# Tax Avoidance and Tax Incidence

Scott D. Dyreng

Martin Jacob

Xu Jiang

Maximilian A. Müller*

This draft: November 2017

ABSTRACT

We examine corporate tax avoidance in a setting where shareholders might not bear the entire economic burden of the corporate tax because the firm's market power allows it to pass on the burden to workers or consumers. Depending on the model conditions, tax avoidance increases or decreases in market power. Using empirical analyses, we find that high market power firms avoid less tax than low market power firms. We also find empirical support for the model conditions underlying this result. Our findings suggest that firms with high market power report high tax rates but pass the tax burden to workers or consumers while maximizing after-tax profits.

**Keywords**: Tax avoidance, tax burden, tax incidence, tax undersheltering puzzle

**JEL classification**: H20, H25

---

* Dyreng is at Duke University (scott.dyreng@duke.edu), Jacob is at WHU – Otto Beisheim School of Management (martin.jacob@whu.edu), Jiang is at Duke University (xu.jiang@duke.edu), and Müller is at WHU – Otto Beisheim School of Management (maximilian.mueller@whu.edu). We thank Kathleen Andries, Kay Blaufus, Nadja Dwenger, Sebastian Eichfelder, John Gallemore, Shane Heitzman, Jochen Hundsdoerfer, Ken Klassen, Ed Maydew, Roni Michaely, Andreas Peichl, Leslie Robinson (discussant), Richard Sansing, Nemit Shroff, and seminar and conference participants at Duke University, University of Mannheim, Université de Neuchâtel, University of Oulu, University of Waterloo, WHU – Otto Beisheim School of Management, and the 7th Conference on Current Research in Taxation in Vienna for many helpful comments.

## 1. Introduction

Over the past decade a burgeoning literature has developed examining corporate tax avoidance. Researchers have consistently found wide variation in the degree of tax avoidance across firms in the economy, and efforts to explain this variation have been only marginally successful. At the same time, policymakers are changing tax regulation to ensure that firms pay their "fair share" in taxes. However, even if firms pay their "fair share", recent empirical evidence shows that the taxes that firms *pay* are likely different from the taxes that they economically *bear*. For example, firms might be able to pass part of the corporate tax burden to workers in form of lower wages (e.g., Fuest et al. 2017, Suárez Serrato and Zidar 2016), or customers in the form of higher prices.

Though the question of who bears the economic burden of the corporate tax, or corporate tax incidence, has received substantial attention by economists over the years, the question of how tax incidence is related to tax avoidance has been almost entirely ignored. Yet, the idea that corporate taxes might be borne by some party other than the shareholders of the firm is ultimately linked to the cost-benefit calculus firms undergo when determining whether to invest in tax avoidance strategies. We examine how tax avoidance varies when the corporate tax burden might not be entirely borne by the shareholders of the firm, but instead can be passed to non-shareholder stakeholders of the firm.

Using a model of a profit-maximizing firm that allows for the passing of taxes to workers, we show that tax avoidance is related to tax incidence, but that the nature of the relationship depends on the tax deductibility of capital, the productivity of capital relative to the productivity of labor, and the elasticity of labor supply or consumer demand (i.e., the firm's market power). On the one hand, the model shows that if the firm can employ labor at a low wage without distorting the labor supply (i.e., the firm has high labor market power), then the firm will reduce wages to pass part of the tax burden to workers. But even after passing the economic tax burden to workers, the firm can still improve after-tax profits by reducing tax payments. That is, high labor market power allows the firm to pay low wages, which creates relatively high pre-tax profits. The increase in pre-tax profits increases the marginal benefit of tax avoidance and, therefore, results in more tax avoidance. Thus, the relation between market power and tax avoidance could be positive.

On the other hand, even if the productivity of capital is high relative to labor, firms facing an inelastic labor supply may find that on the margin, labor is more attractive than capital as those firms can lower their wages. This results in them investing in too much labor relative to capital. Moreover, if the cost of capital can be reduced by engaging in tax avoidance (because some fraction of the cost of capital is not tax deductible), the distortion created by investing in too much labor relative to capital becomes particularly costly. We show, therefore, that if a large enough fraction of capital is non-deductible and if the productivity of capital relative to labor is sufficiently high, the relation between market power and tax avoidance reverses such that as the firm's market power increases, tax avoidance decreases, and firms pass on a larger fraction of the tax burden to employees. We note that these results are essentially the same when we allow firms to pass on taxes to consumers or suppliers through input and output prices instead of passing on taxes to workers.[1]

Whether the relation between tax incidence and tax avoidance is positive or negative, is therefore an empirical question, but the model gives guidance as to when the relation is more likely to be positive or negative depending, for example, on the production function of the firm. Because production functions are likely to vary across firms, the model implies that the relation between tax avoidance and tax incidence is also likely to vary in the cross section of firms.

Our model merges a central insight from the public finance literature on tax incidence with recent research in the accounting literature on tax avoidance. The tax incidence literature emphasizes that firms do not necessarily *bear* a tax even though they *pay* a tax (e.g., Gruber 2010). The tax avoidance literature examines firms' tax planning behavior aimed at reducing tax payments (e.g.,

[1] We discuss in detail why the intuition is the same when taxes can be passed on to customers or suppliers in Section 2.3.

Dyreng, Hanlon, and Maydew 2008, Dyreng et al. 2017). Combined, our model shows that the two phenomena are not independent, but interact with other market features in predictable ways.

We empirically test the model to determine the relation between tax avoidance and the firm's ability to pass the economic burden of corporate taxes to workers or customers because of its market power. We use the concentration and total similarity measures of Hoberg and Phillips (2016) as proxies for market power, which reflects the firm's ability to exploit either relatively high demand inelasticity on the revenue side (i.e., customers), or relatively high supply inelasticity on the cost side (i.e., workers or suppliers). We find that, on average, firms with high market power, that is, the power to more easily push the economic burden of the corporate tax away from shareholders and onto some other party, exhibit lower levels of corporate tax avoidance.

Our model predicts that the negative relation between market power and tax avoidance will most likely arise when the productivity of capital is high or when a relatively high proportion of the cost of capital is not tax deductible. Accordingly, we show that the negative relation between market power and tax avoidance is significantly stronger when capital is relatively more important in the production function. Further, our model predicts that the negative relation between market power and tax avoidance will be stronger if firms can more easily substitute labor with capital at the margin. We use R&D expenditures as a proxy for substitutability because R&D is naturally labor intense, and not easily replaced with investments in capital. Accordingly, we show that the negative relation between market power and tax avoidance is stronger in firms with low R&D.

To address concerns about potentially correlated omitted variables, we examine the 1997 check-the-box regulation introduction as a shock to tax avoidance opportunities for US multinational firms. In a triple difference setting, we compare domestic and multinational firms (first difference) around the check-the-box introduction (second difference) with high versus low market power using the Hoberg and Phillips (2016) measures (third difference). We find that multinational firms with low market power reduce their cash ETRs and thus increase tax avoidance activities after the introduction of check-the-box regulations. This result is consistent with the association reported in Fuest et al. (2017) that tax incidence on workers and tax avoidance opportunities are negatively correlated.

While our main finding of a negative relation between market power and tax avoidance predictably varies in the cross-section as described above, suggesting the correlation is not spurious, concerns may remain that market power is not exogenous to the firm. Accordingly, we exploit shocks to import tariffs in the United States (Frésard 2010) and examine their effect on tax avoidance of U.S. firms (see also Brown et al. 2014). When import tariffs are cut, foreign competition enters the market and product demand becomes more elastic because consumers gain access to substitute products at more competitive prices. This makes it harder for firms to pass the corporate tax burden to consumers through higher prices. Consistent with the predictions of our model, we find that after large import tariff cuts, firms avoid more tax and have lower ETRs.[2] In a separate test, we proxy for labor supply elasticity using the labor skill index by Ghaly, Dang, and Stathopoulos (2017). If more highly (less) skilled employees work in an industry, a firm has less (more) market power in the labor market. We find that firms employing more highly skilled labor avoid more taxes. Both results are consistent with our main findings: more elastic demand or labor supply implies that less of the corporate tax burden can be passed to consumers or employees and, thus, firms are more likely to engage in tax avoidance.

Finally, we provide evidence for the channel through which market power affects tax avoidance. Our model predicts that for tax avoidance to increase with labor supply elasticity or consumer demand elasticity, a crucial condition is that capital investment must increase with wages and thus labor supply or consumer demand elasticity. In other words, as tax avoidance increases, we should find that firms invest more in capital. Consistent with the condition for a negative relation between market power and tax avoidance requiring a negative relation between market power and capital

[2] This result is consistent with Brown et al. (2014), though the theory they use to explain the result differs from ours.

investment, we find that less market power (or higher elasticities of consumer demand or labor supply) is associated with higher capital expenditures in all settings.

Our paper contributes to the literature in several ways. We introduce a fundamental concept of tax economics to the tax avoidance literature by arguing that tax avoidance and tax incidence are connected. Introducing this concept allows us to provide a partial explanation for the observed variation in tax avoidance activities grounded in the theory of tax incidence. Even in the absence of agency problems (e.g., Desai and Dharmapala 2006) or reputational concerns (e.g., Gallemore, Maydew, and Thornock 2014), we show that under certain conditions, if less of the corporate tax burden falls on shareholders, firms have weaker incentives to engage in tax avoidance. Our results can thus help to explain the "tax undersheltering puzzle" (Weisbach 2002) and the disperse distribution of ETRs (e.g., Dyreng, Hanlon, and Maydew 2008). Firms can maximize their after-tax profit by passing on the tax to other stakeholders instead of directly reducing tax payments through tax avoidance. Allowing for the possibility that the corporate tax incidence partly falls on stakeholders, therefore, directly addresses the open question "*why […] some corporations avoid more tax than others*" (Hanlon and Heitzman 2010, p. 146) and provides future researchers with a theoretical framework that can be adapted to other tax avoidance settings.

Our findings also have implications beyond the tax avoidance literature. The effect of taxes on investment decisions (e.g., Summers 1981, Auerbach 1983, Djankov et al. 2010), employment (e.g., Ljungqvist and Smolyansky 2016), or capital structure (e.g., Graham 1996, Heider and Ljungqvist 2015) could be functions of the corporate tax incidence falling on firms' owners vis-à-vis other stakeholders such as consumers or workers. Our model suggests that the responsiveness of investments and capital structure decisions to corporate tax rate changes depends on the ability to pass on the corporate tax burden to other stakeholders.

Our paper also contributes to the literature examining the effect of competition and product market power on tax avoidance. While Kubick et al. (2015) find that product market power is positively related to tax avoidance, Brown et al. (2014) and our study find the opposite. Kubick et al. (2015) argue that firms with product market power are insulated from competitive threats because they "*are able to influence the price, quality, and nature of the product […] to a greater extent than […] competitors,*" which hedges them against risks associated with avoiding taxes. Our model shows that the relation between market power and tax avoidance is more complex than Kubick et al (2015) allow, such that under some conditions the relation is positive (which would be consistent with the results in Kubick et al 2015) and under other conditions it is negative. Our empirical results ultimately suggest that firms with more market power avoid less tax, which is the opposite the Kubick et al. (2015) result, but consistent with the Brown et al. (2014) result.

Finally, our results have policy implications. International organizations such as the European Commission or the OECD, the academic literature, and the media increasingly raise concerns about tax avoidance and, in particular, about low ETRs. The Base Erosion and Profit Shifting (BEPS) initiative is one example of specific actions taken by one of these organizations (OECD 2013). However, combating tax avoidance can have heterogeneous effects on firms, depending on the corporate tax incidence falling on firm owners. Firms that are perceived as "good citizens" because they do not avoid taxes in terms of nominally paying taxes might be passing the corporate tax burden to consumers, suppliers, and/or workers. Hence, policymakers should consider tax payments *and* tax incidence when setting tax policies, consumer laws, and employment rights.

## 2. Relation Between Tax Incidence and Tax Avoidance

### *2.1 Corporate Tax Incidence*

The public finance literature has long asked who bears the economic burden, or incidence, of the corporate tax. Harberger (1962) shows that the corporate tax burden fully falls on shareholders, but his model requires several restrictive assumptions. When the Harberger (1962) assumptions of a closed economy (Mutti and Grubert 1984), competitive labor markets and perfect labor mobility (Arulampalam, Devereux, and Maffini 2012, Fuest, Peichl, and Siegloch 2017), and fixed capital stock (Feldstein 1974) are relaxed, the corporate tax incidence does not fall entirely on shareholders. While there are still many open questions in general equilibrium models (e.g., Gravelle 2013), under reasonable assumptions, this literature concludes that the corporate tax does not fully fall on firm owners (see also the conclusions of Clausing 2012, 2013).[3]

Consistent with this conclusion, a survey by Fuchs, Kruger, and Poterba (1998) among economists at top 40 U.S. institutions shows that the median respondent thinks that only about 40% of the corporate tax burden is borne by shareholders. Indeed, several empirical studies find that the incidence of the corporate tax partly falls on employees in the form of lower wages (e.g., Felix 2007, Arulampalam, Devereux, and Maffini 2012, Liu and Altshuler 2013, Fuest, Peichl, and Siegloch 2017), with estimates suggesting that workers bear roughly one third to one half of the corporate tax burden. There is also empirical evidence that consumers bear a portion of the economic burden of the corporate tax in the form of higher prices (e.g., Krzyzaniak and Musgrave 1963, Vasquez-Ruiz 2011). Despite the vast number of studies published on corporate tax incidence, Fullerton and Metcalf (2002, p. 1842), write that "*[t]he standard assumption about the corporate income tax that the burden falls 100% on capital remains […] even though it is commonly believed to be false*."

Existing tax avoidance research recognizes that there are also costs to tax avoidance, which could include direct costs such as transactions costs, or indirect costs, such as agency costs or reputational costs. This line of thinking, however, is potentially incomplete if shareholders do not actually bear the burden of the corporate tax and if there is cross sectional variation in tax incidence. Why would shareholders incur the costs of tax avoidance if they do not bear the economic burden of

3 Among others, Auerbach (2005), Harberger (2008), Clausing (2012, 2013), and Gravelle (2013) discuss several other issues in general equilibrium models that can affect the model's implications about the corporate tax incidence.

the tax in the first place? As Gruber (2010, p. 713) states "*what seems clear […] is that assuming that all the burden of the corporate tax is on investors […] is likely to be incorrect*." But exactly how this assumption affects corporate tax avoidance is unclear.

### *2.2 Tax Avoidance Implications of Tax Incidence*

To illustrate how corporate tax incidence and tax avoidance relate to each other, we model the tax avoidance decision of a single firm. In the following model, we allow the equilibrium market-clearing wage to depend on the elasticity of the labor supply. The wage may also depend on the tax rate so that the corporate tax incidence can fall on employees. Importantly, we note that all the following predictions are essentially the same if we instead allow the tax incidence to fall on consumers by allowing the market-clearing output price to depend on demand elasticity. In Section 2.3 and Appendix A.2, we offer an intuitive explanation after explaining in more detail the model.

In the model, the firm maximizes its after-tax profits by optimizing its choice of capital input *K*, labor input *L*, and tax avoidance *A*. Output is generated by a production function $F(K,L)$ and sold at price *p*. The production function $F(K,L)$ satisfies the standard assumptions $F_K > 0$, $F_L > 0$, $F_{KK} < 0$, $F_{LL} < 0$, and $F_{KL} > 0$. The assumptions imply that more capital or labor input results in more output but at a decreasing rate. In addition, capital and labor are complements in the sense that more capital increases the marginal productivity of labor and vice versa. We further assume that the cost of capital per unit is $r$. Similarly, labor input $L$ incurs wage costs of $w$ per unit of labor. Wages are fully tax deductible, whereas the cost of capital may not be fully tax-deductible. We introduce a parameter, $\eta \in [0,1]$ to capture the proportion of the cost of capital that is tax deductible. Full deductibility ($\eta = 1$) could be achieved in a cash-flow tax with an immediate full loss offset. However, existing corporate tax systems are more restrictive ($\eta < 1$), because (1) the cost of equity capital is not tax deductible, (2) loss offset is restricted, and (3) tax depreciation can be below economic depreciation, for example, when there is rapid technological change (see, also, Haufler and Schjelderup 2000, Fuest, Peichl, and Siegloch 2017).

The firm's profit before tax is subject to the statutory tax rate $\tau$, which can be reduced by tax avoidance $A$, measured in percentage points. Thus, the ETR is $\tau - A$.[4] Tax avoidance is a costly activity leading, for example, to direct costs for tax advisors or indirect costs from reputational damage (e.g., Graham et al. 2014). We therefore follow the standard approach to model the cost of tax avoidance with a strictly convex cost function $C(A)$, where $C'(A) > 0$, $C''(A) > 0$, and $C(A) = 0$ for $A = 0$ (see also Dharmapala and Riedel 2013). For simplicity, we assume that cost of tax avoidance are not tax deductible. Our model implications are similar when the cost of tax avoidance is treated as tax deductible (see Appendix A.3). This results in the following after-tax profit:

$$\Pi(K, L, A) = [1 - (\tau - A)](pF(K, L) - wL - \eta rK) - (1 - \eta)rK - C(A) \tag{1}$$

First order conditions with respect to $L$, $K$, and $A$ result in:

$$pF_L(K^*, L^*) = w \tag{2}$$

$$[1 - (\tau - A^*)]pF_K(K^*, L^*) = [1 - \eta(\tau - A^*)]r \tag{3}$$

$$pF(K^*, L^*) - wL^* - \eta rK^* = C'(A^*). \tag{4}$$

The first order conditions have the usual interpretation of equating the marginal benefit of $K$, $L$, and $A$ with the marginal cost. Since labor is fully tax deductible, neither the tax rate nor the amount of tax avoidance *directly* affects the optimal level of labor, $L^*$, as illustrated in equation (2). In other words, the first order condition for labor is identical to that of a zero-tax world. If capital is not fully tax deductible reflecting most existing tax systems ($\eta < 1$), both $\tau$ and $A^*$ will directly affect the marginal benefit and marginal cost of capital and thus $K^*$, as illustrated in equation (3). The higher $\eta$ is, the lower the marginal cost of capital and the less distortion of $K^*$ from a zero-tax world. If $\eta = 1$, we obtain the pure profit tax result as in Diamond and Mirlees (1971) and capital input is identical to

4 We simplify the model and assume that profits and cash flows are the same and that there are no deferred taxes. Hence, the cash ETR and GAAP ETR are the same in our simple model.

that of a zero-tax world, i.e. $K^*$ is independent of $\tau$. In all other cases ($\eta < 1$), the higher $\tau - A^*$ is, the lower the marginal benefit of capital relative to the marginal cost and $K^*$ will be distorted relative to a zero-tax world, i.e., $K^*$ will be decreasing in $\tau$.[5] Empirical evidence in both the U.S. (e.g. Giroud and Rauh 2017) and internationally (e.g. Djankov et al. 2010) suggests that $K^*$ is decreasing in $\tau$, further lending support to our assumption that $\eta < 1$.

Equation (4) describes the tax avoidance decision and states that the marginal cost of tax avoidance is equal to the marginal benefit, which is the tax base, $F(K^*, L^*) - wL^* - \eta rK$ (i.e., revenue minus all the deductible costs). Intuitively, the higher the tax base, the higher the marginal benefit from reducing an additional 1% tax off that higher base, resulting in greater tax avoidance. Equation (4) also illustrates that if firms have relatively higher capital input K, the marginal benefit of tax avoidance increases relative to a firm with more labor input as long as capital is not fully deductible ($\eta < 1$) because of a higher tax base.

For the sake of illustrating the relation of tax incidence and tax avoidance, we focus on firms' ability to pass on some of the corporate tax burden to employees through wages.[6] We assume that wages are determined competitively by labor market clearing, i.e., by equating labor demand with labor supply, where equations (2), (3) and (4) implicitly define the labor demand $L^*$ as a function of $w, r, \tau$, and $\eta$.[7] We do not explicitly model the wage determination process but note that the equilibrium market-clearing wage, $w^*$, depends on the elasticity of the labor supply, which determines a firm's market power in the labor market.[8] Higher supply elasticity implies lower labor

---

5 We discuss the case when $\eta = 1$ in more detail below.

6 In other words, our analysis is a partial equilibrium analysis as in reality, the firm can simultaneously shift its tax burden to employees, suppliers and customers in a general equilibrium model. While we show below that our results remain qualitatively unchanged when we focus on shifting tax burdens to customers, we acknowledge that a general equilibrium analysis may yield new insights which we leave that for future research.

7 Note that $L^*$ is indirectly affected by $r$ and $\tau$ through $K^*$ in equation (4) as the endogenous variable $K^*$ is a function of $r$ and $\tau$.

8 We deliberately exclude other factors such as corporate governance to keep the model simple. While these factors may be related to a firm's market power and tax avoidance, they are unlikely to fully substitute for a firm's market power. We view the interaction of these other factors with market power and tax avoidance as beyond the scope of our paper

market power of the firm and, thus, higher wages a firm has to pay. We denote such dependence as $w^*$ being a function of $\mu$, the labor supply elasticity, where $\frac{dw^*}{d\mu} > 0$, i.e., more elastic labor supply implies a less competitive labor market and, thus, higher wages.[9] Since optimal tax avoidance $A^*$ is a function of $w^*$, $\mu$ will affect $A^*$ indirectly through $w^*$. In addition, note that in general, the market-clearing wage $w^*$ is decreasing in the tax rate $\tau$, i.e., firms will shift (part of) their tax burden to workers in the form of decreased wages ($\frac{dw^*}{d\tau} < 0$) due to the indirect tax distortion effect on capital. Such a decrease, of course, is a function of $\mu$, implying that tax incidence will be a function of wage supply elasticity ($\frac{d^2w^*}{d\tau\, d\mu} \neq 0$). Taken together, $\frac{dA^*}{d\mu}$ captures how labor supply elasticity affects tax avoidance and how tax avoidance relates to tax incidence. We are interested in the sign of $\frac{dA^*}{d\mu}$.

Starting with the case of full deductibility of the cost of capital, i.e., when $\eta = 1$, $\frac{dA^*}{d\mu} < 0$ unambiguously, i.e., a more elastic labor market always results in lower tax avoidance.

**Result 1**: If $\eta = 1, \frac{dA^*}{d\mu} < 0$.

When both capital and wages are fully tax deductible, equations (2), (3) and (4) are independent of $\tau$. This implies that $w^*$ is independent of $\tau$, i.e., the wage is independent of the tax rate. In other words, workers do not bear any tax cost and the entire tax incidence falls on firm owners. This is the pure profit tax case (e.g., Gruber 2010). Since owners bear all the tax burden in this case, the marginal benefit of the tax avoidance is determined by revenue minus all expenses, i.e. $pF(K^*, L^*) - w^*L^* - rK^*$, which can be shown to be decreasing in $w^*$ and thus decreasing in $\mu$. Intuitively, even though the wage is independent of the statutory tax rate, it still increases with elasticity. Higher wages result in lower demand for labor and thus lower demand for capital since capital and labor are

and, hence, a fruitful avenue for future research. We also write $w$ as $w^*$ to illustrate that wage is determined by market-clearing that is not explicitly modelled.

9 Since wage determination is not modelled, $\mu$ is not explicitly included in equations (2) to (4).

complements in the production function. As a result, the tax base, which is the pre-tax profit when $\eta = 1$, becomes smaller. This reduces the marginal benefit of tax avoidance and results in less tax avoidance.

We now examine the empirically more descriptive case when the cost of capital is not fully tax-deductible ($\eta < 1$), mirroring empirical evidence that tax rates affect corporate investment (Djankov et al. 2010, Giroud and Rauh 2017). This also reflects current tax systems because firms cannot deduct cost of equity from the tax base and profits and losses are taxed asymmetrically. Further, in some situations, there are also limitations on the deductibility of interest on debt. If the cost of capital is not fully tax-deductible, as discussed above, a higher tax rate will result in owners shifting the corporate tax burden to the workers in the form of decreasing wages, i.e., $\frac{dw^*}{d\tau} < 0$. Firms with a relatively more elastic labor supply, however, cannot reduce their wages much, resulting in a higher wage and thus a higher burden borne by owners. In other words, the slope of the wage decrease as tax rates increase is smaller for firms with more elastic labor supply, i.e., $\frac{d^2w^*}{d\tau\, d\mu} > 0$. When firms can avoid taxes, this higher burden of firms with relatively more elastic labor supply, however, can translate into either higher or lower tax avoidance, through the following two mechanisms.

The first mechanism is similar to the case discussed when capital is fully tax-deductible ($\eta = 1$). Higher wages result in lower labor demand, which reduces capital demand due to the complementarity of capital and labor. Lower capital and lower labor decrease the tax base and thus the marginal benefit of avoiding taxes (i.e., $F(L^*, K^*)$ is decreasing in $w^*$), leading to less tax avoidance for firms with relatively higher labor supply elasticity.

The second mechanism is subtler and relies on the firm's ability to avoid taxes as well as the differential tax deductibility of capital and labor. Higher wages make capital more attractive relative to labor at the margin.[10] Firms with higher wages will thus invest more in capital, i.e., $\frac{dK^*}{dw^*} > 0$, despite the complementarity of $K$ and $L$ in the production function. Tax avoidance also decreases the cost of capital because tax avoidance counteracts the limited tax deductibility of the cost of capital.[11] Since higher tax avoidance increases the net (of tax) marginal benefit of capital,[12] firms may find it beneficial to both invest more in capital and avoid more taxes. In this case, tax avoidance increases with labor supply elasticity. In other words, firms with more elastic labor supply find it more difficult to shift the tax burden to workers by lowering wages. Instead, they reduce their tax burden by shifting to capital and avoiding more tax to reduce the after-tax cost of capital.

These two mechanisms indicate that the relation between labor supply elasticity and tax avoidance is ambiguous. However, note that from the discussions of the mechanisms above, for tax avoidance to increase with labor supply elasticity, a necessary condition is that capital investment must increase with wages and thus labor supply elasticity[13], as more capital investment increases the marginal benefit of tax avoidance. This gives the second result.

**Result 2**: $\frac{dA^*}{d\mu} > 0$ only if $\frac{dK^*}{d\mu} > 0$.

Two factors are necessary for tax avoidance to increase with labor supply elasticity: the cost of capital must not be entirely tax deductible, i.e., $\eta < 1$ (which is the case in most existing tax systems) and capital must be relatively important in the production function. When some fraction of capital is not tax deductible, more tax avoidance is beneficial as it increases the net marginal benefit of capital.

---

[10] One can argue that when there is an increased demand for capital, cost of capital should also increase in a competitive capital market. Our results remain qualitatively unchanged so long as the elasticity of capital supply is sufficiently smaller than that of labor. In addition, at least in the short run, it is plausible that capital supply is likely to be less elastic than labor supply.

[11] Note that if capital is fully tax-deductible, the cost of capital cannot be reduced by avoiding tax.

[12] Increasing $A$ by, say, 1% increases the marginal benefit by 1% but increases the marginal cost only by $\eta \times 1\%$ as the non-deductible marginal cost, $(1-\eta) \times 1\%$, is not affected by $A$. In addition, higher $K$, by increasing production, also increases the tax base, $pF(K^*, L^*) - wL^* - \eta r K^*$ and thus the marginal benefit of tax avoidance, resulting in a larger $A^*$.

[13] The literature on capital deepening shows that firms shift from relatively more expensive labor inputs to less labor-intensive capital investments (e.g., Autor et al. 2003, Autor et al. 2007).

The importance of capital is crucial because increased capital investment is the channel through which tax avoidance increases with labor supply elasticity. To see this, suppose that capital $K$ is negligible in the production function ($K$ is relatively small) or that capital productivity $\alpha$ is small. Then increasing capital investment will also have a negligible effect on the output, resulting in negligible marginal benefit of increasing tax avoidance and the second channel is thus less likely to dominate. Intuitively, one would conjecture that the less tax deductible capital is (i.e., the smaller $\eta$ is) and the more important capital is in generating output, the more likely it is that the second mechanism works and thus the more likely tax avoidance increases with labor supply elasticity.

We confirm the above conjectures by using a specific Cobb-Douglas production function $F(K,L) = K^{\alpha}L^{\beta}$ where $\alpha > 0$ is the capital productivity, $\beta > 0$ is the labor productivity, $\alpha + \beta < 1$, and a specific tax avoidance cost function $C(A) = \frac{1}{2}kA^2$ where $k > 0$. The importance of capital in the Cobb-Douglas production function can thus be captured by the parameter $\frac{\alpha}{\beta}$ while keeping $\alpha + \beta$ fixed. A necessary condition for $\frac{dA^*}{d\mu} > 0$ is that $2\alpha + \beta > 1$.[14] A set of necessary conditions are listed in Result 3.

**Result 3**: $\frac{dA^*}{d\mu} > 0$ only if 1) η is sufficiently small and 2) $\alpha + \beta$ is sufficiently large and $\frac{\alpha}{\beta}$ is sufficiently large when $(K,L) = K^{\alpha}L^{\beta}$ where $\alpha > 0$, $\beta > 0$ and $\alpha + \beta < 1$ .[15]

*2.3 Allowing for Market Power in the Consumer Market*

While our three results are based on a setting where firms shift their tax burden onto employees through lower wages, we show in Appendix A.2 that the results are qualitatively similar in a setting where firms shift their burden onto customers through higher prices while assuming that taxes cannot be passed on to workers. The reason is that there is no qualitative difference between shifting the tax

[14] We discuss below that in our sample, both conditions $\alpha + \beta < 1$ and $2\alpha + \beta > 1$ cannot be rejected in any industry.
[15] The condition on $\alpha + \beta$ is a special feature of the Cobb-Douglas production function where $\alpha + \beta$ captures the economy of scale. The larger the economy of scale, the larger the effect of capital and labor on production, which is also the same reason underlying the condition that $2\alpha + \beta > 1$.

burden through increasing product prices or reducing employee wages. Market power still affects tax avoidance through the two mechanisms discussed above. To see this, note that firms with lower market power cannot increase their prices much, resulting in a relatively lower product market price. A lower product market price results in, everything else equal, lower pre-tax profits. The lower pre-tax profits reduce the marginal benefit of tax avoidance, resulting in lower tax avoidance, corresponding to the first mechanism. On the other hand, lower product market price makes wages relatively more expensive than capital at the margin, which may result in firms investing more in capital as well as avoiding more tax at the margin since capital is not fully tax-deductible.[16] To see this, note that the first order condition implies that $F_L = \frac{w}{p}$. A decrease in $p$ has the same effect as an increase in $w$, which makes labor more expensive on the margin and unaffected by tax avoidance. Capital will then become relatively more attractive on the margin as more tax avoidance can reduce the after-tax cost of capital. Thus, firms with high product demand elasticity may invest more in capital and engage in higher tax avoidance, consistent with the second mechanism. Again, the crucial determining factors of the two mechanisms are that 1) capital is not fully tax deductible so tax avoidance is beneficial and 2) capital is relatively important in the production function so the benefit of tax avoidance is sufficiently large. Those two conditions are independent of whether firms' market power is from the product market or the labor market.

### *2.4 Summary of Model Implications*

Our model illustrates that corporate tax incidence and tax avoidance are not independent. The model shows that the relation between tax avoidance and tax incidence depends on the tax deductibility of capital as well as the importance of capital in the production function. To the extent that there are cross-sectional differences in market power (i.e., labor supply elasticity or consumer

[16] Of course, there is a third effect that lower product market results in capital being more expensive on the margin, which results in a decrease in capital investment and thus lower tax avoidance. The conditions ensure that this effect is dominated.

demand elasticity), production functions, and the deductibility of capital, there will be cross-sectional differences in tax avoidance. Thus, the model helps explain the empirical finding that many firms appear to avoid relatively little tax, even though the costs of tax avoidance sometimes appear to be relatively low. Our model suggests that market power and factors of production can significantly change the costs and benefits of tax avoidance.

## 3. Empirical Specification and Data

### *3.1 Baseline Regression*

To test the empirical implications of our theoretical model, we estimate the following regression:

$$\begin{aligned} Cash\ ETR_{i,t} = {} & \alpha_0 + \beta_1 Market\ Power_{i,t} + \beta_2 Investment_{i,t} + \beta_3 Cash_{i,t} + \beta_4 Income_{i,t} \\ & + \beta_5 Sales\ Growth_{i,t} + \beta_6 Leverage_{i,t} + \beta_7 Size_{i,t} + \beta_8 Foreign_{i,t} + \beta_9 LCF_{i,t} \\ & + \beta_{10} Intangibles_{i,t} + \beta_{11} PPE_{i,t} + \beta_{12} R\&D_{i,t} + \beta_{13} Advertising_{i,t} \\ & + \beta_{14} SG\&A_{i,t} + \beta_{15} Special\ Items_{i,t} + \alpha_t + \varepsilon_{i,t} \end{aligned} \tag{9}$$

where *Cash ETR* is the one-year *Cash ETR* winsorized at zero and one.[17] The variable *Market Power* is one of two pricing power and competition proxies developed by Hoberg and Phillips (2016).[18] First, we use the *Total Similarity* measure by Hoberg and Phillips (2016) and expect that firms with more similar rivals have less pricing power. Hence, they face more elastic consumer demand and/or labor supply. In our regressions we multiply *Total Similarity* with –1 so that a higher value indicates high market power of the firm. Second, we use the *TNIC HHI* from Hoberg and Phillips (2016) and expect that firms in more concentrated industries have more market power. Our model yields ambiguous predictions for the relation between market power and tax avoidance, depending on whether capital and labor are substitutes at the margin (see our Result 2 above).[19] We therefore make no prediction for the coefficient on *Market Power* ($\beta_1 \lesseqgtr 0$). We also include a standard set of control variables following prior literature related to tax avoidance decisions (e.g., Dyreng, Hanlon, and

[17] In Tables A.1 to A.5, we document that all our results are robust to using the three-year Cash ETR.
[18] The data on these two proxies are obtained from the Hoberg and Phillips data library at http://hobergphillips.usc.edu/.
[19] We note that our results on tax avoidance and capital investment are robust to using the Hoberg, Phillips, and Prabhala (2014) product market fluidity measures that proxies for greater competitive threats.

Maydew 2010, Dyreng et al. 2017). For example, we include *Investment*, defined as capital expenditures scaled by gross property, plant, and equipment; *Cash*, defined as cash holdings and short-term investments scaled by lagged total assets; *Income*, defined as earnings before interest, taxes, depreciation, and amortization (EBITDA) scaled by lagged total assets; *Sales Growth*, the natural logarithm of the growth rate of sales from $t - 1$ to $t$; *Leverage*, defined as total debt scaled by total assets; and *Size*, the natural logarithm of total assets. We also include dummy variables for being a multinational company (*Multinational*)[20] and whether the firm has a tax loss carryforward (*LCF*). Finally, we include the ratio of intangible assets to total assets (*Intangibles*), the ratio of gross property, plant, and equipment to total assets (*PPE*), ratio of research and development expenses to sales (*R&D*), the ratio of advertising expenses to sales (*Advertising*), the ratio of selling, general, and administrative expense to sales (*SG&A*) and the ratio of special items to total assets (*Special Items*). Further, we include year fixed effects ($\alpha_t$). Standard errors are clustered at the firm level.

### *3.2 Data and Summary Statistics*

We start with all available Compustat observations for 1996–2015 since the Hoberg and Phillips (2016) measures are not available prior to 1996. Our sample restrictions follow prior literature on tax avoidance imposing minimal requirements (e.g., Dyreng, Hanlon, and Maydew 2008, 2010). Specifically, we include firms incorporated and headquartered in the United States with at least three consecutive years of non-missing cash taxes paid. We further eliminate real estate investment trusts, that is, firms with SIC code of 6798, because they are taxed differently than corporations. We also require non-missing observations for independent variables and positive pre-tax income. After imposing these sample requirements, we obtain an initial sample of 5,890 firms and 38,127 observations. Table 1 presents summary statistics for our main variables. On average, our sample firms have a one-year cash ETR of 27.8%. The average firms holds 15% in cash or short-term

[20] We use a threshold for having foreign income (0.2% of total assets) to avoid cases where firms with limited international operations are treated as multinational firms.

equivalents, has capital expenditures of 13% of total assets, spends about 3% of sales in R&D, and has an operating profit to assets ratio of 18%. Further, about 16% (50%) of assets are intangibles (property, plant, and equipment).

[Insert Table 1 about here]

## 4. Empirical Results

### *4.1 Baseline Results*

Table 2 presents the regression results from estimating equation (9). We find positive and significant relation between of *Market Power* and *Cash ETR* which is consistent with Result 2 from the model.[21] In model one, we use *Total Similarity* × -1 as the proxy for *Market Power* and find that cash ETRs are higher for firms with relatively few competitors, i.e., for firms with high market power and thus with ability to shift the economic burden of taxes away from shareholders. The results are also economically significant. Using the coefficient estimates from Column (1) of Table 2, we find that a one standard deviation increase in *Total Similarity* × -1, increases *Cash ETR* by 1.40 percentage points (= 0.0038 × 3.678). This is equivalent to 5.0% of the sample average *Cash ETR* of 27.8%. We find similar results when using the concentration measure *TNIC HHI*. Firms with more market power are less likely to avoid taxes and report higher cash ETRs. The results suggest that a one standard deviation increase in *TNIC HHI* increases *Cash ETR* by 0.45 percentage points (= 0.0211 × 0.215), or 1.6% of average *Cash ETR*. The coefficients on the control variables are generally consistent with our expectations and prior literature.

[Insert Table 2 about here]

### *4.2 Cross-Sectional Variation*

While our model yields ambiguous predictions on the relation between market power and tax avoidance, we consistently find a positive relation between *Cash ETR* and *Market Power* in our

[21] One potential concern could be that tax avoiding firms may have cost advantages that leads them to more market power. If true, this would bias against our findings because our findings indicate that if a firm's high tax avoidance increases its market power, we would find a positive association between tax avoidance and market power.

baseline test. However, the model allows us to derive conditions under which the relation is not ambiguous. In particular, Result 3 indicates that the productivity parameters of the Cobb-Douglas production function need to satisfy the conditions $2\alpha + \beta > 1$ as well as $\alpha + \beta < 1$ for our results to hold. To test these conditions empirically, we estimate the following regression for each of the 50 Hoberg and Philips (2016) 10K-based industries in our sample:

$$\ln(Sales)_{i,t} = \alpha \times \ln(TotalAssets)_{i,t} + \beta \times HoursWorked_{i,t} + \alpha_i + \alpha_t + \varepsilon_{i,t}, \quad (10)$$

where *ln(Sales)* is the natural logarithm of sales to measure output, *ln(TotalAssets)* is the natural logarithm of total assets to proxy for capital input,[22] and *HoursWorked* as our proxy for labor input.[23] We define *HoursWorked* as the number of employees per firm multiplied with the average hours of worked in the U.S. according to the OECD.[24] We acknowledge that this is a rough approximation of productivity parameters but limited data availability precludes us from estimating more detailed and precise productivity factors at the firm or the industry–year level. The results from these 50 estimations reconcile our main finding with the model. The estimates for alpha and beta indicate that both conditions $2\alpha + \beta > 1$ as well as $\alpha + \beta < 1$ can never be rejected in any of our 50 industries.

In the next step, we use these estimates and examine whether the relation between market power and tax avoidance varies with capital productivity. The intuitive idea is that when capital becomes more productive, shifting from labor to capital results in higher profits and, thus, higher benefits of tax avoidance. Since shifting from labor to capital at the margin is more important for low market power firms, we would expect that the higher capital productivity strengthens the link between market power and tax avoidance. We thus extend equation (9) by including a proxy for capital

---

[22] We obtain very similar results when using long-term assets instead of total assets (not reported). Our results are very similar when we exclude industries with at least 500, or 1000 observations when estimating the productivity parameters.

[23] Results (unreported) are similar when using the Hoberg and Phillips (2016) 25 or 100 industry classifications. We also obtain very similar results when using long-term assets instead of total assets (not reported). Our results are likewise similar when we exclude industries without at least 500, or 1000, observations when estimating the productivity parameters.

[24] We obtain data from the following link: https://stats.oecd.org/Index.aspx?DataSetCode=ANHRS.

productivity as well as its interaction with *Market Power*. As measures for capital productivity, we use the $\alpha$ coefficient (denoted *Alpha*) and the ratio of $\alpha$ to $\beta$ (denoted *Alpha/Beta*), respectively from equation (10). To simplify the interpretation of the regression results, we standardize the productivity proxies to have a mean of zero and a standard deviation of one.

Results are reported in Table 3. We find significant and positive coefficients for both *Market Power* proxies indicating that for firms with average capital productivity, higher market power is associated with less tax avoidance. Further, the results show that firms with higher capital productivity appear to avoid more tax. This is consistent with our model because firms with higher capital productivity have higher capital input in their firm. As higher capital input increases the benefits of tax avoidance, firms with high capital productivity avoid more tax. Finally, the interaction between market power and capital productivity is positive and significant at the 1%-level in all four columns. This result indicates that the difference in tax avoidance between high and low market power firms depends on capital productivity as predicted by the importance of the labor-capital-substitution in our model. If capital is relatively unproductive (lower *Alpha* or *Alpha/Beta*), the difference in tax avoidance between low and high market power firms becomes smaller because the shifting from labor to capital input becomes less beneficial for firms. In contrast, if capital is productive, shifting from labor to capital becomes more beneficial and, hence, low market power firms have higher incentives to avoid taxes. This test also addresses concerns about potential alternative explanations for our findings such as increased pressure for more efficiency when there is more competition (e.g., Brown et al. 2014) or smoothing of profits or hedging against negative outcomes (Kubick et al. 2015). While the alternative explanations by Brown et al. (2014) and Kubick et al. (2015) hold for the entire sample, our explanation is directly related to capital productivity.

[Insert Table 3 about here]

Next, we exploit cross-sectional variation in the substitutability of labor and capital. One channel for the positive relation between market power and Cash ETRs is that, at the margin, labor is substituted with capital. If, however, this substitutability is limited, firms cannot easily switch to capital and, thus, the increase in the marginal benefit in tax avoidance is lower. Hence, tax avoidance should respond less to market power. To proxy for substitutability, we use R&D expenditures because R&D is typically labor intense and cannot easily be substituted with capital. Hence, R&D intense firms might be less able to substitute labor with capital at the margin and, thus the positive relation between market power and Cash ETRs might be weaker than for low R&D firms. We use the ratio of R&D expenditures over total assets (*R&D*) and define firms in the top quartile of the R&D distribution as *High R&D* firms. We then estimate the response for *Low R&D* firms, for *High R&D* firms, as well as the difference between the firms. Table 4 presents the regression results. Consistent with our model, we find the relation between market power and tax avoidance to be significant and negative only for firms with low R&D expenditures, that is, for firms with higher substitutability of labor and capital. The relation between market power and tax avoidance is insignificant for R&D intense firms when using *Total Similarity*. When using *TNIC HHI*, the relation becomes negative and significant at the 10% level. Most importantly, we find that the difference between low and high R&D firms is significant at the 1% level in both cases.

[Insert Table 4 about here]

### *4.3 Exploiting the Introduction of the 1997 Check-the-Box Regulation*

One potential concern about the baseline regression is that the variation in firm-specific market power is not exogenous. That is, there may be unobservable characteristics driving both our measures of market power *HHI* or *Total Similarity* and tax avoidance. We complement the above analyses with an alternative identification approach that exploits an exogenous shock to tax avoidance opportunities. We use the 1997 introduction of the Check-the-Box regulation as a shock to tax avoidance opportunities (Desai and Dharmapala 2009). This regulation reduced the costs of tax avoidance for firms and, thus, increased firms' ability to avoid taxes (Altshuler and Grubert 2006).

Our approach is a triple difference design where we compare firms with low market power to firms with more market power (*first difference*) around the 1997 introduction of the Check-the-Box regulation (*second difference*) and between domestic and multinational firms (*third difference*).[25] Using data from 1992–2000, we thus estimate the following regression:

$$\begin{aligned} Cash\ ETR_{i,t} = {} & \alpha_0 + \beta_1 LowPower_i + \beta_2 Multinational_i + \beta_3 LowPower_i \times Post_t \\ & + \beta_4 LowPower_i \times Multinational_i + \beta_5 Post_t \times Multinational_{ii} \\ & + \beta_6 LowPower_i \times Multinational_i \times Post_t + CONTROLS_{i,t} + \alpha_{j,t} + \varepsilon_{i,t} \end{aligned} \quad (10)$$

where the *Cash ETR 1* is the dependent variable. The variable *Low Power* is a dummy variable equal to one if the firm's *Total Similarly* in 1996 is above the median *Total Similarity*. When using *TNIC HHI* as measure of market power, we set *LowPower* to one if *TNIC HHI* in 1996 is below the median *TNIC HHI*. We use the dummy variable *Multinational* from our main specification. We require non-missing observations and use the pre-1997 status to define the treatment group. Taken together, we define treatment and control groups based on observable firm characteristics before the shock to tax avoidance opportunities to prevent increased tax avoidance opportunities from affecting the selection into treatment and control groups. We include control variables, their interaction with *Multinational* to account for differences between domestic and multinational firms, and industry–year fixed effects ($\alpha_{j,t}$) to ensure that the counterfactual firms are from the same industry.

Table 5 presents regression results from estimating equation (10). The variable of interest is the triple differences coefficient $\beta_6$. In line with our previous results, we find negative and significant coefficients for the triple interaction *Low Power* × *Multinational* × *Post* in both specifications. These

[25] A potential limitation is that there might be confounding events and policy changes. However, such concurrent changes would have to affect the tax avoidance decisions of low market power firms versus firms with more market power and domestic versus multinational firms in the same way as the Check-the-Box regulation. We are not aware of such events. To the extent that both groups are similarly affected by concurrent changes as, for example, by the reduction in the long-term capital gains tax rate from 28% to 20%, the triple difference estimate is not biased.

results indicate that among firms with foreign operations, relative to firms that can more easily pass on taxes to stakeholders, firms with less ability to pass on the corporate tax incidence to stakeholders are more responsive to new tax avoidance opportunities and reduce their ETR. The consistency of the results across specifications also supports the model outcome under the condition that capital and labor are substitutes at the margin: firms with market power have fewer incentives to engage in tax avoidance and report higher ETRs as they can shift the tax burden away from shareholders.

[Insert Table 5 about here]

### *4.4 Exploiting Variation in Consumer Demand Elasticity and Labor Supply Elasticity*

The previous tests are silent about the potential channels through which the incidence of the corporate tax can be passed on to stakeholders. For example, the incidence of the corporate tax falls less on firm owners if the corporate tax results in higher prices for consumers and/or lower wages for consumers. While we cannot directly test these channels, we exploit two distinct settings and measures where one of the channels is affected while the other is held constant.

Our model predicts that less of the corporate tax incidence falls on consumers if demand becomes more elastic, which will affect their tax avoidance. We use shocks to consumer demand elasticity to test this prediction. Shocks to consumer demand elasticity can arise if, for example, more international competitors enter the market. We use changes in import tariffs from Frésard (2010) and examine their effect on tax avoidance using the following regression (see also Brown et al. 2014):[26]

$$Cash\ ETR_{i,t} = \alpha_0 + \beta_1 Tariff\ \ Cut_{j,t} + CONTROLS_{i,t} + \alpha_i + \alpha_t + \varepsilon_{i,t} \tag{12}$$

where *Cash ETR* is the dependent variable. The variable *Tariff Cut* is a dummy variable equal to one if for all years after the firm's industry experienced a significant tariff cut in year *t*. We use the import tariffs at the four-digit SIC code level of Frésard (2010) and define a significant tariff cut if an

[26] Brown et al. (2014) offer two explanations why firms would increase tax avoidance in response to tariff cuts: eroding profit margins and more effective monitoring. Our framework also predicts eroding profits margins, because the increased competition from import tariff shocks reduces demand elasticity. Thus, less of the corporate tax can be passed on to consumers, resulting in lower profit margins.

industry's tariff cut is at least two times larger than the industry's average annual tariff cut over the sample period. We expect $\beta_1$ to be negative (positive) if the conditions in Result 2 are satisfied (not satisfied), since an increase in demand elasticity increases (decreases) the incentive of firms to avoid taxes because with more elastic demand, firms' ability to pass on taxes to consumers is limited.[27]

Column (1) of Table 6 presents the regression results from estimating equation (12) exploiting changes in import tariffs (see also Brown et al. 2014). These tariff cuts lead to more elastic demand in the respective industry because of greater international competition. This curbs the ability of firms to pass on the corporate tax to consumers in the form of higher prices. Consequently, since firm owners now bear more of the corporate tax incidence, our model predicts it is possible to have more or less tax avoidance. Our previous results suggests that higher consumer demand elasticity is associated with more tax avoidance. Therefore, we should observe lower ETRs around tariff cuts. This is exactly what we find in Column (1) of Table 6. The estimates suggest that, after a significant reduction in import tariffs (*Tariff Cut* = 1), firms reduce cash ETR.

Finally, we exploit cross-industry variation in labor skill using the labor skill index by Ghaly, Dang, and Stathopoulos (2017). Their labor skill index is defined at the industry level and measures how many employees in an industry work in job occupations with jobs classified from 1 (no to little skill required) to 5 (extensive skill set required). We use the skill level as a proxy for elasticity because highly skilled labor are more elastic than employees with little or no skill (see, also Fuest, Peichl, and Siegloch 2017). We reestimate our baseline regression from equation (9) but use the labor skill index as the measure of labor supply elasticity. In these regressions, we only include year fixed effects because the index is defied at the industry level. Column (2) of Table 6 presents the regression results. Consistent with our previous results, we find that a higher labor skill index, our proxy for more elastic labor supply, is negatively associated with Cash ETRs. In other words, these results

[27] An alternative explanation could be that as competition drives down margins, firms might decrease tax costs to keep after-tax profits constant. However, one potential issue with this explanation is that one has to find an argument why the firm operated inefficiently with respect to tax planning in absence of more competition.

suggest that higher labor supply elasticity is associated with more tax avoidance. Overall, the results in Table 6 support the idea that consumer demand elasticity and labor supply elasticity relate to the tax avoidance decisions of firms. Higher demand elasticity or labor supply elasticity increases the corporate tax incidence falling on firms and increases their incentives to avoid taxes, or, as illustrated in the notation of our model, a higher $\mu$ leads to a higher profit-maximizing level of tax avoidance $A^*$.

[Insert Table 6 about here]

### *4.5 Assessing the Channel: Investment Responses*

In the model we find that tax avoidance is decreasing in a firm's market power ($\frac{dA^*}{d\mu} > 0$) only if capital is increasing in consumer demand or labor supply elasticity ($\frac{dK^*}{d\mu} > 0$). To test whether this prediction from the model holds, we re-estimate all our tests from above but use *Investment* as dependent variable.[28] We predict that the sign on our proxies for *Market Power* when *Investment* is the dependent variable will always be the opposite from what it was when *Cash ETR* was the dependent variable.

In Table 7, we present evidence consistent with our prediction from Result 2 in the model. Firms with more similar competitors (higher *Total Similarity*), have higher *Investment*. The coefficient estimate in Column (1) suggests that a one standard deviation increase in *Total Similarity* is associated with an increase in *Investment* of about 2.8% of the sample average *Investment*. The results in the other columns are likewise consistent with our prediction: firms with high market power industries have lower capital expenditures and lower tax avoidance. We find support for these associations around Check-the-Box. Further, following an increase in consumer demand elasticity, firms also increase their capital investments (Column (5)). Finally, the coefficient on *Labor Skill Index* has the expected negative sign and is statistically significant (Column (6)). Overall, the results

[28] To account for investment opportunities, we also control for Tobin's *q*. Our results do not change if we exclude *q*.

in Table 7 support the channel—more capital investment—in our model that leads to an increase in tax avoidance when firms have less market power.

[Insert Table 7 about here]

### *4.6 Robustness Tests*

To ensure our results are robust to other commonly used proxies for tax avoidance we repeat our analyses using a three-year cash ETR, *Cash ETR3*, and with *GAAP ETR*. In Table A.1 to A.5 in the Appendix we show the results using *Cash ETR3.* In Table A.6 in the Appendix, we present the results using *GAAP ETR.* Across all these tests the results are mostly consistent with those reported in the main tables, suggesting that our findings are not driven by the choice tax avoidance proxy.

Second, one potential concern about our results is that a high ETR could reflect unsuccessful tax avoidance and not a lack of tax avoidance (Saavedra 2017) and that firms with more market power can more easily absorb unsuccessful tax avoidance (Kubick et al. 2015). While unsuccessful tax avoidance would not be consistent with our model's predictions, we still want to rule out this measurement concern. Firms with large tax settlements have higher ETRs and we could misinterpret our results when these less successful tax avoiders drive our findings. We replicate all our main results and exclude unsuccessful tax avoiders according to of Saavedra (2017). Our results hold when excluding these less successful tax-avoiding firms (Table A.7 of the Appendix). This finding suggests that our results are unlikely to be explained by unsuccessful tax avoiders.

## 5. Conclusion

We examine the relation between corporate tax incidence and corporate tax avoidance. Using the model of a profit-maximizing firm, we show that the relation between the ability to shift the economic burden of corporate income taxes away from shareholders and tax avoidance is ambiguous. However, the model generates predictions that are unambiguous when capital is important relative to labor in the production function. Empirically, we show that firms with limited ability to pass taxes away from shareholders invest more in capital and avoid more taxes. Cross-firm differences in the ability to pass on the corporate tax incidence to stakeholders can therefore be one explanation for the tax undersheltering puzzle.

The role of tax incidence in tax avoidance has implications for future academic research. For example, if firms can pass on the corporate tax burden to other stakeholders, the responsiveness of other important firm decisions, such as investment or capital structure decisions to tax rate changes could be affected. Our model provides a starting point for modeling and testing these responses. Further, our study suggests the need to control for a market power when examining the effect of cross-sectional variation in tax avoidance. We also view modelling and testing for interactive effects of other factors that have been shown to affect the tax avoidance decision, for example, corporate governance, with a firms' ability to pass on taxes to stakeholders as a fruitful avenue for future research.

Our results also have important policy implications. Recent attempts to combat tax avoidance and international profit shifting are likely to have heterogeneous effects across firms if implemented in isolation. Such initiatives will likely have a more severe negative economic impact on firms with low market power than firms with high market power because high market power firms can shift the economic burden of the corporate tax away from shareholders even if the firm is forced to pay the tax. Hence, policymakers should carefully consider the interaction of corporate tax incidence on corporate tax avoidance when enacting provisions that affect explicit tax payments.

**References**


Altshuler, Rosanne, and Harry Grubert (2006): Governments and multinational corporations in the race to the bottom. *Tax Notes*, 110, 979–992.

Arulampalam, Wiji, Michael P. Devereux, and Giorgia Maffini (2012): The direct incidence of corporate income tax on wages. *European Economic Review*, 56, 1038–1054.

Auerbach, Alan J. (1983): Corporate taxation in the United States. *Brookings Papers on Economic Activity*, 2, 451–513.

Auerbach, Alan J. (2005): Who bears the corporate tax? A review of what we know. In J.M. Poterba (ed.), *Tax Policy and the Economy*, Volume 20, 1–40. National Bureau of Economic Research, Cambridge, MA.

Autor, David H., Donohue, John III, and Schwab, Steward J. (2006): The costs of wrongful discharge laws. *Review of Economics and Statistics*, 88, 211–231.

Autor, David H., William R. Kerr, and Adriana D. Kugler (2007): Does Employment Protection Reduce Productivity? Evidence from US States. *The Economics Journal*, 117, F189–F219.

Brown, Jennifer, Claudia Custodio, Steve Hillegeist, and Eugenia Yia (2014): Competitive pressure and tax avoidance. Unpublished working paper, Arizona State University.

Chen, Shuping, Xia Chen, Qiang Cheng, and Terry Shevlin (2010): Are family firms more tax aggressive than non-family firms? *Journal of Financial Economics*, 95, 41–61.

Clausing, Kimberley (2012): In search of corporate tax incidence. *Tax Law Review*, 65, 433–472.

Clausing, Kimberley (2013): Who pays the corporate tax in a global economy? *National Tax Journal*, 66, 151–184.

Diamond, Peter A., and James A. Mirrlees (1971): Optimal Taxation and Public Production I: Production Efficiency. *American Economic Review*, 61, 8–27.

Desai, Mihir A., and Dhammika Dharmapala (2006). Corporate tax avoidance and high-powered incentives. *Journal of Financial Economics*, 79, 145–179.

Desai, Mihir A., and Dhammika Dharmapala (2009): Corporate tax avoidance and firm value. *Review of Economics and Statistics*, 91, 537–546.

Dharmapala, Dhammika and Nadine Riedel (2013): Earnings shocks and tax-motivated income-shifting: Evidence from European multinationals. *Journal of Public Economics*, 97, 95–107.

Djankov, Simeon, Tim Ganser, Caralee McLiesh, Rita Ramalho, and Andrei Shleifer (2010): The effect of corporate taxes on investment and entrepreneurship. *American Economic Journal: Macroeconomic*s, 2, 31–64.

Dyreng, Scott D., Michelle Hanlon, and Edward L. Maydew (2008): Long-run corporate tax avoidance. *Accounting Review*, 83, 61–82.

Dyreng, Scott D., Michelle Hanlon, and Edward L. Maydew (2010): The effects of executives on corporate tax avoidance. *Accounting Review*, 85, 1163–1189.

Dyreng, Scott D., Edward L. Maydew, Michelle Hanlon, and Jacob R. Thornock (2017): Changes in corporate effective tax rates over the past twenty-five years. *Journal of Financial Economics*, 124, 441–463.

Feldstein, Martin (1974): Incidence of a capital income tax in a growing economy with variable savings rates. *Review of Economic Studies*, 41, 505–513

Felix, Alison (2007): Passing the burden: Corporate tax incidence in open economies. Federal Reserve Bank of Kansas City, Regional Research Working Paper Series, No. 07-01.

Frésard, Laurent (2010): Financial strength and product market behavior: The real effects of corporate cash holdings. *Journal of Finance*, 65, 1097–1122.

Fuchs, Victor R., Alan B. Krueger, and James M. Poterba (1998). Economists' views about parameters, values, and policies: Survey results in labor and public economics. *Journal of Economic Literature*, 36, 1387–1425.

Fuest, Clemens, Andreas Peichl, and Sebastian Siegloch (2017): Do higher corporate taxes reduce wages? *American Economic Review*, forthcoming.

Fullerton, Don, and Gilbert E. Metcalf (2002): Tax incidence. In Alan J. Auerbach and Martin Feldstein (Eds.), *Handbook of Public Economics*, Volume 4, 1788–1872.

Gallemore, John, Edward L. Maydew, and Jacob R. Thornock (2014): The reputational costs of tax avoidance. *Contemporary Accounting Research*, 31, 1103–1133.

Ghaly, Mohammed, Viet Anh Dang, and Konstantinos Stathopoulos (2017): Cash Holdings and Labor Heterogeneity: The Role of Skilled Labor, *Review of Financial Studies*, forthcoming.

Giroud, Xavier and Joshua Rauh (2017): State Taxation and the Reallocation of Business Activity: Evidence from Establishment-Level Data, Working Paper.

Graham, John R. (1996): Debt and the marginal tax rate. *Journal of Financial Economics*, 41, 41–73.

Graham, John R., Michelle Hanlon, Terry Shevlin, and Nemit Shroff (2014): Incentives for tax planning and avoidance: Evidence from the field. *Accounting Review*, 89, 991–1023.

Graham, John R., and Alan L. Tucker (2006): Tax shelters and corporate debt policy. *Journal of Financial Economics,* 81, 563–594

Gravelle, Jennifer (2013): Corporate tax incidence: Review of general equilibrium estimates and analysis. *National Tax Journal*, 66, 185–214.

Gruber, Jonathan (2010): *Public Finance and Public Policy*, 3rd edition. Worth Publishers, New York.

Hanlon, Michelle, and Shane Heitzman (2010). A review of tax research. *Journal of Accounting and Economics* 50, 127–178.

Harberger, Arnold C. (1962): The incidence of the corporation income tax. *Journal of Political Economy*, 70, 215–240.

Haufler, Andreas, and Guttorm Schjelderup (2000): Corporate tax systems and cross country profit shifting. *Oxford Economic Papers*, 52, 306–325.

Heider, Florian, and Alexander Ljungqvist (2015): As certain as debt and taxes: Estimating the tax sensitivity of leverage from state tax changes. *Journal of Financial Economics*, 118, 684–712.

Hoberg, Gerard, and Gordon Phillips (2016): Text-Based Network Industries and Endogenous Product Differentiation. Journal of Political Economy, 124, 1423–1465.

Hoberg, Gerard, Gordon Phillips, and Nagpuranand Prabhala (2014): Product Market Threats, Payouts, and Financial Flexibility. *Journal of Finance*, 69, 293–324

Kotlikoff, Laurence J., and Lawrence H. Summers (1987): Tax incidence. In Alan J. Auerbach and Martin Feldstein (Eds.), *Handbook of Public Economics*, Volume 2, 1043–1092.

Krzyzaniak, Marian, and Robert A. Musgrave (1963). *The Shifting of the Corporation Income Tax*. Johns Hopkins Press, Baltimore, MD.

Kubick, Thomas T., Daniel P. Lynch, Michael A. Mayberry, and Thomas C. Omer (2015) Product market power and tax avoidance: Market leaders, mimicking strategies, and stock returns. *The Accounting Review*, 90, 675–702.

Liu, Li and Rosanne Altshuler (2013): Measuring the Burden of the Corporate Income Tax under Imperfect Competition. *National Tax Journal*, 66, 215–238.

Ljungqvist, Alexander, and Michael Smolyansky (2016): To cut or not to cut? On the impact of corporate taxes on employment and income. SSRN Working Paper.

Mutti, John, and Harry Grubert (1985): The taxation of capital income in an open economy: The importance of resident–nonresident tax treatment. *Journal of Public Economics*, 27, 291–309.

Organisation for Economic Co-operation and Development (2013): *Action Plan on Base Erosion and Profit Shifting*. OECD Publishing.

Saavedra, Daniel (2017): Less successful tax avoiders. SSRN Working Paper.

Shoven, John B. (1976): The incidence and efficiency effects of taxes on income from capital. *Journal of Political Economics*, 84, 1261–1283.

Suárez Serrato, Juan Carlos, and Owen Zidar (2016): Who benefits from state corporate tax cuts? A local labor markets approach with heterogeneous firms. *American Economic Review*, 106, 2582–2624.

Summers, Lawrence H. (1981): Taxation and corporate investment: A q-theory approach. *Brookings Papers on Economic Activity*, 1, 67–127.

Vasquez-Ruiz, Harold A. (2011): A new approach to estimate the incidence of the corporate income tax. Working Paper, Georgia State University.

Weisbach, David A. (2002). Ten truths about tax shelters. *Tax Law Review*, 55, 215–253.

**Appendix A.1: Algebraic Details**

We provide detailed proofs of the three results in Section 2.3, which provides the foundation for the empirical analysis. We rewrite the results here for convenience. We first prove those results when wage is determined by a competitive labor market with varying labor supply elasticities.

**Result 1**: *If* $\eta = 1, \frac{dA^*}{d\mu} < 0$.

**Proof of Result 1**: When $\eta = 1$, we can write the first order conditions as

$$pF_K(K^*, L^*) = r \quad \text{(A.1)}$$

$$pF_L(K^*, L^*) = w^* \quad \text{(A.2)}$$

$$pF(K^*, L^*) - w^*L^* - rK^* = C'(A^*) \quad \text{(A.3)}$$

where we substitute the market-clearing wage $w^*$ into the first-order conditions. Note that equations (A.1) to (A.3) implicitly define $K^*$, $A^*$ and $L^*$ as functions of $w^*$ and $r$.

Differentiate equation (A.3) with respect to $w^*$ results in

$$[pF_K(K^*, L^*) - r]\frac{\partial K^*}{\partial w^*} + [pF_L(K^*, L^*) - w^*]\frac{\partial L^*}{\partial w^*} - L^* = C''(A^*)\frac{\partial A^*}{\partial w^*} \quad \text{(A.4)}$$

From (A.1), $pF_K(K^*, L^*) - r = 0$ whereas from (A.2), $pF_L(K^*, L^*) - w^* = 0$. Therefore

$C''(A^*)\frac{\partial A^*}{\partial w^*} = -L^* < 0$, implying that $\frac{\partial A^*}{\partial w^*} < 0$ and $\frac{dA^*}{d\mu} = \frac{\partial A^*}{\partial w^*}\frac{dw^*}{d\mu} < 0$. Result 1 is thus proved. Q.E.D.

**Result 2**: $\frac{dA^*}{d\mu} > 0$ only if $\frac{dK^*}{d\mu} > 0$.

**Proof of Result 2**: When $0 \leq \eta < 1$, we rewrite the first order conditions from equations (5) to (7) here for convenience:

$$[1 - (\tau - A^*)]pF_K(K^*, L^*) = [1 - \eta(\tau - A^*)]r \quad \text{(A.5)}$$

$$pF_L(K^*, L^*) = w^* \tag{A.6}$$

$$pF(K^*, L^*) - w^*L^* - \eta r K^* = C'(A^*) \tag{A.7}$$

where we again substitute the market-clearing wage $w^*$ into the first-order conditions.

Differentiate equation (A.7) with respect to $w^*$ results in

$$[pF_K(K^*, L^*) - \eta r]\frac{\partial K^*}{\partial w^*} + [pF_L(K^*, L^*) - w^*]\frac{\partial L^*}{\partial w^*} - L^* = C''(A^*)\frac{\partial A^*}{\partial w^*} \tag{A.8}$$

Rearranging terms in (A.5) results in $pF_K(K^*, L^*) - \eta r = \frac{(1-\eta)r}{1-(\tau-A^*)}$ whereas from (A.6), $pF_L(K^*, L^*) - w^* = 0$. Therefore we can rewrite equation (A.8) as

$$\left[\frac{(1-\eta)r}{1-(\tau-A^*)}\right]\frac{\partial K^*}{\partial w^*} - L^* = C''(A^*)\frac{\partial A^*}{\partial w^*} \tag{A.9}$$

Since $L^* > 0$ and $\frac{(1-\eta)r}{1-(\tau-A^*)} > 0$, $\frac{\partial A^*}{\partial w^*} < 0$ if and only if $\frac{\partial K^*}{\partial w^*} > 0$ and $\frac{dK^*}{d\mu} = \frac{\partial K^*}{\partial w^*}\frac{dw^*}{d\mu} > 0$. Result 2 is thus proved. Q.E.D.

**Result 3**: $\frac{dA^*}{d\mu} > 0$ only if 1) η is sufficiently small and 2) $\alpha + \beta$ is sufficiently large and $\frac{\alpha}{\beta}$ is sufficiently large; one necessary condition is that $2\alpha + \beta > 1$.

**Proof of Result 3**:

Inserting $F(K, L) = K^\alpha L^\beta$ and $C(A) = \frac{1}{2}kA^2$ into equations (A.5) to (A.7) results in:

$$[1 - (\tau - A^*)]p\alpha(K^*)^{\alpha-1}(L^*)^\beta = [1 - \eta(\tau - A^*)]r \tag{A.10}$$

$$p\beta(K^*)^\alpha(L^*)^{\beta-1} = w^* \tag{A.11}$$

$$p(K^*)^\alpha(L^*)^\beta - w^*L^* - \eta r K^* = kA^* \tag{A.12}$$

Note that (A.10) is equivalent to

$$\eta r K^* = \frac{\eta[1 - (\tau - A^*)]\alpha}{[1 - \eta(\tau - A^*)]}p(K^*)^\alpha(L^*)^\beta \tag{A.13}$$

whereas (A.11) is equivalent to

$$p\beta(K^*)^\alpha(L^*)^\beta = w^*L^* \tag{A.14}$$

Insert (A.13) and (A.14) into (A.12) results in

$$\left\{\frac{1}{\beta}-\frac{1}{\beta}\frac{\eta[1-(\tau-A^*)]\alpha}{[1-\eta(\tau-A^*)]}-1\right\}w^*L^* = kA^* \tag{A.15}$$

Using equations (A.10) and (A.11) to cancel out $K^*$ results in

$$p\left(\frac{[1-(\tau-A^*)]\alpha}{[1-\eta(\tau-A^*)]r}\right)^\alpha(\frac{\beta}{w^*})^{1-\alpha} = {L^*}^{1-\alpha-\beta} \tag{A.16}$$

From (A.16) we can solve for $L^*$. Insert into equation (A.15) and rearranging terms will generate an equation of $A^*$ as a function of $w^*$:

$$\frac{\alpha}{r}\beta^{\frac{1-\alpha}{\alpha}}p^{\frac{1}{\alpha}}\frac{[1-(\tau-A^*)]}{[1-\eta(\tau-A^*)]}(kA^*)^{-\frac{1-\alpha-\beta}{\alpha}} = (w^*)^{\frac{\beta}{\alpha}} \tag{A.17}$$

Note that $\frac{dA^*}{d\mu}=\frac{\partial A^*}{\partial w^*}\frac{dw^*}{d\mu}$, $\frac{dA^*}{d\mu}>0$ if and only if $\frac{\partial A^*}{\partial w^*}>0$. Thus, equation (A.17) will be our focus as it determines how $A^*$ changes with $w^*$.

Denote $f(A^*)\equiv\frac{[1-(\tau-A^*)]}{[1-\eta(\tau-A^*)]}(A^*)^{-\frac{1-\alpha-\beta}{\alpha}}$, i.e., the left hand side of equation (A.17) that varies with $A^*$. Differentiate both sides of equation (A.17) with respect to $w^*$ results in

$\frac{\alpha}{r}\beta^{\frac{1-\alpha}{\alpha}}p^{\frac{1}{\alpha}}(k)^{-\frac{1-\alpha-\beta}{\alpha}}\frac{\partial f(A^*)}{\partial A^*}\frac{\partial A^*}{\partial w^*}=\frac{\beta}{\alpha}(w^*)^{\frac{\beta}{\alpha}-1}>0$. Thus, $\frac{\partial A^*}{\partial w^*}>0$ if and only if $\frac{\partial f(A^*)}{\partial A^*}>0$.

After some tedious algebra, we can write

$\frac{\partial f(A^*)}{\partial A^*}=\frac{g(A^*,\alpha,\beta,\tau,\eta)}{\alpha A^{\frac{1-\beta}{\alpha}}[1-\eta(\tau-A^*)]^2}$ where

$g(A^*,\alpha,\beta,\tau,\eta)$

$\equiv -(A^*)^2(1-\alpha-\beta)\eta-(1-\alpha-\beta)(1-\tau)(1-\tau\eta)$

$+A\{2\alpha+\beta-1-[1-\beta-2(1-\alpha-\beta)\tau]\eta\}$

Clearly the sign of $\frac{\partial f(A^*)}{\partial A^*}$ depends on the sign of $g(A^*, \alpha, \beta, \tau, \eta)$. First note that if $2\alpha + \beta - 1 - [1 - \beta - 2(1 - \alpha - \beta)\tau]\eta \le 0$, all terms in $g(A^*, \alpha, \beta, \tau, \eta)$ will be negative, resulting in $g(A^*, \alpha, \beta, \tau, \eta) < 0$. Thus, $\frac{\partial f(A^*)}{\partial A^*} > 0$ and thus $\frac{dA^*}{d\mu} > 0$ only if

$$2\alpha + \beta - 1 - [1 - \beta - 2(1 - \alpha - \beta)\tau]\eta > 0 \qquad \text{(A.18)}$$

which will be satisfied only if $2\alpha + \beta - 1 > 0$. Thus, $2\alpha + \beta - 1 > 0$ is a necessary condition. Note that equation (A.18) is equivalent to $\eta < \frac{2\alpha+\beta-1}{1-\beta-2\tau(1-\alpha-\beta)}$.

Next, when equation (A.18) is satisfied, $g(A^*, \alpha, \beta, \tau, \eta)$ is a standard quadratic function of $A^*$ with the maximum reached at $A^* = \frac{2\alpha+\beta-1-[1-\beta-2(1-\alpha-\beta)\tau]\eta}{2(1-\alpha-\beta)\eta}$. Thus

$$g(A^*, \alpha, \beta, \tau, \eta) \le g\left(\frac{2\alpha+\beta-1-[1-\beta-2(1-\alpha-\beta)\tau]\eta}{2(1-\alpha-\beta)\eta}, \alpha, \beta, \tau, \eta\right)$$

$$= \frac{(1-\eta)[(2\alpha+\beta-1)^2-\eta(1-\beta)^2+4\alpha\eta\tau(1-\alpha-\beta)]}{4(1-\alpha-\beta)\eta}.$$

Therefore for $\frac{\partial f(A^*)}{\partial A^*} > 0$ to be possible, we must have

$$h(\alpha, \beta, \tau, \eta) \equiv (2\alpha + \beta - 1)^2 - \eta(1 - \beta)^2 + 4\alpha\eta\tau(1 - \alpha - \beta) > 0.$$

Note that $h(\alpha, \beta, \tau, \eta)$ is decreasing in η as

$$\frac{\partial h(\alpha,\beta,\tau,\eta)}{\partial \eta} = -(1 - \beta)^2 + 4\alpha\tau(1 - \alpha - \beta)$$

$$< -(1 - \beta)^2 + 4\frac{1-\beta}{2}\tau\left(1 - \frac{1-\beta}{2} - \beta\right)$$

$= -(1 - \beta)^2(1 - \tau) < 0$ where the first inequality is because $4\alpha\tau(1 - \alpha - \beta)$ is decreasing in $\alpha$ as its derivative with respect to $\alpha$ is $4\tau(1 - 2\alpha - \beta) < 0$ as $2\alpha + \beta - 1 > 0$. In addition, $h(\alpha, \beta, \tau, 0) = (2\alpha + \beta - 1)^2 > 0$ and $h\left(\alpha, \beta, \tau, \frac{2\alpha+\beta-1}{1-\beta-2\tau(1-\alpha-\beta)}\right) = -\frac{2(1-\beta)(1-\tau)(1-\alpha-\beta)(2\alpha+\beta-1)}{1-\beta-2(1-\alpha-\beta)\tau} <$

0.[29] Thus, $h(\alpha,\beta,\tau,\eta) > 0$ only if $\eta < \eta^* < \frac{2\alpha+\beta-1}{1-\beta-2\tau(1-\alpha-\beta)}$ where $\eta^*$ is the unique solution to $h(\alpha,\beta,\tau,\eta^*) = 0$, i.e., $\frac{dA^*}{d\mu} > 0$ only if η is sufficiently small.

Now we explore what conditions on $\alpha$ and $\beta$ are necessary for $\frac{dA^*}{d\mu} > 0$. Fix $\alpha + \beta = k \in (0,1)$. Then we can rewrite equation (A.18) as $k + \alpha - 1 - [(1-2\tau)(1-k) + \alpha]\eta > 0$, Note that $\frac{\partial l(\alpha,k,\tau,\eta)}{\partial \alpha} = 1 - \eta > 0$. In addition, $l(0,k,\tau,\eta) = -(1-k)[1 + (1-2\tau)\eta] < 0$ and $l(k,k,\tau,\eta) = 2k(1-\tau\eta) - (1-2\tau)\eta - 1 > 0$ when $k > \frac{1+(1-2\tau)\eta}{2(1-\tau\eta)} \in (\frac{1}{2}, 1)$, i.e., $k$ is sufficiently large. Thus, $l(\alpha,k,\tau,\eta) > 0$ only if both $\alpha + \beta = k$ is sufficiently large and $\frac{\alpha}{\beta}$ is sufficiently large for fixed $\alpha + \beta$, i.e., $\alpha > \frac{(1-k)[1+(1-2\tau)\eta]}{1-\eta}$ and thus $\frac{\alpha}{\beta} > \frac{(1-k)[1+(1-2\tau)\eta]}{2k(1-\tau\eta)-(1-2\tau)\eta-1}$.

Recall that for $\frac{\partial f(A^*)}{\partial A^*} > 0$ to be possible, we must have $h(\alpha,\beta,\tau,\eta) \equiv (2\alpha + \beta - 1)^2 - \eta(1-\beta)^2 + 4\alpha\eta\tau(1-\alpha-\beta) > 0$. Fix $\alpha + \beta = k \in (0,1)$, we can then write $H(\alpha,k,\tau,\eta) \equiv (k + \alpha - 1)^2 - \eta(1 + \alpha - k)^2 + 4\alpha\eta\tau(1-k)$. Note that

$\frac{\partial H(\alpha,k,\tau,\eta)}{\partial \alpha} = 2\{\alpha + k - 1 - [\alpha + (1-k)(1-2\tau)]\eta\} > 0$ from equation (A.18).

In addition, $H\left(\frac{(1-k)[1+(1-2\tau)\eta]}{1-\eta}, k, \tau, \eta\right) = -\frac{4(1-k)^2(1-\tau)\eta(1-\tau\eta)}{1-\eta} < 0$ and $H(k,k,\tau,\eta) = 1 - \eta - 4k(1-k)(1-\tau\eta) > 0$ if and only if $k < \frac{1-\tau\eta-\sqrt{(1-\tau)\eta(1-\tau\eta}}{2(1-\tau\eta)} < \frac{1}{2}$ or $k > \frac{1-\tau\eta+\sqrt{(1-\tau)\eta(1-\tau\eta)}}{2(1-\tau\eta)} \in (\frac{1}{2}, 1)$. Therefore, $H(\alpha,k,\tau,\eta) > 0$ only if $k > \max\left(\frac{1-\tau\eta+\sqrt{(1-\tau)\eta(1-\tau\eta)}}{2(1-\tau\eta)}, \frac{1+(1-2\tau)\eta}{2(1-\tau\eta)}\right) = \frac{1-\tau\eta+\sqrt{(1-\tau)\eta(1-\tau\eta)}}{2(1-\tau\eta)}$ [30] and $> \alpha^* > \frac{(1-k)[1+(1-2\tau)\eta]}{1-\eta}$, where $\alpha^*$ is the unique solution to $H(\alpha^*,k,\tau,\eta) = 0$. Note that $\alpha > \alpha^*$

---

[29] Recall that for $\frac{\partial f(A^*)}{\partial A^*} > 0$ to be possible, we need $\eta < \frac{2\alpha+\beta-1}{1-\beta-2\tau(1-\alpha-\beta)}$.

[30] $\frac{1-\tau\eta+\sqrt{(1-\tau)\eta(1-\tau\eta)}}{2(1-\tau\eta)} > \frac{1+(1-2\tau)\eta}{2(1-\tau\eta)}$ as $1 - \tau\eta + \sqrt{(1-\tau)\eta(1-\tau\eta)} - 1 - (1-2\tau)\eta = \sqrt{(1-\tau)\eta(1-\tau\eta)} - (1-\tau)\eta > \sqrt{(1-\tau)\eta(\eta-\tau\eta)} - (1-\tau)\eta = (1-\tau)\eta - (1-\tau)\eta = 0$.

for fixed $\alpha + \beta = k$ is equivalent to $\frac{\alpha}{\beta} > \frac{\alpha^*}{k-\alpha^*}$. Thus $\frac{dA^*}{d\mu} > 0$ only if $\alpha + \beta = k$ is sufficiently large and $\alpha$ sufficiently large for fixed $\alpha + \beta$, which is equivalent to $\frac{\alpha}{\beta}$ being sufficiently large.

Result 3 is thus proved. Q.E.D.

**Appendix A.2: Proofs of the results of an extension with varying product demand elasticity**

We now show that those three results remain qualitatively the same when the product price, $p$, is determined by a competitive product market with varying product demand elasticities. Denote the product demand elasticity by λ. The firm will still choose $K, L$ and $A$ to maximize $\Pi(K, L, A) = [1 - (\tau - A)](pF(K, L) - wL - \eta rK) - (1 - \eta)rK - C(A)$. Thus, first order conditions will still be the same:

$$[1 - (\tau - A^*)]pF_K(K^*, L^*) = [1 - \eta(\tau - A^*)]r \quad \text{(A.19)}$$

$$pF_L(K^*, L^*) = w \quad \text{(A.20)}$$

$$pF(K^*, L^*) - wL^* - \eta rK^* = C'(A^*) \quad \text{(A.21)}$$

Note that equations (A.19) to (A.21) implicitly define $K^*$ and $L^*$ and thus the output quantity $F(K^*, L^*)$ as a function of $p$, which is the product supply function. Setting the product supply to be equal to product demand will generate the equilibrium price $p^*$ as a function of λ with $\frac{dp^*}{d\lambda} < 0$, i.e., more elastic demand results in lower product prices. Note that $A^*$ depends on λ solely through its dependence on $p^*$. Thus, the sign of $\frac{dA^*}{d\lambda}$ depends inversely on the sign of $\frac{\partial A^*}{\partial p^*}$.

Differentiating equation (A.21), where $p$ is replaced with $p^*$, with respect to $\lambda$ results in

$$C''(A)\frac{dA^*}{d\lambda} = \frac{dp^*}{d\lambda}F + [p^*F_K(K^*, L^*) - \eta r]\frac{dK^*}{d\lambda} + [p^*F_L(K^*, L^*) - w]\frac{dL^*}{d\lambda}$$

$$= \frac{dp^*}{d\lambda}F + [p^*F_K(K^*, L^*) - \eta r]\frac{dK^*}{d\lambda} \quad \text{(A.22)}$$

where the second equality is due to equation (A.20), $p^* F_L(K^*, L^*) = w$, where we replace $p$ by $p^*$.

First note that, when $\eta = 1$, equation (A.19) implies that $p^* F_K(K^*, L^*) = r$, where we replace $p$ by $p^*$. Then, equation (A.22) becomes

$C''(A)\frac{dA^*}{d\lambda} = \frac{dp^*}{d\lambda}F + [p^* F_K(K^*, L^*) - r]\frac{dK^*}{d\lambda} = \frac{dp^*}{d\lambda}F < 0$, resulting in $\frac{dA^*}{d\lambda} < 0$. We thus have

**Result 1**: *If* $\eta = 1$, $\frac{dA^*}{d\lambda} < 0$, i.e., tax avoidance decreases in demand elasticity when capital is fully tax deductible.

Second note that, when $0 \leq \eta < 1$, since $\frac{dp^*}{d\lambda} < 0$ and $p^* F_K(K^*, L^*) - \eta r = \frac{(1-\eta)r}{1-(\tau - A^*)} > 0$, $\frac{dA^*}{d\lambda} < 0$ only if $\frac{dK^*}{d\lambda} > 0$. We thus have

**Result 2**: $\frac{dA^*}{d\lambda} > 0$ only if $\frac{dK^*}{d\lambda} > 0$.

Finally, assuming $F(K, L) = K^\alpha L^\beta$ and $C(A) = \frac{1}{2}kA^2$, since the first order conditions are of the same form, similar algebra will result in $\frac{\alpha}{r}\,\beta^{\frac{1-\alpha}{\alpha}}(p^*)^{\frac{1}{\alpha}}\frac{[1-(\tau - A^*)]}{[1-\eta(\tau - A^*)]}(kA^*)^{-\frac{1-\alpha-\beta}{\alpha}} = (w)^{\frac{\beta}{\alpha}}$. Since the sign of the sign of $\frac{dA^*}{d\lambda}$ depends inversely on the sign of $\frac{\partial A^*}{\partial p^*}$ and that $\frac{\partial A^*}{\partial p^*} < 0$ if and only if $\frac{\partial f(A^*)}{\partial A^*} > 0$, where recall that $f(A^*) = \frac{[1-(\tau - A^*)]}{[1-\eta(\tau - A^*)]}$. We thus have $\frac{dA^*}{d\lambda} > 0$ if and only if $\frac{\partial f(A^*)}{\partial A^*} > 0$, which is the same condition as in the previous case. This results in

**Result 3**: $\frac{dA^*}{d\lambda} > 0$ only if 1) η is sufficiently small and 2) $\alpha + \beta$ is sufficiently large and $\frac{\alpha}{\beta}$ is sufficiently large; one necessary condition is that $2\alpha + \beta > 1$.

**Appendix C: Variable Definitions**

| **Firm-Level Variables** | |
|---|---|
| *Cash ETR 1* | *Cash ETR 1* is cash taxes paid scaled by pre-tax income in the current year, winsorized at 0 and 1. |
| *Cash ETR 3* | *Cash ETR 3* is the sum of cash taxes paid during *t* – 2 and *t* scaled by the sum of pre-tax income in the current year during *t* – 2 and *t*, winsorized at 0 and 1. |
| *GAAP ETR 1* | *GAAP ETR 1* is tax expenses paid scaled by pre-tax income in the current year, winsorized at 0 and 1. |
| *GAAP ETR 3* | *GAAP ETR 3* is the sum of tax expenses paid during *t* – 2 and *t* scaled by the sum of pre-tax income in the current year during *t* – 2 and *t*, winsorized at 0 and 1. |
| *Total Similarity* | *Total Similarity* is the firm-by-firm pairwise similarity score based on product descriptions from Hoberg and Phillips (2016). |
| *TNIC HHI* | *TNIC HHI* is the firm specific industry concentration measure based on *text*-based network industry classifications (TNIC) from Hoberg and Phillips (2016). |
| *Tariff Cut* | *Tariff Cut* is a dummy variable equal to one if there is a substantial import tariff cut according to Frésard (2010) in *t* or *t* - 1. A substantial tariff cut is one that is above three times the median tariff cut in the industry. |
| *Labor Skill Index* | *Labor Skill Index* is the industry specific labor skill index as defined by Ghaly, Dang, and Stathopoulos (2017). |
| *Investment* | *Investment* is capital expenditures scaled by lagged PPE. |
| *Cash* | *Cash* is cash scaled by lagged total assets. |
| *Income* | *Income* is EBITDA scaled by lagged total assets. |
| *Sales Growth* | *Sales Growth* is the natural logarithm of the growth rate of sales from *t*–1 to *t*. |
| *Leverage* | *Leverage* is total debt scaled by total assets. |
| *Size* | *Size* is the natural logarithm of total assets |
| *Profit margin* | *Profit margin* is pre-tax income scaled by sales |
| *Multinational* | *Multinational* is a dummy variable equal to one if the firm has non-missing values for pre-tax income from foreign operations above 0.2% of total assets and zero otherwise. In our triple difference analysis, we require only non-missing observations when calculating *Multinational*. |
| *LCF* | *LCF* is a dummy variable equal to one if the firm has non-missing, non-zero values for tax loss carryforwards and zero otherwise. |
| *Intangibles* | *Intangibles* is the ratio of intangible assets to total assets. |
| *PPE* | *PPE* is the ratio of gross property, plant, and equipment to total assets. |
| *R&D* | *R&D* is the ratio of R&D expenses to sales. We replace missing values with 0 (Dyreng, Hanlon, and Maydew 2010). |
| *Advertising* | *Advertising* is the ratio of advertising expenses to Sales. We replace missing values with 0 (Dyreng, Hanlon, and Maydew 2010). |
| *SG&A* | *SG&A* is the ratio of selling, general, and administrative expense to sales. We replace missing values with 0 (Dyreng, Hanlon, and Maydew 2010). |
| *Special Items* | *Special Items* is the ratio of special items to total assets. |

**Table 1: Summary Statistics**

This table presents descriptive statistics of our main variables for 38,127 observations over 1996–2015. Summary statistics on tariff cuts (labor skill index) are based on 6,925 (38,087) observations. Variables are defined in Appendix B.

| Variable | Mean | Standard Deviation | 25th Percentile | Median | 75th Percentile |
|---|---|---|---|---|---|
| Cash ETR | 0.2778 | 0.2185 | 0.1192 | 0.2611 | 0.3699 |
| Total Similarity | 3.0761 | 3.6780 | 1.2156 | 1.7594 | 3.4439 |
| TNIC HHI | 0.2400 | 0.2152 | 0.0917 | 0.1655 | 0.3122 |
| Tariff Cut | 0.7667 | 0.4229 | 0.0000 | 1.0000 | 1.0000 |
| Labor Skill Index | 3.1554 | 0.4159 | 2.9695 | 3.1811 | 3.3880 |
| Cash | 0.1459 | 0.1668 | 0.0226 | 0.0786 | 0.2122 |
| Income | 0.1767 | 0.1051 | 0.1072 | 0.1548 | 0.2211 |
| Sales Growth | 0.2430 | 0.3449 | 0.0468 | 0.1866 | 0.3837 |
| Leverage | 0.2045 | 0.1797 | 0.0290 | 0.1835 | 0.3282 |
| Size | 6.5157 | 2.0174 | 5.0902 | 6.4646 | 7.8220 |
| Investments | 0.1296 | 0.0983 | 0.0637 | 0.1010 | 0.1651 |
| Multinational | 0.3839 | 0.4983 | 0.0000 | 0.0000 | 1.0000 |
| LCF | 0.3385 | 0.4732 | 0.0000 | 0.0000 | 1.0000 |
| Intangibles | 0.1592 | 0.1833 | 0.0081 | 0.0869 | 0.2551 |
| PPE | 0.4974 | 0.3834 | 0.1807 | 0.4022 | 0.7480 |
| R&D | 0.0249 | 0.0515 | 0.0000 | 0.0000 | 0.0208 |
| Advertising | 0.0092 | 0.0229 | 0.0000 | 0.0000 | 0.0058 |
| SG&A | 0.1993 | 0.1636 | 0.0719 | 0.1741 | 0.2944 |
| Special Items | -0.0040 | 0.0161 | -0.0052 | 0.0000 | 0.0000 |

## Table 2: Baseline Panel Regression Results

This table presents the regression results on tax avoidance behavior over 1996–2015. The dependent variable is *Cash ETR*. The independent variables are defined in Appendix B. We include year fixed effects in both regressions. We report robust standard errors clustered at the firm level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

| | **Total Similarity × –1** | **TNIC HHI** |
|---|---|---|
| | (1) | (2) |
| **Market Power** | **0.0038*** ** | **0.0211*** ** |
| | **(0.0005)** | **(0.0075)** |
| Cash | -0.0129 | -0.0141 |
| | (0.0130) | (0.0130) |
| Income | -0.1412*** | -0.1351*** |
| | (0.0171) | (0.0171) |
| Sales Growth | -0.0443*** | -0.0482*** |
| | (0.0049) | (0.0048) |
| Leverage | -0.0700*** | -0.0709*** |
| | (0.0119) | (0.0119) |
| Size | -0.0021** | -0.0031*** |
| | (0.0010) | (0.0010) |
| Investments | 0.0176 | 0.0096 |
| | (0.0164) | (0.0164) |
| Multinational | 0.0159*** | 0.0202*** |
| | (0.0035) | (0.0035) |
| LCF | -0.0379*** | -0.0378*** |
| | (0.0035) | (0.0035) |
| Intangibles | 0.0262** | 0.0351*** |
| | (0.0115) | (0.0115) |
| PPE | -0.0442*** | -0.0437*** |
| | (0.0059) | (0.0060) |
| R&D | -0.4795*** | -0.5390*** |
| | (0.0485) | (0.0472) |
| Advertising | 0.0577 | 0.0681 |
| | (0.0769) | (0.0769) |
| Special Items | -3.3377*** | -3.3404*** |
| | (0.0973) | (0.0975) |
| SG&A | 0.0735*** | 0.0770*** |
| | (0.0146) | (0.0147) |
| Year FE | Yes | Yes |
| Observations | 38,127 | 38,127 |
| Adjusted $R^2$ | 0.119 | 0.116 |

## Table 3: Capital Productivity, Market Power, and Tax Avoidance

This table presents the regression results on tax avoidance behavior over 1996–2015. The dependent variable is *Cash ETR*. The independent variables are defined in Appendix B. We estimate labor (*Beta*) and capital productivity (*Alpha*) separately for each the Hoberg and Philips (2016) 10K Industry using the following equation: *ln(Sales) = Alpha * ln(TotalAssets) + Beta * HoursWorked + Firm FE + Year FE + ε*. The variable *HoursWorked* is the product of number of employees and the average hours worked per year (using OECD data). We run this regression for each of the 50 industry classifications. In this table, we use the standardized Alpha estimates and the Alpha to Beta ratio with a mean of zero and a standard deviation of one. We include year fixed effects. We report robust standard errors clustered at the firm level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

| | Exp. | **Total Similarity × –1** | | **TNIC HHI** | |
|---|---|---|---|---|---|
| | Sign | (1) | (2) | (3) | (4) |
| Market Power | + | 0.0019*** | 0.0029*** | 0.0212*** | 0.0200*** |
| | | (0.0005) | (0.0005) | (0.0080) | (0.0077) |
| Market Power × Alpha | + | 0.0024*** | | 0.0331*** | |
| | | (0.0004) | | (0.0067) | |
| Market Power × Alpha/Beta | + | | 0.0019*** | | 0.0177*** |
| | | | (0.0005) | | (0.0067) |
| Alpha | – | -0.0048** | | -0.0216*** | |
| | | (0.0024) | | (0.0027) | |
| Alpha/Beta | – | | -0.0002 | | -0.0107*** |
| | | | (0.0021) | | (0.0024) |
| Controls | | Yes | Yes | Yes | Yes |
| Year FE | | Yes | Yes | Yes | Yes |
| Observations | | 38,117 | 38,117 | 38,117 | 38,117 |
| Adjusted R-squared | | 0.120 | 0.117 | 0.122 | 0.120 |

**Table 4: Market Power, R&D Intensity, and Tax Avoidance**

This table presents the regression results on tax avoidance behavior over 1996–2015. The dependent variable is *Cash ETR*. The independent variables are defined in Appendix B. We additionally interact Total Similarity × –1 and TNIC HHI, respectively with a dummy variable equal to one if the firm is above (*High R&D*) or below (*Low R&D*) the top quartile of R&D intensity in a given industry year. All regressions include year fixed effects. We report robust standard errors clustered at the firm level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

| | **Total Similarity × –1** | **TNIC HHI** |
|---|---|---|
| | (1) | (2) |
| Market Power × Low R&D | 0.0046*** | 0.0273*** |
| | (0.0005) | (0.0082) |
| Market Power × High R&D | -0.0005 | -0.0313* |
| | (0.0008) | (0.0161) |
| *Difference in Coefficients* | *0.0050**** | *0.0586**** |
| *[t-stat]* | *[5.34]* | *[3.32]* |
| Controls | Yes | Yes |
| Year FE | Yes | Yes |
| Observations | 38,127 | 38,127 |
| Adjusted R-squared | 0.1197 | 0.1162 |

**Table 5: Market Power and Cash ETRs around the 1997 Check-the-Box Regulation:**

This table presents the regression results on tax avoidance behavior over 1992–2000. The dependent variable is *Cash ETR*. We compare high similarity firms and low similarity firms (low and high concentration). Firms above (below) the median *Total Similarity* (*TNIC HHI*) are denoted *Low Market Power* firms. The variable *Post* is a dummy variable equal to one for years after 1996. The variable Multinational is a dummy equal to one if a firm has non-negative pre-tax foreign income (of at least 0.2% of total assets) and zero if non-missing foreign income is below this threshold. The independent variables are defined in Appendix B. We include include industry–year fixed effects in both columns. We report robust standard errors clustered at the firm level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

| | **Total Similarity** | **TNIC HHI** |
|---|---|---|
| | (1) | (2) |
| Low Market Power | -0.0021 | -0.0368 |
| | (0.0301) | (0.0292) |
| Low Market Power × Post | 0.1078** | 0.0991** |
| | (0.0485) | (0.0471) |
| **Low Market Power × Post × Multinational** | **-0.1161**** | **-0.1084**** |
| | **(0.0498)** | **(0.0491)** |
| Controls | Yes | Yes |
| Industry–Year FE | Yes | Yes |
| Observations | 4,371 | 4,371 |
| Adjusted $R^2$ | 0.269 | 0.269 |

**Table 6: Consumer Demand Elasticity, Labor Supply Elasticity, and Cash ETRs**

This table presents the regression results on tax avoidance behavior over 1974–2005. The dependent variable is *Cash ETR*. The variable *Tariff Cut* is a dummy variable equal to one after there is a substantial tariff cut according to Frésard (2010) in an industry. We include industry–year and firm fixed effects in Column (1). In Column (2), we use the industry-specific proxy for labor skill by Ghaly, Dang, and Stathopoulos (2017). In these tests, we include year fixed effects. Other control variables are defined in Appendix B. We report robust standard errors clustered at the industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

| | (1) | (2) |
|---|---|---|
| Tariff Cut | -0.1161** | |
| | (0.0498) | |
| Labor Skill Index | | -0.0085* |
| | | (0.0048) |
| Controls | Yes | Yes |
| Firm FE | Yes | No |
| Industry–Year FE | Yes | No |
| Year FE | No | Yes |
| Observations | 4,371 | 38,093 |
| Adjusted $R^2$ | 0.269 | 0.066 |

**Table 7: Market Power and Investment**

This table examines investment responses in the different setting from Table 2, 3, 4, and 5. We use the ratio of capital expenditures over total assets (*Investments*) as dependent variables. All other independent variables are included. The fixed effects and the calculation of standard errors follow the respective table. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

| | Exp. Sign | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| TNIC Similarity | + | 0.0010*** | | | | | |
| | | (0.0003) | | | | | |
| TNIC HHI | – | | -0.0120*** | | | | |
| | | | (0.0035) | | | | |
| High Similarity × Post × Multinational | | | | 0.0302* | | | |
| | | | | (0.0156) | | | |
| Low Concentration × Post ×Multinational | | | | | 0.0417** | | |
| | | | | | (0.0168) | | |
| Tariff Cut | | | | | | 0.0117* | |
| | | | | | | (0.0068) | |
| Labor Skill Index | | | | | | | 0.0052** |
| | | | | | | | (0.0022) |
| Controls | | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry FE | | Yes | Yes | No | No | No | No |
| Firm FE | | No | No | No | No | Yes | Yes |
| Year FE | | Yes | Yes | No | No | No | No |
| Industry-Year FE | | No | No | Yes | Yes | Yes | Yes |
| Clustering | | Firm | Firm | Firm | Firm | Industry | Ind-Year |
| Observations | | 38,045 | 38,045 | 4,668 | 4,668 | 5,469 | 51,847 |
| Adjusted $R^2$ | | 0.313 | 0.313 | 0.922 | 0.926 | 0.614 | 0.204 |

# Appendix – Additional Tables

## Table A.1: Baseline Panel Regression Results with CashETR3

This table presents the regression results on tax avoidance behavior over 1996–2015. The dependent variable is the three-year cash ETR (*Cash ETR 3*). The independent variables are defined in Appendix B. We include year fixed effects in both columns. We report robust standard errors clustered at the firm level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

| | **Total Similarity × –1** | **TNIC HHI** |
|---|---|---|
| | (1) | (2) |
| **Market Power** | **0.0031*** ** | **0.0222*** ** |
| | **(0.0005)** | **(0.0076)** |
| Controls | Yes | Yes |
| Year FE | Yes | Yes |
| Observations | 38,129 | 38,127 |
| Adjusted $R^2$ | 0.088 | 0.086 |

## Table A.2: Capital Productivity, Market Power, and Tax Avoidance

This table presents the regression results on tax avoidance behavior over 1996–2015. The dependent variable is the three-year cash ETR (*Cash ETR 3*). The independent variables are defined in Appendix B. We estimate labor (*Beta*) and capital productivity (*Alpha*) separately for each the Hoberg and Philips (2016) 10K Industry using the following equation: *ln(Sales) = Alpha * ln(TotalAssets) + Beta * HoursWorked + Firm FE + Year FE + ε*. The variable *HoursWorked* is the product of number of employees and the average hours worked per year (using OECD data). We run this regression for each of the 50 industry classifications. In this table, we use the standardized Alpha estimates and the Alpha to Beta ratio with a mean of zero and a standard deviation of one. We include year fixed effects in all columns. We report robust standard errors clustered at the firm level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

| | Exp. | **Total Similarity × –1** | | **TNIC HHI** | |
|---|---|---|---|---|---|
| | Sign | (1) | (2) | (3) | (4) |
| Market Power | + | 0.0009** | 0.0020*** | 0.0207*** | 0.0209*** |
| | | (0.0005) | (0.0005) | (0.0080) | (0.0077) |
| Market Power × Alpha | + | 0.0029*** | | 0.0234*** | |
| | | (0.0004) | | (0.0075) | |
| Market Power × Alpha/Beta | + | | 0.0026*** | | 0.0094 |
| | | | (0.0005) | | (0.0066) |
| Alpha | – | -0.0032 | | | |
| | | (0.0025) | | | |
| Alpha/Beta | – | | 0.0027 | -0.0184*** | -0.0072*** |
| | | | (0.0021) | (0.0027) | (0.0023) |
| Controls | | Yes | Yes | Yes | Yes |
| Year FE | | Yes | Yes | Yes | Yes |
| Observations | | 38,119 | 38,119 | 38,119 | 38,119 |
| Adjusted R-squared | | 0.093 | 0.089 | 0.089 | 0.086 |

#

## Table A.3: Market Power, R&D Intensity, and Tax Avoidance

This table presents the regression results on tax avoidance behavior over 1996–2015. The dependent variable is the three-year cash ETR (*Cash ETR 3*) in Columns (1) and (2). The independent variables are defined in Appendix B. We additionally interact Total Similarity × –1 and TNIC HHI, respectively with a dummy variable equal to one if the firm is above (*High R&D*) or below (*Low R&D*) the top quartile of R&D intensity in a given industry year. All regressions include year fixed effects. We report robust standard errors clustered at the firm level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

| | **Total Similarity × –1** | **TNIC HHI** |
|---|---|---|
| | (1) | (2) |
| Market Power × Low R&D | 0.0040*** | 0.0315*** |
| | (0.0005) | (0.0083) |
| Market Power × High R&D | -0.0018** | -0.0429*** |
| | (0.0008) | (0.0149) |
| *Difference in Coefficients* | *0.0058**** | *0.0744**** |
| *[t-stat]* | *[5.93]* | *[4.56]* |
| Controls | Yes | Yes |
| Year FE | Yes | Yes |
| Observations | 38,129 | 38,127 |
| Adjusted R-squared | 0.0896 | 0.1162 |

## Table A.4: Market Power and Cash ETRs around the 1997 Check-the-Box Regulation:

This table presents the regression results on tax avoidance behavior over 1992–2000. The dependent variable is the three-year cash ETR (*Cash ETR 3*). We compare high similarity firms and low similarity firms (low and high concentration). Firms above (below) the median *Total Similarity* (*TNIC HHI*) are denoted *Low Market Power* firms. The variable *Post* is a dummy variable equal to one for years after 1996. The variable Multinational is a dummy equal to one if a firm has non-negative pre-tax foreign income (of at least 0.2% of total assets) and zero if non-missing foreign income is below this threshold. The independent variables are defined in Appendix B. We include year fixed effects in both columns. We report robust standard errors clustered at the firm level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

| | **Total Similarity** | **TNIC HHI** |
|---|---|---|
| | (1) | (2) |
| Low Market Power | -0.0001 | -0.0165 |
| | (0.0309) | (0.0289) |
| Low Market Power × Post | 0.1141** | 0.0553 |
| | (0.0453) | (0.0435) |
| **Low Market Power × Post × Multinational** | **-0.1090**** | **-0.0604** |
| | **(0.0473)** | **(0.0456)** |
| Controls | Yes | Yes |
| Industry–Year FE | Yes | Yes |
| Observations | 4,371 | 4,371 |
| Adjusted $R^2$ | 0.256 | 0.220 |

**Table A.5: Consumer Demand Elasticity, Labor Supply Elasticity, and Cash ETRs**

This table presents the regression results on tax avoidance behavior over 1974–2005. The dependent variable is the three-year cash ETR (*Cash ETR 3*). The variable *Tariff Cut* is a dummy variable equal to one after there is a substantial tariff cut according to Frésard (2010) in an industry. We include industry–year and firm fixed effects in Column (1). In Column (2), we use the industry-specific proxy for labor skill by Ghaly, Dang, and Stathopoulos (2017). In these tests, we include year fixed effects. Other control variables are defined in Appendix B. We report robust standard errors clustered at the industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

| | (1) | (2) |
|---|---|---|
| Tariff Cut | -0.1090** | |
| | (0.0473) | |
| Labor Skill Index | | -0.0107** |
| | | (0.0044) |
| Controls | Yes | Yes |
| Firm FE | Yes | No |
| Industry–Year FE | Yes | No |
| Year FE | No | Yes |
| Observations | 4,371 | 38,093 |
| Adjusted $R^2$ | 0.256 | 0.066 |

**Table A.6: Robustness to Using GAAP ETR**

This table replicates our main results from Table 2, 3, 4, and 5 but uses the one-year GAAP ETR. The fixed effects and the calculation of standard errors follow the respective table. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

| | Exp. Sign | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| TNIC Similarity | – | -0.0034*** | | | | | |
| | | (0.0005) | | | | | |
| TNIC HHI | + | | 0.0227*** | | | | |
| | | | (0.0074) | | | | |
| High Similarity × Post × Multinational | | | | -0.0980** | | | |
| | | | | (0.0424) | | | |
| Low Concentration × Post ×Multinational | | | | | -0.0761* | | |
| | | | | | (0.0407) | | |
| Tariff Cut | | | | | | -0.0375** | |
| | | | | | | (0.0162) | |
| Labor Skill Index | | | | | | | -0.0106** |
| | | | | | | | (0.0043) |
| Controls | | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm FE | | No | No | No | No | Yes | Yes |
| Year FE | | Yes | Yes | No | No | No | No |
| Industry-Year FE | | No | No | Yes | Yes | Yes | Yes |
| Clustering | | Firm | Firm | Firm | Firm | Industry | Ind-Year |
| Observations | | 34,117 | 34,117 | 3,937 | 3,937 | 5,346 | 33,877 |
| Adjusted $R^2$ | | 0.132 | 0.129 | 0.285 | 0.285 | 0.467 | 0.109 |

**Table A.7: Robustness to Excluding for Unsuccessful Tax Avoiders**

This table replicates our main results from Table 2, 3, 4, and 5 but excludes unsuccessful tax avoiders according to Saavedra (2017). All specifications follow the respective main table. The fixed effects and the calculation of standard errors follow the respective table. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

| | Exp. Sign | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| TNIC Similarity | – | -0.0037*** | | | | | |
| | | (0.0004) | | | | | |
| TNIC HHI | + | | 0.0201*** | | | | |
| | | | (0.0067) | | | | |
| High Similarity × Post × | | | | -0.0931** | | | |
| Multinational | | | | (0.0423) | | | |
| Low Concentration | | | | | -0.0819* | | |
| × Post ×Multinational | | | | | (0.0436) | | |
| Tariff Cut | | | | | | -0.0440** | |
| | | | | | | (0.0184) | |
| Labor Skill Index | | | | | | | -0.0149*** |
| | | | | | | | (0.0046) |
| Controls | | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry FE | | Yes | Yes | No | No | No | No |
| Firm FE | | No | No | No | No | Yes | No |
| Year FE | | Yes | Yes | No | No | No | Yes |
| Industry-Year FE | | No | No | Yes | Yes | Yes | No |
| Clustering | | Firm | Firm | Firm | Firm | Industry | Ind-Year |
| Observations | | 36,270 | 36,272 | 4,061 | 4,061 | 4,353 | 36,078 |
| Adjusted $R^2$ | | 0.115 | 0.104 | 0.259 | 0.257 | 0.449 | 0.094 |