 10,972 acquisitions. Following prior literature (e.g. Gopinath *et al.*, 2017; Fons-Rosen *et al.*, 2019), we winsorize TFP at the 1st and 99th percentiles by acquirer country. Table 3 reports the average log TFP separately for both horizontal and non-horizontal deals. Firm combinations in both types of deals appear to be similarly productive on average with non-horizontal deals having a slightly higher mean log TFP. We also compute TFP for the combination of target firms with an acquirer firm and all of the acquirer firm's subsidiaries to account for a potential integration of the target firm into a corporate group. The resulting average log TFP for horizontal deals is again presented in Table 3 and is slightly larger than the TFP computed for target-acquirer combinations. Table 3 also reports summary statistics for other annual firm-level information from Orbis that we use in our empirical analysis. In particular, we use EBITDA, sales, operating revenue and total assets. The average EBITDA return on assets in the sample is 0.080 while the asset turnover ratio (revenue to total assets) is 1.199 when output is measured by sales and 1.214 when output is measured by total operating revenue. Consistent with prior findings, acquirer firms are larger than target firms in terms of total assets.

Finally, we complement our dataset with information on GDP growth in the acquirer and target country as well as the wage difference between the two countries. The latter is computed as the difference in the average wage in the acquirer country and the average wage in the target country, divided by the mean of the average wages in the acquirer and

Table 3: Summary statistics

| Variable | Observations | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| Log TFP (horizontal deals, combined firm) | 49,581 | 2.097 | 1.825 | -0.777 | 10.910 |
| Log TFP (non-horizontal deals, combined firm) | 45,355 | 2.255 | 1.879 | -0.777 | 10.910 |
| Log TFP (combined firm incl. acquirer subsidiaries) | 49,607 | 2.128 | 1.831 | -0.634 | 10.931 |
| EBITDA over total assets (combined firm) | 65,065 | 0.080 | 0.113 | -0.863 | 1.128 |
| Sales over total assets (combined firm) | 63,773 | 1.199 | 1.120 | 0.000 | 8.775 |
| Operating revenue over total assets (combined firm) | 73,957 | 1.214 | 1.135 | 0.000 | 8.294 |
| *POST* | 49,420 | 0.352 | 0.478 | 0.000 | 1.000 |
| Cross-border | 49,420 | 0.131 | 0.337 | 0.000 | 1.000 |
| Distance | 49,420 | 5.530 | 0.589 | 4.088 | 9.103 |
| Hostile | 49,420 | 0.000 | 0.019 | 0.000 | 1.000 |
| Toe | 49,420 | 0.039 | 0.193 | 0.000 | 1.000 |
| Total assets (acquirer) | 49,420 | 15.327 | 1.973 | 4.190 | 25.718 |
| Total assets (target) | 49,420 | 17.305 | 2.400 | 8.023 | 26.182 |
| Wage Difference | 49,420 | 0.029 | 0.246 | -1.798 | 1.846 |
| GDP growth (acquirer) | 49,420 | 1.668 | 2.556 | -14.724 | 10.800 |
| GDP growth (target) | 49,420 | 1.707 | 2.599 | -14.724 | 10.800 |
| Absolute tax rate differential ($\Delta\tau$) | 49,420 | 0.896 | 2.172 | 0.000 | 31.010 |
| Average absolute tax rate differential (avg. $\Delta\tau$) | 49,607 | 0.844 | 2.168 | 0.000 | 31.010 |
| Positive tax rate differential $\Delta\tau^{+}$ | 49,420 | 30.159 | 5.131 | 10.000 | 52.000 |
| Negative tax rate differential $\Delta\tau^{-}$ | 49,420 | 0.518 | 1.327 | 0.000 | 31.010 |
| CIT (Target) | 49,420 | 0.379 | 1.830 | 0.000 | 22.460 |
| Absolute EATR differential ($\Delta EATR$) | 45,162 | 6.920 | 5.185 | 0.000 | 55.000 |
| EATR (Target) | 45,162 | 0.248 | 0.054 | 0.055 | 0.459 |
| Absolute EMTR differential ($\Delta EMTR$) | 45,162 | 0.724 | 2.443 | 0.000 | 24.100 |
| EMTR (Target) | 45,162 | 0.288 | 0.049 | 0.088 | 0.508 |
| Transfer pricing risk (TPR), demeaned, acquirer | 48,116 | 0.000 | 0.240 | -0.470 | 0.496 |
| Transfer pricing risk (TPR), demeaned, target | 47,724 | 0.000 | 0.238 | -0.464 | 0.502 |
| Merger control (acquirer) | 8,394 | 2.253 | 0.869 | 0.600 | 3.600 |
| Merger control (target) | 8,394 | 2.423 | 0.920 | 0.600 | 3.600 |

This table reports summary statistics for the variables of interest in the main analyses. Unless indicated otherwhise, the descriptive statistics refer to the sample of horizontal deals. With the exception of *Merger control*, all variables are from the firm-level analysis and thus represent statistics based on firm-year observations. *Merger control* is used in the deal-level analysis und thus statistics across the sample of individual deal observations are presented. A detailed description of the individual variables can be found in Table A.1.

the target country. Summary statistics show that wages are on average higher in acquirer countries while GDP growth is similar in both acquirer and target countries with a sample average of 1.668% and 1.707%, respectively.

## 4.3 International taxation and regulatory data

Our main variable of interest are international tax rate differentials between target and acquirer locations in M&As. In the following, we briefly describe how such differentials arise in the international tax system.[15] When analyzing the impact of tax rate differentials on the productivity change after an M&A deal, the relevant perspective is that of the management of the merged firm. Most M&A deals take the form of an acquisition and it is thus reasonable to assume that allocation decisions are taken from the perspective of the acquirer country. In the following we always refer to the tax rate faced by the acquiring firm when describing a tax rate. The relevant tax rate differential is thus the difference between the tax rate on profits that the acquirer firm receives from the target in the form of dividends and the tax rate on profits realized at the acquirer location. While the tax burden in each location depends on the statutory corporate income tax rate and the withholding tax rate (if applicable) for inter-corporate dividends, the resulting difference also depends on the approach taken by the acquirer country to relieve firms of double taxation. Table 4 describes the computation of the absolute tax rate differential for the various double tax relief methods. The exemption method, which is applied by most European countries, fully or partially exempts foreign income from corporate taxation. The tax burden for profits received from the target is thus determined by the corporate income and withholding taxes in the target location, and the resulting tax rate differential is mainly driven by cross-border differences in these tax rates. Some countries, like the United States, Japan and the United Kingdom, used to apply the credit method instead. With this approach, foreign income is taxed at the domestic corporate tax rate but taxes paid abroad are credited against the domestic tax liability. This credit is usually limited to the amount of domestic tax payments due. As a consequence, tax differentials only arise when the effective tax rate of the acquirer country is below that of the target country. Credit regimes differ in the scope of the credit. A direct credit only considers the withholding tax paid abroad while indirect credits also include the underlying taxation of corporate profits.

For our empirical analysis, we have collected tax information for a large set of developed countries for the period 2000-2015, including the statutory corporate tax rate, country-pair specific withholding taxes on cross-border dividends and country-pair specific double tax relief methods. The latter may either be based on unilateral approaches, bilateral tax treaties

[15] See Huizinga & Voget (2009) for a comprehensive description of double-taxation of cross-border dividends.

Table 4: Tax rate differentials

| Double Tax Relief Method | Absolute Effective Tax Rate Difference $\Delta\tau$ | |
|---|---|---|
| Exemption | $\left\|\tau_a^{CIT}\psi - \left(1-(1-\psi)\,\tau_a^{CIT}\right)\left(\tau_b^{CIT} + \left(1-\tau_b^{CIT}\right)\tau_{ba}^{w}\right)\right\|$ | |
| Indirect Credit | $\left\|\tau_a^{CIT} - \tau_b^{CIT} - \left(1-\tau_b^{CIT}\right)\tau_{ba}^{w}\right\|$ | if $\tau_b^{CIT} + \left(1-\tau_b^{CIT}\right)\tau_{ba}^{w} \geq \tau_a^{CIT}$ |
| | 0 | if $\tau_b^{CIT} + \left(1-\tau_b^{CIT}\right)\tau_{ba}^{w} < \tau_a^{CIT}$ |
| Direct Credit | $\left\|\tau_a^{CIT} - \tau_b^{CIT} - \left(1-\tau_b^{CIT}\right)\left(\tau_a^{CIT} - \tau_{ba}^{w}\right)\right\|$ | if $\tau_{ba}^{w} < \tau_a^{CIT}$ |
| | $\left\|\tau_a^{CIT} - \tau_b^{CIT} - \left(1-\tau_b^{CIT}\right)\tau_{ba}^{w}\right\|$ | if $\tau_{ba}^{w} \geq \tau_a^{CIT}$ |

This table summarizes the computation of the difference between the effective tax rate on profits that a firm in location $a$ receives from a firm in location in the form of dividends and the tax rate on profits realized in location $b$. $\tau_a^{CIT}$ and $\tau_b^{CIT}$ are the top statutory tax rates in location $a$ and $b$, respectively. $\tau_{ba}^{w}$ is the final withholding tax rate on dividends paid from location $a$ to location $b$. $\psi$ is the exemption rate.

or multilateral agreements such as the Parent-subsidiary Directive which requires European Union (EU) and European Economic Area (EEA) members to exempt profits of substantial holdings in other member states from domestic taxation. We compute for each individual M&A deal from the perspective of the acquiring firm the effective tax rates on profits realized by the target and the acquirer, respectively. The average absolute tax rate differential ($\Delta\tau$) in our sample is 0.896 percentage points which reflects that there is a substantial number of domestic deals with a zero tax differential between target and acquirer firms (see Table 3). For cross-border deals, the average is 4.581 percentage points and ranges up to 31 percentage points. We report the full sample distribution of absolute tax rate differentials in the Online Appendix. In our empirical analysis, we show that our results hold both for the whole sample as well as for the sample of cross-border deals only. We complement our statutory tax measures with effective tax measures which are computed following the Devereux & Griffith (2003) model and which also account for other features of the tax system such as depreciation rules and the treatment of financing costs. While effective average tax rates (EATRs) are similar to our statutory measures, the summary statistics in Table 3 show that effective marginal tax rate (EMTR) differentials may be substantially larger.

We further augment our sample with information on transfer pricing risk from Mescall & Klassen (2018). Mescall & Klassen (2018) define transfer pricing risk as "the risk of a decrease in future cash flows that result from tax authorities' actions related to a corporation's transfer pricing activities". They gather country specific risk assessments through a survey among a large number of transfer pricing practitioners. These risk assessments are then regressed against country specific regulatory and enforcement variables to obtain the weights to compute a country-year specific measure of transfer pricing risk. To obtain a relative measure, countries are ranked within each year according to the computed transfer pricing risk and the rank variable is normalized to range between 0 and 1. We rerank the original data from Mescall & Klassen (2018) among our sample of countries and then follow the same procedure to obtain a relative measure of transfer pricing risk.

Finally, for our Heckman selection model, we use the merger control index provided by the OECD (see Høj, 2007). The merger control index captures whether laws or procedures allow national authorities to intervene in M&A deals beyond enforcing competition (e.g. to protect domestic industries).

# 5 Results

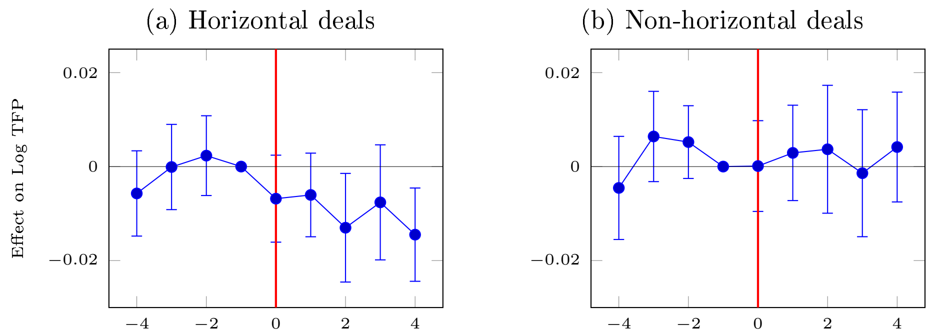
## 5.1 Tax differentials and changes in Total Factor Productivity

We begin the econometric analysis by graphically examining the results of our event study design which is presented in Figure 3 (a) for horizontal M&A deals and Figure 3 (b) for non-horizontal M&A deals. The figures show how the tax differential affects TFP per period before and after the acquisition is completed. Standard errors are adjusted for clustering on the firm-pair level to account for the possibility of unobserved correlated shocks because the variable of interest (i.e. the tax differential in the post-deal period) varies with the deal completion year (firm-pair specific) and the locations of the target and the acquirer firm. Alternative adjustment for clustering on the target-acquirer-country-pair level does not change our inference (results are reported in the Online Appendix).[16]

We do not detect a significant pre-trend prior to the deal completion, which validates our reseach design. The p-value of the joint significance test for the coefficients of the pre-event dummy variables is 0.31, such that we cannot reject joint insignificance. In the years after the two firms are combined, the effect of the tax differential on TFP turns significantly negative for horizontal M&As for which prior studies have found high productivity gain potential

[16] We note, however, that country-pair clusters substantially differ in size (see Table 1) which may bias the estimated cluster-robust standard errors (Carter *et al.*, 2017).

Figure 3: Event study, Total Factor Productivity




This table plots the coefficient estimates $\alpha_n, n \in [-4, 4]$ and the corresponding 95% confidence intervals of a generalized difference-in-differences model that takes the following form: $ln(TFP_{lkt}) = \sum_{n=-4}^{4} \alpha_n D^n_{lkt} \times \Delta\tau_{lkt} + \sum_{n=-4}^{4} \gamma_n D^n_{lkt} + POST_{lkt} \times \text{Cross-border}_{lk} + \beta_1 \Delta\tau_{lkt} + \boldsymbol{\phi_{lk}} + \boldsymbol{\phi_t} + \epsilon_{lkt}$ where $TFP_{lkt}$ estimated total factor productivity in year $t$ of the combined firm that consists of target $l$ and acquirer $k$. The dummy variables $D^n_{lkt}$ indicate if the deal that involved target $l$ and acquirer $k$ was completed $n$ periods ago. $\alpha_{-1}$ is normalized to zero such that all effects are measured relative to the year directly preceding the deal completion. The event dummies are binned up at the endpoints ($D^{-4}_{lkt}$ and $D^4_{lkt}$): for example, the dummy $D^4_{lkt}$ takes the value one in year $t$ if the deal between target $l$ and acquirer $k$ was completed four or more years ago. Panel (a) presents the results for the sample of horizontal deals while panel (b) presents results for the sample of non-horizontal deals. All regressions include firm-fixed and year-fixed effects. Standard errors are adjusted for clustering at the firm-pair level. The underlying regression results are presented in Table A.2.

through the efficient allocation of tasks (p-value of the joint significance test: 0.02). Thus, our empirical findings are consistent with tax differentials distorting this allocation and thereby inhibiting the realization of productivity gains. The full effect is in place two years after the deal completion.[17] On the other hand, non-horizontal deals exhibit no sensitivity to the tax differential, possibly reflecting that such deals aim at diversifying operations and exhibit little productivity gain potential via the reallocation of substitutable tasks such that the tax-driven distortion of task allocation impacts productivity gains to a much smaller extent.[18]

Next, we move to a panel regression analysis to obtain an average estimate of the impact of tax differentials on post-acquisition productivity. The results for the regression model described in expression (5) are presented in Table 5. Columns (1)-(3) display results of the

[17]The p-value of the joint significance test for the coefficients of the pre-event dummy variables is 0.31. For the post-event dummies, the p-value for joint significance is 0.02.

[18]When considering the average total effect of the M&A deal (i.e. $\alpha_n \times \overline{\Delta\tau} + \gamma_n$, where $\overline{\Delta\tau}$ is the sample mean of tax differentials), horizontal M&As appear to exhibit a more positive development in productivity than non-horizontal M&As. We report results for the total effect in Online Appendix Figure OA.3. This is similar to findings by Devos *et al.* (2009) who argue that within-industry mergers offer greater opportunities to realize synergies through elimination of duplicate investments, while mergers across industries appear to be undertaken for reasons other than synergies such as empire building or the managers' desire to protect their human capital (Morck *et al.*, 1990). In a similar vein, Schoar (2002) finds that firms which diversify experience a net reduction in productivity.

Table 5: Regression results, Total Factor Productivity

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| $POST \times \Delta\tau$ | -0.002<br>(0.003) | -0.008**<br>(0.003) | 0.003<br>(0.004) | -0.008**<br>(0.003) | 0.004<br>(0.004) | | |
| $POST \times \Delta\tau^{+}$ | | | | | | -0.011**<br>(0.005) | 0.003<br>(0.005) |
| $POST \times \Delta\tau^{-}$ | | | | | | -0.009**<br>(0.004) | 0.004<br>(0.005) |
| $POST$ | -0.008<br>(0.006) | -0.001<br>(0.008) | -0.015<br>(0.010) | -0.000<br>(0.077) | 0.014<br>(0.083) | -0.005<br>(0.077) | 0.015<br>(0.083) |
| $\Delta\tau$ | 0.002<br>(0.002) | 0.005*<br>(0.003) | 0.000<br>(0.003) | 0.004<br>(0.003) | 0.000<br>(0.003) | | |
| $\Delta\tau^{+}$ | | | | | | -0.001<br>(0.004) | 0.001<br>(0.003) |
| $\Delta\tau^{-}$ | | | | | | 0.010***<br>(0.004) | -0.001<br>(0.004) |
| $POST \times$ Cross-border | 0.016<br>(0.017) | 0.022<br>(0.024) | 0.010<br>(0.025) | 0.022<br>(0.027) | 0.018<br>(0.028) | 0.024<br>(0.027) | 0.018<br>(0.028) |
| $POST \times$ Distance | | | | -0.002<br>(0.014) | -0.010<br>(0.015) | -0.001<br>(0.014) | -0.010<br>(0.015) |
| $POST \times$ Hostile | | | | 0.007<br>(0.035) | 0.120<br>(0.116) | 0.004<br>(0.035) | 0.121<br>(0.116) |
| $POST \times$ Toehold | | | | -0.043<br>(0.035) | 0.083**<br>(0.035) | -0.042<br>(0.035) | 0.083**<br>(0.036) |
| CIT (Target) | | | | 0.003**<br>(0.002) | 0.002<br>(0.002) | 0.005***<br>(0.002) | 0.002<br>(0.002) |
| Wage Difference | | | | -0.027<br>(0.032) | -0.025<br>(0.032) | -0.041<br>(0.032) | -0.023<br>(0.032) |
| GDP Growth (Acquirer) | | | | 0.016***<br>(0.003) | 0.016***<br>(0.004) | 0.016***<br>(0.003) | 0.016***<br>(0.004) |
| GDP Growth (Target) | | | | 0.004<br>(0.003) | 0.006<br>(0.003) | 0.004<br>(0.003) | 0.006<br>(0.004) |
| Total Assets (Acquirer) | | | | 0.048***<br>(0.007) | 0.065***<br>(0.008) | 0.047***<br>(0.007) | 0.065***<br>(0.008) |
| Total Assets (Target) | | | | 0.030***<br>(0.006) | 0.020***<br>(0.006) | 0.030***<br>(0.006) | 0.020***<br>(0.006) |
| Obs. | 94,936 | 49,581 | 45,355 | 49,420 | 45,181 | 49,420 | 45,181 |
| No. of deals | 10,972 | 5,680 | 5,292 | 5,662 | 5,276 | 5,662 | 5,276 |
| Adj. $R^2$ | 0.956 | 0.961 | 0.950 | 0.962 | 0.951 | 0.962 | 0.951 |

This table presents the baseline regression results. The dependent variable is the logarithm of estimated total factor productivity in the combined firm. Column (1) contains results for all deals. Columns (2), (4) and (6) contains results for horizontal deals. Columns (3), (5) and (6) contains results for non-horizontal deals. All regressions include firm-fixed and year-fixed effects. Cluster-robust standard errors (adjusted for clustering at the firm-pair level) are provided in parentheses. Stars behind coefficients indicate the significance level, * 10%, ** 5%, *** 1%.

fixed effects panel regressions controlling for a cross-border indicator as well as firm and year fixed effects. Column (1) employs the pooled sample, while Columns (2) and (3) respectively consider only horizontal and non-horizontal M&As corresponding to the event study graphs in Figures 3(a) and 3(b). For the horizontal M&As, the coefficient of the post-acquisition tax differential is significantly negative, suggesting that productivity gains are lower with larger absolute tax differentials. For the non-horizontal M&As (and also for the pooled sample), this coefficient remains insignificant. We then augment the specifications by including the full set of control variables in column (4) (horizontal M&As) and column (5) (non-horizontal M&As). The coefficient for the variable of interest remains very similar and is robust to controlling for macroeconomic dynamics, differences in input costs, firm size, and various deal characteristics. For horizontal M&As, the coefficient of interest in column (4) implies that an increase in the absolute tax differential between acquirer and target location by 1 percentage point drives down the acquisition-induced productivity gain by about 0.8% for horizontal M&As. In order to test whether our results are driven by a comparison of domestic and cross-border deals, we have rerun all regressions with the sample restricted to only cross-border deals and find very similar results. The corresponding estimates are reported in the Online Appendix.

Table 6: Regression results, alternative performance measures

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| $POST \times \Delta\tau$ | -0.001** | -0.001** | -0.018*** | -0.012*** | -0.017*** | -0.011*** |
| | (0.001) | (0.001) | (0.004) | (0.004) | (0.003) | (0.003) |
| $POST$ | 0.001 | -0.004** | 0.080*** | 0.028** | 0.075*** | 0.024* |
| | (0.002) | (0.002) | (0.013) | (0.012) | (0.013) | (0.012) |
| $\Delta\tau$ | 0.001** | 0.001** | 0.010*** | 0.008*** | 0.008*** | 0.007*** |
| | (0.000) | (0.000) | (0.003) | (0.003) | (0.003) | (0.003) |
| $POST \times$ Cross-border | -0.000 | -0.001 | -0.047 | -0.033 | -0.050 | -0.034 |
| | (0.004) | (0.004) | (0.034) | (0.034) | (0.032) | (0.031) |
| $POST \times$ Distance | | 0.000 | | -0.000*** | | -0.000*** |
| | | (0.000) | | (0.000) | | (0.000) |
| $POST \times$ Hostile | | -0.003 | | -0.527*** | | -0.526*** |
| | | (0.005) | | (0.116) | | (0.122) |
| $POST \times$ Toehold | | -0.006 | | -0.128*** | | -0.136*** |
| | | (0.005) | | (0.034) | | (0.033) |
| CIT (Target) | | -0.000* | | 0.005** | | 0.007*** |
| | | (0.000) | | (0.002) | | (0.002) |
| Wage Difference | | -0.002 | | 0.053 | | 0.042 |
| | | (0.005) | | (0.036) | | (0.031) |
| GDP Growth (Acquirer) | | 0.004*** | | 0.007*** | | 0.009*** |
| | | (0.000) | | (0.003) | | (0.002) |
| GDP Growth (Target) | | 0.001* | | 0.006*** | | 0.007*** |
| | | (0.000) | | (0.002) | | (0.002) |
| Total Assets (Acquirer) | | 0.023*** | | 0.272*** | | 0.279*** |
| | | (0.001) | | (0.013) | | (0.013) |
| Total Assets (Target) | | 0.012*** | | 0.123*** | | 0.116*** |
| | | (0.001) | | (0.008) | | (0.008) |
| Obs. | 65,065 | 64,452 | 63,773 | 62,461 | 73,957 | 72,015 |
| No. of deals | 7,416 | 7,348 | 7,092 | 7,050 | 8,125 | 8,030 |
| Adj. $R^2$ | 0.551 | 0.571 | 0.793 | 0.823 | 0.785 | 0.816 |

This table presents regression results using alternative firm performance measures. In columns (1) and (2), the dependent variable is the sum of EBITDA in the target and acquirer firm divided by the sum of total assets in the target and acquirer firm. In columns (3) and (4), the dependent variable is the sum of sales in the target and acquirer firm divided by the sum of total assets in the target and acquirer firm. In columns (5) and (6), the dependent variable is the sum of operating revenue in the target and acquirer firm divided by the sum of total assets in the target and acquirer firm. All columns present results for horizontal deals. All regressions include firm-fixed and year-fixed effects. Cluster-robust standard errors (adjusted for clustering at the firm-pair level) are provided in parentheses. Stars behind coefficients indicate the significance level, * 10%, ** 5%, *** 1%.

We complement our analysis in columns (6) (horizontal M&As) and column (7) (non-horizontal M&As) by allowing for different coefficients for positive and negative tax differentials. For horizontal M&As, the estimated coefficients for both the negative (i.e. tax differences where the effective tax rate of the target location is below that of the acquirer location) and the positive post-acquisition tax differential is significantly negative and also very similar in size. Hence it is indeed the absolute spread in the tax rate differential which matters and not the direction of this differential. For non-horizontal M&As, these coefficients remain small and insignificant as before.

In the next set of regressions, which is presented in Table 6, we focus on the set of horizontal M&As and employ alternative performance indicators different from total factor productivity. Columns (1) and (2) employ EBITDA over assets as the dependent variable, first without and then with other control variables. Similarly, columns (3) and (4) use sales over assets, and columns (5) and (6) use operating revenue over assets as dependent variables. As before, acquirer and target are considered as a joint firm because separate consideration would introduce distortions from profit shifting. In all cases, the coefficient of interest is robust to employing these alternative performance indicators.

Our model implies that the effect of the tax differential on productivity is less pronounced when firms are able to easily reallocate profits between affiliates. Where to produce and where to record profits become separate questions with costless profit shifting. In order to test this implication, we apply the time-varying transfer pricing risk indicator developed by Mescall & Klassen (2018). Column (1) of Table 7 resembles column (2) of Table 5 but the regression includes the transfer pricing risk indicators for the acquirer and target country and all interaction effects with these two variables. In particular, the transfer pricing risk induced by the target country's institutions appears to matter as indicated by the significantly negative coefficient of the interaction with the post-acquisition tax differential, $POST \times \Delta\tau \times TPR(Target)$. Hence, the effect of the post-acquisition tax differential on productivity becomes stronger with higher transfer pricing risk (and vice versa becomes weaker with lower transfer pricing risk), which reflects that higher cost of profit shifting increases the incentive to inefficiently allocate real resources in the post-acquisition period. With respect to transfer pricing risk induced by the acquiring country's institutions, the

Table 7: Regression results, transfer pricing risk

| | (1) | (2) |
|---|---|---|
| $POST \times \Delta\tau$ | -0.012*** | -0.011** |
| | (0.005) | (0.004) |
| $POST \times \Delta\tau \times$ TPR (Target) | -0.043*** | -0.043*** |
| | (0.014) | (0.013) |
| $POST \times \Delta\tau \times$ TPR (Acquirer) | -0.017 | -0.010 |
| | (0.015) | (0.014) |
| $POST$ | -0.003 | -0.068 |
| | (0.008) | (0.087) |
| $\Delta\tau$ | 0.003 | 0.002 |
| | (0.004) | (0.004) |
| TPR (Target) | -0.196*** | -0.127* |
| | (0.069) | (0.070) |
| TPR (Acquirer) | 0.068 | 0.080 |
| | (0.070) | (0.070) |
| $POST \times$ TPR (Target) | 0.134* | 0.132* |
| | (0.074) | (0.072) |
| $POST \times$ TPR (Acquirer) | -0.035 | -0.079 |
| | (0.073) | (0.072) |
| $\Delta\tau \times$ TPR (Target) | 0.035*** | 0.023** |
| | (0.011) | (0.011) |
| $\Delta\tau \times$ TPR (Acquirer) | 0.033*** | 0.021* |
| | (0.012) | (0.011) |
| $POST \times$ Cross-border | 0.047* | 0.026 |
| | (0.026) | (0.031) |
| Cross-border$\times$ TPR(Target) | -0.332*** | -0.248*** |
| | (0.093) | (0.092) |
| $POST \times$ Distance | | 0.010 |
| | | (0.016) |
| $POST \times$ Hostile | | 0.001 |
| | | (0.036) |
| $POST \times$ Toehold | | -0.029 |
| | | (0.036) |
| CIT (Target) | | 0.004*** |
| | | (0.002) |
| Wage Difference | | 0.001 |
| | | (0.034) |
| GDP Growth (Acquirer) | | 0.015*** |
| | | (0.004) |
| GDP Growth (Target) | | 0.004 |
| | | (0.003) |
| Total Assets (Acquirer) | | 0.028*** |
| | | (0.006) |
| Total Assets (Target) | | 0.043*** |
| | | (0.007) |
| Obs. | 47,583 | 47,565 |
| No. of deals | 5,547 | 5,539 |
| Adj. $R^2$ | 0.959 | 0.959 |

This table presents regression results including transfer pricing risk. The dependent variable is the logarithm of estimated total factor productivity in the combined firm. All columns present results for horizontal deals. All regressions include firm-fixed and year-fixed effects. Cluster-robust standard errors (adjusted for clustering at the firm-pair level) are provided in parentheses. Stars behind coefficients indicate the significance level, * 10%, ** 5%, *** 1%.

coefficient of the interaction term $POST \times \Delta\tau \times TPR(Acquirer)$ also has a negative sign but it is less than half in size and insignificant. These interaction effects remain very similar when including the full set of control variables in column (2) of Table 7.

Table 8: Regression results (weighted regression, alternative tax and TFP measures)

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| $POST \times \Delta\tau$ | -0.012*** | | | -0.008** | |
| | (0.004) | | | (0.003) | |
| $POST \times \Delta$EMTR | | -0.006*** | | | |
| | | (0.001) | | | |
| $POST \times \Delta$EATR | | | -0.007* | | |
| | | | (0.004) | | |
| $POST \times avg.\ \Delta\tau$ | | | | | -0.007* |
| | | | | | (0.003) |
| $POST$ | 0.148* | -0.075 | -0.023 | 0.023 | 0.027 |
| | (0.085) | (0.086) | (0.084) | (0.076) | (0.076) |
| $\Delta\tau$ | 0.012*** | | | 0.004 | |
| | (0.003) | | | (0.003) | |
| $\Delta$EMTR | | 0.002 | | | |
| | | (0.001) | | | |
| $\Delta$EATR | | | 0.005 | | |
| | | | (0.003) | | |
| $avg.\ \Delta\tau$ | | | | | 0.005* |
| | | | | | (0.003) |
| $POST \times$ Cross-border | 0.083*** | 0.009 | 0.015 | 0.024 | 0.020 |
| | (0.029) | (0.025) | (0.031) | (0.026) | (0.026) |
| $POST \times$ Distance | -0.028* | 0.017 | 0.002 | -0.008 | -0.009 |
| | (0.016) | (0.016) | (0.016) | (0.014) | (0.014) |
| $POST \times$ Hostile | 0.007 | -0.010 | 0.005 | -0.066** | -0.065** |
| | (0.036) | (0.036) | (0.036) | (0.032) | (0.032) |
| $POST \times$ Toehold | -0.030 | -0.022 | -0.021 | -0.027 | -0.028 |
| | (0.036) | (0.036) | (0.036) | (0.032) | (0.032) |
| CIT (Target) | 0.007*** | | | 0.003* | 0.003* |
| | (0.002) | | | (0.001) | (0.001) |
| EATR (Target) | | 0.333** | | | |
| | | (0.137) | | | |
| EMTR (Target) | | | 0.102 | | |
| | | | (0.149) | | |
| Wage Difference | -0.034 | -0.017 | -0.030 | -0.018 | -0.017 |
| | (0.032) | (0.033) | (0.032) | (0.032) | (0.032) |
| GDP Growth (Acquirer) | 0.014*** | 0.013*** | 0.014*** | 0.015*** | 0.015*** |
| | (0.004) | (0.004) | (0.004) | (0.003) | (0.003) |
| GDP Growth (Target) | 0.006* | 0.004 | 0.004 | 0.004 | 0.004 |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) |
| Total Assets (Acquirer) | 0.029*** | 0.028*** | 0.028*** | 0.026*** | 0.026*** |
| | (0.006) | (0.006) | (0.006) | (0.005) | (0.005) |
| Total Assets (Target) | 0.031*** | 0.039*** | 0.040*** | 0.048*** | 0.048*** |
| | (0.008) | (0.008) | (0.008) | (0.007) | (0.007) |
| Obs. | 49,420 | 45,162 | 45,162 | 49,607 | 49,607 |
| No. of deals | 5,662 | 5,468 | 5,468 | 5,679 | 5,679 |
| Adj. $R^2$ | 0.949 | 0.955 | 0.955 | 0.966 | 0.966 |

This table presents regression results using alternative tax and TFP measures. In columns (1)-(3), the dependent variable is the logarithm of estimated total factor productivity in the combined firm. Column (1) repeats the baseline regression presented in column (4) of Table 5 in a weighted regression. The weight for an observation of a particular deal is the number of M&A deals obtained from Zephyr for the sample period (irrespective of data availability for TFP computation) with the same acquirer country and the same value for the cross-border indicator (i.e. crossborder deal vs. domestic deal). See the Online Appendix for an overview of the sample selection. In columns (4) and (5), the dependent variable is the logarithm of estimated total factor productivity in the target firm, the acquirer firm and all subsidiaries of the acquirer prior to the deal. All columns present results for horizontal deals. All regressions include firm-fixed and year-fixed effects. Cluster-robust standard errors (adjusted for clustering at the firm-pair level) are provided in parentheses. Stars behind coefficients indicate the significance level, * 10%, ** 5%, *** 1%.

In the set of regressions presented in Table 8, we check the robustness of our results in several dimensions. Our estimates may not be representative because the data requirements for observing productivity for the acquirer as well as the target firm are strong, thereby unbalancing the estimation sample. In column (1), we therefore weight each observation in the sample by the proportion of similar deals in the population of M&As. The corresponding weights are obtained from stratifying the sample by the acquirer's country of origin and by domestic versus cross-border deal status. The coefficient of the post-acquisition tax differential is then -0.012 compared to a value of -0.008 without weighting. Hence, data availability issues apparently do not result in an overestimate of the effect size, but rather in an underestimate. Another important concern is the appropriate measure for the tax differential. For example, Egger *et al.* (2009) find that results on the impact of corporate taxation on investment are sensitive to the measure of the tax rate. In columns (2) and (3), we therefore substitute the differential in statutory tax rates by the differential in effective marginal tax rates (EMTR), $POST \times \Delta EMTR$, and alternatively by the differential in effective average tax rates (EATR), $POST \times \Delta EATR$. EATRs and EMTRs are computed following the Devereux & Griffith (2003) model, taking into account the taxation of cross-border transfers of profits. The point estimates are similar in both cases. The standard error decreases for the coefficient estimate of the effective marginal tax rate while it increases for the effective average tax rate. This is consistent with a smaller measurement error in the former variable as the merged firm faces decisions at intensive margins: Instead of deciding about the unique location of a new indivisible investment project, the firm already operates two similar units with overlapping activities at different locations. In column (4) and (5), we use historic ownership data about subsidiaries of acquirer firms to test if results are robust to accounting for these affiliates. The affiliates are included in calculating the total factor productivity of the group, which is then employed as an alternative measure of the dependent variable. The corresponding coefficient estimates turn out to be quite similar to the baseline estimates. The specification in column (5) also accounts for the variance in affiliate locations by employing asset-weighted average tax rates for the acquirer group and the target for measuring the tax differential within the merged group. In both specifications, the coefficient estimates turn out to be quite similar to the baseline estimates.

## 5.2 Selection vs. reallocation

Besides the direct effect of tax differentials on the reallocation of tasks in the wake of an acquisition, there might also be a selection effect such that only particular types of M&As are realized which are not representative. For example, a large tax differential may entice a higher share of badly matched firms to merge because they can make up for their lower synergy potential by higher tax savings from reallocating tasks between acquirer and target location. However, expression (3) in the theoretical model implies that this behavioral selection effect represents only a part of the total selection effect and that the direction of the total selection effect remains ambiguous. In the set of regressions presented in Table 9, we therefore estimate selection models which allow us to explicitly test for the presence of sample selection effects. Column (1) reports the estimates of the specification in expression (7), which does not correct for sample selection. These estimates are compared to the estimates of the Heckman selection models in columns (2) to (5) which vary with respect to the set of matched firms for which no M&A was observed. In column (2), this set of firms is formed by subsequently matching the acquirer with the five firms which are most similar to the target firm with respect to operating revenue and within the same industry. The unreported binary first stage regression, which models the probability of an M&A to take place, includes all second stage regressors as controls and additionally a variable which measures the target country's regulatory authority to inhibit M&As.[19] Comparing columns (1) and (2), the coefficient of the tax differential remains very similar becoming even slightly more negative when controlling for sample selection. This is in line with the inverse Mills ratio's coefficient being quite insignificant with a t-value of 0.9. Hence, sample selection does not appear to bias the coefficients of the linear regression approach. This may reflect that the sign of the selection effect in expression (2) is ambiguous and that it is close to zero. Potentially, arbitrage opportunities of tax differentials are not considered in the run-up of a typical M&A because it is dominated by other considerations (Auerbach & Reishus, 1987). Similar to the robustness test for the main analysis, we have rerun the selection model including only cross-border deals and find that the results are very similar.[20] In the regression

[19] The corresponding coefficient is significantly negative with a t-value of -4.77

[20] See Table OA.6 in the Online Appendix.

Table 9: Regression results, selection

| | OLS Baseline | Heckman Selection Model | | | |
|---|---|---|---|---|---|
| | | Up to 5 alternative | | Up to 10 alternative | |
| | | targets | acquirers | targets | acquirers |
| | (1) | (2) | (3) | (4) | (5) |
| Avg. post-deal $\Delta\tau$ | -0.027*** | -0.032*** | -0.027*** | -0.032*** | -0.025*** |
| | (0.008) | (0.008) | (0.006) | (0.007) | (0.007) |
| Crossborder | 0.029 | 0.002 | 0.053 | -0.016 | 0.062 |
| | (0.057) | (0.072) | (0.035) | (0.074) | (0.038) |
| Change in avg. $\Delta\tau$ | 0.019*** | 0.024*** | 0.019*** | 0.025*** | 0.018** |
| | (0.007) | (0.009) | (0.006) | (0.008) | (0.009) |
| Distance | 0.007 | -0.024 | 0.018 | -0.032 | 0.026 |
| | (0.021) | (0.031) | (0.032) | (0.034) | (0.037) |
| Hostile | 0.096*** | 0.097** | 0.098** | 0.097* | 0.096** |
| | (0.026) | (0.047) | (0.042) | (0.051) | (0.044) |
| Toehold | -0.035 | -0.033 | -0.039 | -0.033 | -0.039 |
| | (0.031) | (0.042) | (0.043) | (0.038) | (0.045) |
| Change in CIT (Target) | -0.004 | -0.003 | -0.003 | -0.002 | -0.003 |
| | (0.006) | (0.004) | (0.003) | (0.003) | (0.003) |
| Change in Wage Difference | -0.056 | -0.046 | -0.057 | -0.047 | -0.056 |
| | (0.045) | (0.051) | (0.054) | (0.061) | (0.043) |
| Change in Avg. GDP Growth (Acquirer) | 0.044*** | 0.044*** | 0.047*** | 0.044*** | 0.048*** |
| | (0.016) | (0.012) | (0.012) | (0.016) | (0.013) |
| Change in Avg. GDP Growth (Target) | 0.003 | -0.003 | -0.003 | -0.004 | -0.004 |
| | (0.016) | (0.013) | (0.010) | (0.016) | (0.015) |
| Change in Total Assets (Acquirer) | 0.062** | 0.041* | 0.037* | 0.040* | 0.036* |
| | (0.027) | (0.024) | (0.020) | (0.021) | (0.022) |
| Change in Total Assets (Target) | -0.037 | -0.017 | -0.013 | -0.016 | -0.012 |
| | (0.025) | (0.022) | (0.020) | (0.019) | (0.022) |
| $\lambda$ | | 0.090 | -0.023 | 0.104 | -0.041 |
| | | (0.096) | (0.063) | (0.094) | (0.066) |
| Obs. | 3,359 | 8,017 | 7,513 | 11,844 | 10,244 |

This table presents regression results on the deal-level. Column (1) presents the results of an OLS model while columns (2)-(5) present the results of a Heckman selection model using the strictness of regulatory restrictions on M&As in the target country (columns 2 and 4) or the acquirer country (columns 3 and 5) as an additional instrument in the unreported first-stage regressions. The dependent variable is the difference in the average logarithm of estimated total factor productivity in the combined firm before and after the deal completion. Similarly, the control variables (CIT, Wage Difference, GDP Growth, Total Assets) are the difference in their average before and after the deal completion. All columns present results for horizontal deals. The alternative options in the Heckman selection model are hypothetical deals with alternative targets and acquirers, respectively. Each actual deal is complemented with up to 5 or 10 hypothetical deals with the actual acquirer (target) but alternative target firms (acquirer firms). The alternative target firms (acquirer firms) are drawn from the same industry sector (2-digit SIC code) as the actual target firm (acquirer firm) and are required to have an average operating revenue over the observation period that differs from the average operating revenue over the observation period of the actual target firm (acquirer firm) by a maximum of 10,000 USD. When there are more than 5 (10) candidates for the alternative target firms (acquirer firms), the 5 (10) with the smallest absolute difference in average operating revenue to the actual target firm (acquirer firm) are chosen. All regressions include year-fixed effects. Bootstrapped standard errors are provided in parentheses. Stars behind coefficients indicate the significance level, * 10%, ** 5%, *** 1%.

reported in column (3), we select five alternative acquirers which are most similar to the actual acquirer to arrive at the set of firm matches for which no M&A is observed and use the acquirer country's regulatory authority to inhibit M&As as an additional instrument in the first stage.[21] The regressions reported in column (4) and (5) resemble the specifications of columns (2) and (3) but the set of firm pairs without M&A is doubled by selecting up to

[21] The corresponding coefficient in the first stage is significantly negative with a t-value of -7.2

10 instead of up to 5 alternative matches of firms. The insight remains robust: the coefficients of the tax differential are very similar to the estimate in column (1) which does not account for sample selection. Furthermore, the coefficients of the inverse Mills ratio are insignificant, which indicates that there is no sample selection bias.

# 6 Conclusion

In this paper, we investigate how the change in firm productivity following corporate M&As is affected by differences in profit taxation between the target and the acquirer location. In our theoretical framework, tax differentials between the locations of firms involved in an M&A distort the post-acquisition allocation of productive activity. If tax differences are large enough, firms assign some activity to units that are less productive but more profitable due to a lower tax burden. With respect to overall productivity in the combined firm, this choice is inefficient and reduces the productivity gain after the M&A.

We employ detailed firm-level data to test this effect empirically. We estimate TFP in the combined firm before and after the acquisition is completed and relate it to the absolute value of the difference between the effective tax rates on profits generated in the target and the acquirer location. Our results suggest that an increase in the absolute tax differential by one percentage point reduces the post-acquisition productivity by 0.8% for firms from the same industry combined in horizontal M&As. For horizontal M&As, operating activity of target and acquirer is similar and synergy gains are likely to result from bundling tasks at one or the other location which can be distorted by tax differentials. This effect is observed both for positive tax differentials (i.e. when the effective tax rate is higher in the target location) and negative tax differentials (i.e. when the effective tax rate is higher in the acquirer location). For non-horizontal M&As between firms from different industries, we find no significant effect reflecting that these deals are unlikely to generate productivity gains from the potentially distorted relocation of tasks as the firms' operations are dissimilar. Consistent with our expectation that tax differentials are less distortive if firms are able to assign part of their profit from high-tax to low-tax locations via transfer mispricing, we find that the impact of the tax differential is mitigated when transfer pricing risk is smaller, leading to lower costs of transfer price manipulation. such that firms can shift profits more easily. In further analyses, we show that the empirical effect is mainly driven by inefficient reallocation of productive resources after the M&A deal is completed rather than by firm selection in anticipation of such effects prior the deal.

The findings of this paper have several important implications. First, they point to a potential advantage of tax regimes that are neutral with respect to the location of investment. While such regimes have previously been implemented in the United States (until 2017), Japan and the United Kingdom (until 2009) where worldwide tax regimes were combined with a credit on foreign tax payments they are now all but replaced in developed economies by systems that exempt foreign profits from domestic taxation and lead to effective international tax differences. Devereux *et al.* (2015) suggest higher tax administration costs as a potential motive for switching from a credit to an exemption regime despite the distortive impact of the latter. In the light of our findings, these benefits should, however, be carefully weighted against negative effects on the efficiency of international factor allocation.

Second, tax differentials turn out to be an additional impediment to cross-border knowledge flows that has so far been largely ignored. Given that a large fraction of conventional trade barriers has been eliminated in comprehensive bilateral and multilateral agreements, substantial differences in tax policy across countries are likely to emerge as an important obstacle to the international transmission of technology. In the light of recent announcements of tax rate cuts that might lead to further divergence of international tax systems, this aspect has become even more relevant.

Finally, while the analysis of firm reactions to international tax competition has so far mostly focused on its relevance for financial accounting (see Hines, 1999), our results highlight that differences in taxation are also harmful in real terms by reducing productivity growth. We show that firms make real adjustments not only with respect to the level of domestic tax rates but also with regard to the international tax system.

# References


Ackerberg, Daniel A., Caves, Kevin, & Frazer, Garth. 2015. Identification properties of recent production function estimators. *Econometrica*, **83**(6), 2411–2451.

Akcigit, Ufuk, Baslandze, Salome, & Stantcheva, Stefanie. 2016. Taxation and the international mobility of inventors. *American Economic Review*, **106**(10), 2930–2981.

Andrade, Gregor, Mitchell, Mark, & Stafford, Erik. 2001. New evidence and perspectives on mergers. *Journal of Economic Perspectives*, **15**(2), 103–120.

Arulampalam, Wiji, Devereux, Michael P, & Liberini, Federica. 2019. Taxes and the location of targets. *Journal of Public Economics*, **176**(July), 161–178.

Auerbach, Alan J, & Reishus, David. 1987. The impact of taxation on mergers and acquisitions. *Chap. 4, pages 69–86 of:* Auerbach, Alan J (ed), *Mergers and acquisitions*. University of Chicago Press.

Balsvik, Ragnhild, & Haller, Stefanie A. 2010. Foreign firms and host-country productivity: does the mode of entry matter? *Oxford Economic Papers*, **63**(1), 158–186.

Bartelsman, Eric J, & Beetsma, Roel MWJ. 2003. Why pay more? Corporate tax avoidance through transfer pricing in OECD countries. *Journal of Public Economics*, **87**(9), 2225–2252.

Becker, Johannes, & Fuest, Clemens. 2010. Taxing foreign profits with international mergers and acquisitions. *International Economic Review*, **51**(1), 171–186.

Bresman, Henrik, Birkinshaw, Julian, & Nobel, Robert. 1999. Knowledge transfer in international acquisitions. *Journal of International Business Studies*, **30**(3), 439–462.

Brown, David T, & Ryngaert, Michael D. 1991. The mode of acquisition in takeovers: Taxes and asymmetric information. *Journal of Finance*, **46**(2), 653–669.

Carter, Andrew V., Schnepel, Kevin T., & Steigerwald, Douglas G. 2017. Asymptotic behavior of a t-test robust to cluster heterogeneity. *The Review of Economics and Statistics*, **99**(4), 698–709.

Clausing, Kimberly A. 2003. Tax-motivated transfer pricing and US intrafirm trade prices. *Journal of Public Economics*, **87**(9), 2207–2223.

Conyon, Martin J, Girma, Sourafel, Thompson, Steve, & Wright, Peter W. 2002. The impact of mergers and acquisitions on company employment in the United Kingdom. *European Economic Review*, **46**(1), 31–49.

Cravino, Javier, & Levchenko, Andrei A. 2017. Multinational firms and international business cycle transmission. *Quarterly Journal of Economics*, **132**(2), 921–962.

Criscuolo, Chiara, & Martin, Ralf. 2009. Multinationals and US productivity leadership: evidence from Great Britain. *Review of Economics and Statistics*, **91**(2), 263–281.

Davies, Ronald B., Martin, Julien, Parenti, Mathieu, & Toubal, Farid. 2018. Knocking on tax haven's door: Multinational firms and transfer pricing. *The Review of Economics and Statistics*, **100**(1), 120–134.

Desai, Mihir A, & Hines, James R. 2002. Expectations and expatriations: Tracing the causes and consequences of corporate inversions. *National Tax Journal*, **55**(3), 409.

Desai, Mihir A, & Hines, James R. 2003. Evaluating international tax reform. *National Tax Journal*, **56**(3), 487–502.

Desai, Mihir A, & Hines, James R. 2004. Old rules and new realities: Corporate tax policy in a global setting. *National Tax Journal*, **57**(4), 937–960.

Desai, Mihir A, Foley, C Fritz, & Hines, James R. 2005. Foreign direct investment and the domestic capital stock. *American Economic Review*, **95**(2), 33–38.

Desai, Mihir A., Foley, C. Fritz, & Hines, James R. 2009. Domestic effects of the foreign activities of US multinationals. *American Economic Journal: Economic Policy*, **1**(1), 181–203.

Devereux, Michael P, & Griffith, Rachel. 2003. Evaluating tax policy for location decisions. *International Tax and Public Finance*, **10**(2), 107–126.

Devereux, Michael P., Fuest, Clemens, & Lockwood, Ben. 2015. The taxation of foreign profits: A unified view. *Journal of Public Economics*, **125**, 83 – 97.

Devos, Erik, Kadapakkam, Palani-Rajan, & Krishnamurthy, Srinivasan. 2009. How do mergers create value? A comparison of taxes, market power, and efficiency improvements as explanations for synergies. *Review of Financial Studies*, **22**(3), 1179–1211.

Dharmapala, Dhammika. 2014. What do we know about base erosion and profit shifting? A review of the empirical literature. *Fiscal Studies*, **35**(4), 421–448.

Di Giovanni, Julian. 2005. What drives capital flows? The case of cross-border M&A activity and financial deepening. *Journal of International Economics*, **65**(1), 127–149.

Dustmann, Christian, & Rochina-Barrachina, María Engracia. 2007. Selection correction in panel data models: An application to the estimation of females' wage equations. *The Econometrics Journal*, **10**(2), 263–293.

Egger, Peter, Loretz, Simon, Pfaffermayr, Michael, & Winner, Hannes. 2009. Bilateral effective tax rates and foreign direct investment. *International Tax and Public Finance*, **16**(6), 822.

Egger, Peter H., Strecker, Nora M., & Zoller-Rydzek, Benedikt. 2020. Estimating bargaining-related tax advantages of multinational firms. *Journal of International Economics*, **122**, 103258.

Erel, Isil, Liao, Rose C, & Weisbach, Michael S. 2012. Determinants of cross-border mergers and acquisitions. *Journal of Finance*, **67**(3), 1045–1082.

Erel, Isil, Jang, Yeejin, & Weisbach, Michael S. 2015. Do acquisitions relieve target firms' financial constraints? *Journal of Finance*, **70**(1), 289–328.

Erickson, Merle. 1998. The effect of taxes on the structure of corporate acquisitions. *Journal of Accounting Research*, **36**(2), 279–298.

Fajgelbaum, Pablo D, Morales, Eduardo, Serrato, Juan Carlos Suarez, & Zidar, Owen M. 2019. State taxes and spatial misallocation. *Review of Economic Studies*, **86**(1), 333–376.

Fee, C Edward, & Thomas, Shawn. 2004. Sources of gains in horizontal mergers: evidence from customer, supplier, and rival firms. *Journal of Financial Economics*, **74**(3), 423–460.

Feld, Lars P, Ruf, Martin, Scheuering, Uwe, Schreiber, Ulrich, & Voget, Johannes. 2016. Repatriation taxes and outbound M&As. *Journal of Public Economics*, **169**, 13–27.

Feldstein, Martin, & Hartman, David. 1979. The Optimal Taxation of Foreign Source Investment Income. *The Quarterly Journal of Economics*, 613–629.

Feldstein, Martin S. 1995. The effects of outbound foreign direct investment on the domestic capital stock. *Pages 43–66 of:* Martin Feldstein, James R. Hines, R. Glenn Hubbard (ed), *The effects of taxation on multinational corporations*. University of Chicago Press.

Fons-Rosen, Christian, Kalemli-Özcan, Şebnem, Sørensen, Bent E, Villegas-Sanchez, Carolina, & Volosovych, Vadym. 2019. *Quantifying productivity gains from foreign investment*. CEPR Discussion Paper No. DP9434.

Fu, Fangjian, Lin, Leming, & Officer, Micah S. 2013. Acquisitions driven by stock overvaluation: Are they good deals? *Journal of Financial Economics*, **109**(1), 24–39.

Gandhi, Amit, Navarro, Salvador, & Rivers, David A. 2020. On the identification of gross output production functions. *Journal of Political Economy*, **128**(8), 2973–3016.

Giroud, Xavier, & Rauh, Joshua. 2019. State taxation and the reallocation of business activity: Evidence from establishment-level data. *Journal of Political Economy*, **127**(3), 1262–1316.

Goldbach, Stefan, Nagengast, Arne J., Steinmüller, Elias, & Wamser, Georg. 2019. The effect of investing abroad on investment at home: On the role of technology, tax savings, and internal capital markets. *Journal of International Economics*, **116**, 58–73.

Gopinath, Gita, Kalemli-Özcan, Şebnem, Karabarbounis, Loukas, & Villegas-Sanchez, Carolina. 2017. Capital allocation and productivity in South Europe. *The Quarterly Journal of Economics*, **132**(4), 1915–1967.

Greene, W. H. 2018. *Econometric Analysis*. 8 edn. New York: Pearson.

Grossman, Gene M, & Rossi-Hansberg, Esteban. 2008. Trading tasks: A simple theory of offshoring. *American Economic Review*, **98**(5), 1978–97.

Guadalupe, Maria, Kuzmina, Olga, & Thomas, Catherine. 2012. Innovation and foreign ownership. *American Economic Review*, **102**(7), 3594–3627.

Harris, Richard, & Robinson, Catherine. 2002. The effect of foreign acquisitions on total factor productivity: Plant-level evidence from UK manufacturing, 1987–1992. *Review of Economics and Statistics*, **84**(3), 562–568.

Harrison, Ann, & McMillan, Margaret. 2011. Offshoring jobs? Multinationals and US manufacturing employment. *Review of Economics and Statistics*, **93**(3), 857–875.

Hart, Oliver, & Holmstrom, Bengt. 2010. A theory of firm scope. *The Quarterly Journal of Economics*, **125**(2), 483–513.

Hart, Oliver, & Moore, John. 1995. Debt and seniority: An analysis of the role of hard claims in constraining management. *The American Economic Review*, **85**(3), 567–585.

Haskel, Jonathan E, Pereira, Sonia C, & Slaughter, Matthew J. 2007. Does inward foreign direct investment boost the productivity of domestic firms? *Review of Economics and Statistics*, **89**(3), 482–496.

Haufler, Andreas, Mardan, Mohammed, & Schindler, Dirk. 2018. Double tax discrimination to attract FDI and fight profit shifting: The role of CFC rules. *Journal of International Economics*, **114**, 25 – 43.

Heckemeyer, Jost H, & Overesch, Michael. 2017. Multinational's profit response to tax differentials: Effect size and shifting channels. *Canadian Journal of Economics/Revue canadienne d'économique*, **50**(4), 965–994.

Heckman, James J. 1979. Sample selection bias as a specification error. *Econometrica*, **47**(1), 153–161.

Helpman, Elhanan. 1984. A simple theory of international trade with multinational corporations. *Journal of Political Economy*, **92**(3), 451–471.

Helpman, Elhanan. 1985. Multinational corporations and trade structure. *The Review of Economic Studies*, **52**(3), 443–457.

Herman, Edward, & Lowenstein, Louis. 1988. The efficiency effects of hostile takeovers. *In:* Coffee Jr., John, Lowenstein, Louis, & Rose-Ackerman, Susan (eds), *Knights, raiders and targets: The impact of the hostile takeover*. Oxford University Press.

Hines, James R. 1999. Lessons from behavioral responses to international taxation. *National Tax Journal*, **52**(2), 305–322.

Hines, James R, & Rice, Eric M. 1994. Fiscal paradise: Foreign tax havens and American business. *Quarterly Journal of Economics*, **109**(1), 149–82.

Høj, Jens. 2007. *Competition Law and Policy Indicators for the OECD countries*. Economics Department Working Paper No. 568. OECD.

Huizinga, Harry, & Voget, Johannes. 2009. International taxation and the direction and volume of cross-border M&As. *Journal of Finance*, **64**(3), 1217–1249.

Javorcik, Beata Smarzynska. 2004. Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages. *American Economic Review*, **94**(3), 605–627.

Jensen, Michael C. 1986. Agency costs of free cash flow, corporate finance, and takeovers. *The American Economic Review*, **76**(2), 323–329.

Jovanovic, Boyan, & Rousseau, Peter L. 2008. Mergers as reallocation. *Review of Economics and Statistics*, **90**(4), 765–776.

Kalemli-Özcan, Şebnem, Sørensen, Bent, Villegas-Sanchez, Carolina, Volosovych, Vadym, & Yesiltas, Sevcan. 2019. *How to Construct Nationally Representative Firm Level Data from the Orbis Global Database: New Facts and Aggregate Implications*. Working Paper. National Bureau of Economic Research.

Levinsohn, James, & Petrin, Amil. 2003. Estimating production functions using inputs to control for unobservables. *Review of Economic Studies*, **70**(2), 317–341.

Li, Xiaoyang. 2013. Productivity, restructuring, and the gains from takeovers. *Journal of Financial Economics*, **109**(1), 250–271.

Markusen, James R., & Venables, Anthony J. 1998. Multinational firms and the new trade theory. *Journal of International Economics*, **46**(2), 183 – 203.

Mayer, Thierry, & Zignago, Soledad. 2011. Notes on CEPII's distances measures: The GeoDist database.

Mescall, Devan, & Klassen, Kenneth J. 2018. How does transfer pricing risk affect premiums in cross-border mergers and acquisitions? *Contemporary Accounting Research*, **35**(2), 830–865.

Monarch, Ryan, Park, Jooyoun, & Sivadasan, Jagadeesh. 2017. Domestic gains from offshoring? Evidence from TAA-linked U.S. microdata. *Journal of International Economics*, **105**, 150 – 173.

Morck, Randall, Shleifer, Andrei, & Vishny, Robert W. 1990. Do managerial objectives drive bad acquisitions? *The Journal of Finance*, **45**(1), 31–48.

Moretti, Enrico, & Wilson, Daniel J. 2017. The effect of state taxes on the geographical location of top earners: evidence from star scientists. *American Economic Review*, **107**(7), 1858–1903.

Musgrave, Peggy B. 1969. *United States taxation of foreign investment income: Issues and arguments*. Cambridge, Mass.: Harvard Univ Harvard Law School.

Navaretti, Giorgio Barba, Castellani, Davide, & Disdier, Anne-Celia. 2010. How does investing in cheap labour countries affect performance at home? Firm-level evidence from France and Italy. *Oxford Economic Papers*, **62**(2), 234–260.

Rajan, Raghuram, Servaes, Henri, & Zingales, Luigi. 2000. The cost of diversity: The diversification discount and inefficient investment. *The Journal of Finance*, **55**(1), 35–80.

Richman, Peggy Brewer. 1963. *Taxation of foreign investment income: an economic analysis*. Baltimore: Johns Hopkins Press.

Scharfstein, David S., & Stein, Jeremy C. 2000. The dark side of internal capital markets: Divisional rent-seeking and inefficient investment. *The Journal of Finance*, **55**(6), 2537–2564.

Schoar, Antoinette. 2002. Effects of corporate diversification on productivity. *Journal of Finance*, **57**(6), 2379–2403.

Sheen, Albert. 2014. The real product market impact of mergers. *The Journal of Finance*, **69**(6), 2651–2688.

Stiebale, Joel. 2016. Cross-border M&As and innovative activity of acquiring and target firms. *Journal of International Economics*, **99**, 1–15.

Todtenhaupt, Maximilian, Voget, Johannes, Feld, Lars P, Ruf, Martin, & Schreiber, Ulrich. 2020. Taxing away M&A: Capital gains taxation and acquisition activity. *European Economic Review*, **128**, 103505.

Voget, Johannes. 2011. Relocation of headquarters and international taxation. *Journal of Public Economics*, **95**(9), 1067–1081.

Wang, Jian, & Wang, Xiao. 2015. Benefits of foreign ownership: Evidence from foreign direct investment in China. *Journal of International Economics*, **97**(2), 325–338.

Wooldridge, Jeffrey M. 2009. On estimating firm-level production functions using proxy variables to control for unobservables. *Economics Letters*, **104**(3), 112–114.

# Appendix

## A.1 Model appendix

### A.1.1 Micro-founded derivation of the pre-tax profit function

We begin by deriving the pre-tax profit of firm $i = a, b$. It is given by

$$Ak^{\alpha}l^{\beta} - rk - wl \tag{A.1}$$

where $k$ and $l$ are capital and labor input, $r$ and $w$ are the respective input prices and $A$ is the total factor productivity. We assume decreasing returns to scale, $\alpha + \beta < 1$. For given input prices, the management of the firm chooses the level of productive inputs to maximize the profit. This yields the set of optimal input choices

$$l = A^{\gamma}\left(\frac{\beta}{w}\right)^{(1-\alpha)\gamma}\left(\frac{\alpha}{r}\right)^{\alpha\gamma},\ k = A^{\gamma}\left(\frac{\beta}{w}\right)^{\beta\gamma}\left(\frac{\alpha}{r}\right)^{(1-\beta)\gamma} \tag{A.2}$$

where $\gamma = \frac{1}{1-\alpha-\beta}$. Substituting the input choices back into the profit function, we obtain the optimal profit $A^{\gamma}c$ where

$$c = \frac{1 - r^{(2-2\beta-\alpha)\gamma - \frac{1-\beta}{\alpha}}\alpha^{\frac{1-\beta}{\alpha}} - w^{(2-2\alpha-\beta)\gamma - \frac{1-\alpha}{\beta}}\beta^{\frac{1-\alpha}{\beta}}}{(w^{\beta}\beta^{-\beta}r^{\alpha}\alpha^{-\alpha})^{\gamma}}$$

is a function of input prices and is decreasing in both $r$ and $w$. To simplify our derivation, we assume that factor prices are identical for both locations and normalize $c$ to one. This assumption is realistic, for example if capital input is purchased on the international capital market and wages reflect some form of quality-adjusted labor compensation. The latter can be assumed to be homogeneous across different locations if the labor market is sufficiently integrated. Abstracting from input price differentials allows us to clearly isolate the effect of tax differentials on post-acquisition productivity changes. We note, however, that frictions in the markets for labor or capital may preclude uniform input prices and we therefore relax this assumption in our empirical analysis.

For the pre-tax profit function in the main analysis, we use a log-transformation of total factor productivity $\varphi = \ln A$ such that the pre-tax profit becomes $\gamma\varphi$.

### A.1.2 Derivation of expression (2)

To arrive at (2), we first rewrite the profit increase of the M&A and evaluate the integrals to obtain

$$\hat{\pi} = \int_0^1 \hat{\pi}\left(f,a\right)d\theta_f + \int_1^{\bar{\theta}} \hat{\pi}\left(f,b\right)d\theta_f + \int_{\tilde{\theta}}^1 \hat{\pi}\left(f,b\right)d\theta_f - \int_{\tilde{\theta}}^1 \hat{\pi}\left(f,a\right)d\theta_f.$$

$$\begin{aligned}\Longleftrightarrow \hat{\pi}\left(\bar{\theta}\right) =& \frac{1}{2}\left(1-\bar{\tau}\right)\gamma\varphi\left(\bar{\theta}-1\right)^2 + \frac{1}{2}\gamma\varphi\left(\tau_a-\tau_b\right)\epsilon\left(\bar{\theta}^2-3\right)\\ &+\frac{1}{2}\gamma\varphi\left(\left(1-\bar{\tau}\right)+\left(\tau_a-\tau_b\right)\epsilon\right)\left(1-\tilde{\theta}\right)^2.\end{aligned}$$

To find the change in the cut-off productivity parameter $\tilde{\bar{\theta}}$ with respect to a change in the tax rate differential, we totally differentiate $\hat{\pi}\left(\tilde{\bar{\theta}}\right) = c$ with respect to $\tilde{\bar{\theta}}$ and $(\tau_a - \tau_b)$ which yields

$$\begin{aligned}&\left(1-\bar{\tau}\right)\gamma\varphi\left(\tilde{\bar{\theta}}-1\right)d\tilde{\bar{\theta}} + \gamma\varphi\tilde{\bar{\theta}}\left(\tau_a-\tau_b\right)\epsilon d\tilde{\bar{\theta}}\\ &+\frac{1}{2}\gamma\varphi\epsilon\left(\tilde{\bar{\theta}}^2-3\right)d\left(\tau_a-\tau_b\right) + \frac{1}{2}\gamma\varphi\epsilon\left(1-\tilde{\theta}\right)^2 d\left(\tau_a-\tau_b\right)\\ &-\gamma\varphi\left(\left(1-\bar{\tau}\right)+\left(\tau_a-\tau_b\right)\epsilon\right)\left(1-\tilde{\theta}\right)\frac{\partial\tilde{\theta}}{\partial\left(\tau_a-\tau_b\right)}d\left(\tau_a-\tau_b\right) = 0.\end{aligned}$$

Noting that $\frac{\partial\tilde{\theta}}{\partial(\tau_a-\tau_b)} = \frac{-2\epsilon(1-\bar{\tau})}{(1-\bar{\tau}+(\tau_a-\tau_b)\epsilon)^2}$, this can be rearranged to yield expression (2). We obtain the same result if we exchange $a$ and $b$.

### A.1.3 Derivation of expression (3)

Taking the total differential of $\hat{\varphi}_{avg} = \frac{1}{\bar{\theta}_{max}-\tilde{\bar{\theta}}}\int_{\tilde{\bar{\theta}}}^{\bar{\theta}_{max}} \hat{\varphi}d\bar{\theta}$ with respect to $\tau_a - \tau_b$ and applying Leibniz's rule yields

$$\frac{d\hat{\varphi}_{avg}}{d\left(\tau_a-\tau_b\right)} = \frac{d\tilde{\bar{\theta}}}{d\left(\tau_a-\tau_b\right)}\frac{\int_{\tilde{\bar{\theta}}}^{\bar{\theta}_{max}}\hat{\varphi}d\bar{\theta}}{\left(\bar{\theta}_{max}-\tilde{\bar{\theta}}\right)^2} + \frac{1}{\bar{\theta}_{max}-\tilde{\bar{\theta}}}\left(\int_{\tilde{\bar{\theta}}}^{\bar{\theta}_{max}}\frac{d\hat{\varphi}}{d\left(\tau_a-\tau_b\right)}d\bar{\theta} - \hat{\varphi}\left(\tilde{\bar{\theta}}\right)\frac{d\tilde{\bar{\theta}}}{d\left(\tau_a-\tau_b\right)}\right)$$

Evaluating the integrals and noting that $\frac{d\tilde{\theta}}{d(\tau_a-\tau_b)} = -\frac{2\epsilon(1-\bar{\tau})}{(1-\bar{\tau}+\epsilon(\tau_a-\tau_b))^2}$ this expression simplifies to (3).

### A.1.4 Derivation of expression (4)

Introducing a third stage for management to chose the amount $s_i$ of profit shifting to (or from) $i$ implies the following expression for the change in after-tax profit that follows from the allocation of a task $f$ to location $i$

$$\hat{\pi}(f,i) = (\tau_{-i} - \tau_i)(\epsilon + s_i)\gamma\theta_f^i\varphi + (1-\bar{\tau})\gamma\left(\theta_f^i - 1\right)\varphi - \psi\frac{(s_i)^2\gamma\theta_f^i\varphi}{2},\ i = a, b \tag{A.3}$$

Maximizing $\hat{\pi}(f,i)$ with respect to $s_i$ yields

$$\frac{\tau_{-i} - \tau_i}{\psi} = s_i^*,\ i = a, b \tag{A.4}$$

Substituting (A.4) into (A.3) and comparing $\hat{\pi}(f,a)$ and $\hat{\pi}(f,b)$ yields (4).

## A.2 Additional tables

Table A.1: Variables

| Variable | Description | Source |
|---|---|---|
| Total factor productivity (TFP), target and acquirer | Logarithm of total factor productivity of the combined firm (target and acquirer) using input elasticities (weighted by total assets) estimated using the Wooldridge (2009) and Levinsohn & Petrin (2003) method. See Online Appendix for more details on the TFP estimation | Own estimation based on data from Orbis. |
| Total factor productivity (TFP), target and acquirer group | Logarithm of total factor productivity of the combined firm (target, acquirer and all subsidiaries of the acquirer) using input elasticities (weighted by total assets of the respective firm) estimated using the Wooldridge (2009) and Levinsohn & Petrin (2003) method. See Online Appendix for more details on the TFP estimation | Own estimation based on data from Orbis. |
| EBITDA | Sum of earnings before interest, taxes, depreciation and amortization for target and acquirer, divided by the sum of total assets for target and acquirer | Orbis |
| Sales | Sum of sales for target and acquirer, divided by the sum of total assets for target and acquirer | Orbis |
| Operating revenue | Sum of operating revenue, divided by the sum of total assets for target and acquirer | Orbis |
| Absolute tax rate differential ($\Delta\tau$) | Absolute value of the difference in the effective tax rate on corporate profits generated in the target firm and paid to the acquirer as inter-corporate dividends (taking into account withholding taxes and cross-border double taxation relief) and the effective tax rate on corporate profits generated by the acquirer | Hand-collected by author's, based on IBFD |
| Avg. absolute tax rate differential ($\Delta\tau$) | Absolute value of the difference in the effective tax rate on corporate profits generated in the target firm and paid to the acquirer as inter-corporate dividends and the average (weighted by total assets of the respective firm) of the effective tax rates on corporate profits generated by the acquirer and the effective tax rates on corporate profits generated in all subsidiaries of the acquirer and paid to the acquirer as inter-corporate dividends (taking into account withholding taxes and cross-border double taxation relief). | Hand-collected by author's, based on IBFD |

## Table A.1: Variables

| Variable | Description | Source |
|---|---|---|
| Positive tax rate differential ($\Delta\tau^{+}$) | Absolute value of the difference in the effective tax rate on corporate profits generated in the target firm and paid to the acquirer as inter-corporate dividends (taking into account withholding taxes and cross-border double taxation relief) and the effective tax rate on corporate profits generated by the acquirer if positive. Zero if the difference is negative | Hand-collected by author's, based on IBFD |
| Negative tax rate differential ($\Delta\tau^{-}$) | Absolute value of the difference in the effective tax rate on corporate profits generated in the target firm and paid to the acquirer as inter-corporate dividends (taking into account withholding taxes and cross-border double taxation relief) and the effective tax rate on corporate profits generated by the acquirer if negative. Zero if the difference is positive | Hand-collected by author's, based on IBFD |
| Absolute EATR differential ($\Delta EATR$) | Absolute value of the difference in the effective average tax rate (EATR) on corporate profits generated in the target firm and paid to the acquirer as inter-corporate dividends (taking into account withholding taxes and cross-border double taxation relief) and the effective average tax rate (EATR) on corporate profits generated by the acquirer. | European Commission (annual report by the Centre for European Economic Research) |
| Absolute EMTR differential ($\Delta EMTR$) | Absolute value of the difference in the effective marginal tax rate (EMTR) on corporate profits generated in the target firm and paid to the acquirer as inter-corporate dividends (taking into account withholding taxes and cross-border double taxation relief) and the effective marginal tax rate (EMTR) on corporate profits generated by the acquirer. | European Commission (annual report by the Centre for European Economic Research) |
| TPR (acquirer) | The rank of the acquirer country with respect to transfer pricing risk, increasing in transfer pricing risk, normalized to range from 0 to 1 | Mescall & Klassen (2018), reranked among sample countries |
| TPR (target) | The rank of the target country with respect to transfer pricing risk, increasing in transfer pricing risk, normalized to range from 0 to 1 | Mescall & Klassen (2018), reranked among sample countries |
| *POST* | Dummy variable that is equal to one for a specific target-acquirer-firm pair from the year of deal completion onward | Zephyr |
| Cross-border | Dummy variable that is equal to one if the acquirer location differs from the target location and zero otherwise. | Zephyr |
| Distance | Logarithm of the distance between the capital of the acquirer country and the target country in kilometers for cross-border deals. Logarithm of the average distance to the capital of the acquirer/target country in kilometers for domestic deals | Mayer & Zignago (2011) |
| Hostile | Dummy variable that is equal to one if the deal is coded as a hostile deal | Zephyr |
| Toehold | Dummy variable that is equal to one if the acquirer had a minority shareholding in the target before the deal was initiated. | Zephyr |
| CIT (target) | Statutory corporate income tax rate in the target country | Hand-collected by author's, based on IBFD |
| EATR (target) | Effective average tax rate (EATR) on corporate profits in the target country. | European Commission (annual report by the Centre for European Economic Research) |
| EMTR (target) | Effective average tax rate (EMTR) on corporate profits in the target country | European Commission (annual report by the Centre for European Economic Research) |
| Wage Difference | Difference in the average wage in the acquirer country and the average wage in the target country, divided by the mean of the average wages in the acquirer and the target country | ILO |
| GDP growth (acquirer) | Annual percentage growth rate of nominal GDP in the acquirer country | World Bank |
| GDP growth (target) | Annual percentage growth rate of nominal GDP in the target country | World Bank |
| Total assets (acquirer) | Logarithm of total assets of the acquirer | Orbis |
| Total assets (target) | Logarithm of total assets of the target | Orbis |
| Merger control (acquirer) | Indicator capturing the power authorities to intervene in M&As in the acquirer country. | OECD competition law indicators (Høj, 2007) |

Table A.1: Variables

| Variable | Description | Source |
|---|---|---|
| Merger control (target) | Indicator capturing the power authorities to intervene in M&As in the target country. | OECD competition law indicators (Høj, 2007) |

Table A.2: Regression results, event study design

| | (a) | (b) |
|---|---|---|
| $D^{-4}_{lkt} \times \Delta\tau_{lkt}$ | -0.006 | -0.005 |
| | (0.004) | (0.005) |
| $D^{-3}_{lkt} \times \Delta\tau_{lkt}$ | -0.000 | 0.006 |
| | (0.004) | (0.005) |
| $D^{-2}_{lkt} \times \Delta\tau_{lkt}$ | 0.002 | 0.005 |
| | (0.004) | (0.004) |
| $D^{0}_{lkt} \times \Delta\tau_{lkt}$ | -0.007 | 0.000 |
| | (0.004) | (0.005) |
| $D^{1}_{lkt} \times \Delta\tau_{lkt}$ | -0.006 | 0.003 |
| | (0.004) | (0.005) |
| $D^{2}_{lkt} \times \Delta\tau_{lkt}$ | -0.013 | 0.004 |
| | (0.006) | (0.006) |
| $D^{3}_{lkt} \times \Delta\tau_{lkt}$ | -0.008 | -0.001 |
| | (0.006) | (0.006) |
| $D^{4}_{lkt} \times \Delta\tau_{lkt}$ | -0.014 | 0.004 |
| | (0.005) | (0.006) |
| $D^{-4}_{lkt}$ | -0.011 | -0.022 |
| | (0.011) | (0.013) |
| $D^{-3}_{lkt}$ | -0.003 | -0.035 |
| | (0.009) | (0.011) |
| $D^{-2}_{lkt}$ | -0.010 | -0.031 |
| | (0.007) | (0.009) |
| $D^{0}_{lkt}$ | -0.002 | -0.018 |
| | (0.009) | (0.011) |
| $D^{1}_{lkt}$ | -0.009 | -0.037 |
| | (0.011) | (0.013) |
| $D^{2}_{lkt}$ | -0.006 | -0.048 |
| | (0.013) | (0.015) |
| $D^{3}_{lkt}$ | 0.001 | -0.028 |
| | (0.014) | (0.018) |
| $D^{4}_{lkt}$ | 0.017 | -0.035 |
| | (0.017) | (0.021) |
| $POST_{lkt} \times \text{Cross-border}_{lk}$ | 0.025 | 0.017 |
| | (0.026) | (0.026) |
| $\Delta\tau_{lkt}$ | 0.001 | 0.001 |
| | (0.002) | (0.003) |
| Obs. | 49,581 | 45,355 |
| Adj. $R^2$ | 0.961 | 0.950 |

This table presents the regression results for the event studies presented graphically in Figure 3. Cluster robust standard errors (adjusted for clustering at the firm-pair level) are provided in parentheses. See notes of Figure 3 for more details.