# Three Essays on Profit Shifting

by

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**A dissertation submitted in partial fulfillment**
**of the requirements for the degree of**
**Doctor of Philosophy**
**(Economics)**
**in the University of Michigan**
**2014**

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## Dedication

To my parents

## Acknowledgment

I thank Jim Hines, Charlie Brown, Cathy Shakespeare, Joel Slemrod, Nic Duquette, Christian Gillitzer, Dave Knapp, and seminar participants at the University of Michigan for their helpful comments and suggestions.

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# 1 Introduction

To maximize after-tax profits, a multinational corporation that has related firms (affiliates) located across a number of countries has an incentive to shift profits from an affiliate that faces a high corporate tax rate to an affiliate the faces a lower corporate tax rate. Manipulating transfer prices is one of the main means by which corporations reallocate profits. When goods and services are transferred between members of the multinational corporation, the transactions must be valued so that each individual member of the multinational can establish its taxable profits. The prices used for these related-party transactions are referred to as the transfer prices. By under-valuing goods or services passed from a high-tax affiliate to a low-tax affiliate or over-valuing goods or services passed from a low-tax affiliate to a high-tax affiliate, the multinational corporation is able to shift profits to the lower-tax firm. While these transactions are supposed to occur at "arm's length" prices, i.e. the transaction should be priced as it would be if it were occurring between two unrelated parties, difficulty in establishing exactly what the "arm's length" price would be provides an opportunity to shift profit to low-tax countries.

The recent launching of the OECD action plan on Base Erosion and Profit Shifting (BEPS) is indicative of the increased attention that many countries are turning towards the issue of multinational corporations using transfer prices to shift profits. While the number of countries with regulations designed to make profit shifting more costly, and the complexity of the regulations in place, have increased dramatically in recent years, little is understood about how these regulations affect the behavior of multinational corporations. Specifically, for governments interested in increasing tax revenue, nothing has been done to capture the full effect of increased transfer-pricing regulation on the reported profits of the local affiliate of a multinational corporation. This paper is the first to consider how changes in transfer-pricing enforcement affect three components that determine a local affiliate's reported profits: the amount that is shifted out to other affiliates of the multinational corporation, the amount that is shifted in from other affiliates of the multinational corporation, and the affiliate's costs of doing business.

This paper presents a model that illustrates that increased regulation can actually reduce the reported profits of local affiliates of multinational corporations. While past papers have focused solely on how regulations affect an affiliate's ability to shift profit out to other related parties, this paper uses a model of affiliate-to-affiliate profit-shifting flows to show that regulation will not just affect how much profit is shifted out (outflows), but that it will also affect both how much profit is shifted in (inflows) and the affiliate's cost of doing business. The potential for increased regulation to affect true profits in the longer run is also discussed.

For firms that are using related-party transactions to shift profits, the effect of increased regulation on reported profits will depend on how the magnitude of the increase in costs compares to the magnitude of the change in profit-shifting flows. If the increase in costs is large or the decrease in outflows is small, then a firm would be expected to reduce reported profits in response to an increase in regulation. For firms that have related-party transactions that are not being used for profit shifting, the sole effect of increased regulation is to increase the cost of doing business. For these firms, increased regulation will reduce reported profits. Overall, the model suggests that many firms would be expected to reduce reported profits in response to increased transfer-pricing regulation. The effect of increased regulation on the reported profits of a specific firm, however, should depend on the distribution of the other affiliates that are a part of the multinational corporation, as that is what will determine the effect that regulation has on outflows and inflows.

To consider the question of how increased regulation affects reported profits empirically, panel data on the reported profits of multinational corporations at the affiliate level are obtained from the ORBIS database. Changes in transfer-pricing regulation are measured using an index of transfer-pricing risk. Regressing reported profits on the index of transfer-pricing risk reveals a negative relationship between increased regulation and reported profits. The results suggest that the effect of regulation on the cost of doing business must be large relative to the effect of regulation on the amount of profit that is shifted out. This indicates that countries should not expect increased regulation to increase corporate tax collections, and calls into question the optimality of the strategies aimed at increased regulation that have been pursued by many countries in recent years.

The baseline results suggest that an increase of one category in transfer-pricing audit risk reduces reported profits by approximately 1.5%. The magnitude of this effect suggests that the costs associated with increased regulations must be high. While there are many direct costs of increased regulation, e.g. the need to produce more detailed documentation, the magnitude of this result is probably indicative of multinational corporations responding to changes in regulation by making more structural changes, such as changing the path used to

shift profits or having to shift some operations out of higher-tax locations and to lower-tax locations in order to facilitate profit shifting. The effect is less negative for firms that have affiliates in lower-tax countries, which is consistent with increased enforcement decreasing profit-shifting outflows. The fact that the effect is still negative, however, again suggests that the effect of regulation on the costs of doing business is large.

The remainder of the paper is structured as follows. Section 2 provides some background on profit shifting and the use of transfer pricing manipulation. It also discusses previous studies of profit shifting, and the assumptions these studies have made about the costs and benefits of profit shifting. Section 3 introduces a model of optimal profit shifting which allows for both differential enforcement across countries and multiple avenues through which enforcement can affect the cost of profit shifting. Section 4 discusses the data used to test the predictions of the model. Section 5 contains the empirical results. The conclusions and implications are discussed in Section 6.

# 2 Past research on profit shifting

As discussed briefly in the introduction, a multinational corporation can inflate its reported pre-tax profits in low-tax locations by manipulating the transfer prices it uses in related-party transactions.[1] While countries attempt to limit the opportunities for profit shifting by requiring related parties to use the same price that would be set if the transaction were between unrelated parties, in practice it is often extremely difficult to find a comparable transaction between unrelated parties. This is especially true when considering transactions that involve intangibles assets such as intellectual property. There is a growing perception that multinational corporations are using transfer-pricing manipulation to avoid paying their fair share of corporate taxes. This has caused many countries to turn their attention towards trying to limit opportunities for profit shifting. The vast majority of countries now have regulations in place requiring corporations to use arm's length prices. There has also been an increase in the number of countries with other transfer-pricing specific regulation.[2] These regulations include, for example, limitations on the methods that can be used for establishing an arm's length price, specific requirements for the documentation needed to support the transfer prices used and transfer-pricing specific penalties. On top of the increase in regulatory complexity, countries have been devoting increased resources to transfer-pricing compliance, with many countries creating transfer-pricing specific audit teams. The increas-

[1] There are other methods of profit shifting, such as the strategic use of debt, that are not discussed in this paper.

[2] This is emphasized in many of the transfer-pricing surveys published by the Big Four accounting firms. See, for example, pages 6-11 of Ernst & Young (2012).

ing number of publications aimed at helping firms navigate the transfer-pricing environment also reflects this increase in regulatory complexity over time. The effect of the increased focus of tax agencies on transfer-pricing compliance is reflected in surveys by the Big Four accounting firms that indicate that an increasing number of firms identify transfer-pricing compliance as a major tax risk.[3]

Past research on profit shifting has generally been focused on finding evidence that multinationals are responding to the tax differentials that exist across affiliates and on estimating the sensitivity of reported profits to these corporate tax rates. The true profits of the affiliates of multinational corporations are not known to researchers, leading papers to use a variety of methods to estimate the extent to which multinationals actually manipulate the distribution of profits across affiliates in response to tax incentives. Hines and Rice (1994), and some papers that followed, such as Huizinga and Laeven (2008), assume that true profits are generated by a Cobb-Douglas production function and so estimate true profits based on available data on assets, labor compensation and a proxy for productivity. These papers find evidence that reported profits deviate from estimated true profits in a manner that is consistent with profit shifting; higher than expected profits are reported by low-tax affiliates and lower than expected profits are reported by high-tax affiliates. These studies have used a variety of data sets, which results in variation in the magnitude of the estimated responsiveness of reported profits to the corporate tax rate. Heckemeyer and Overesch (2013) do a meta-analysis of the existing literature. They determine that the consensus estimate of the semi-elasticity of reported profits with respect to the corporate tax rate is 0.8, which indicates that a 10 percentage point increase in the corporate tax rate would decrease reported profits by 8%. Clausing (2003) uses a different approach and looks at US intra-firm trade flows. She finds evidence that strongly suggests that sales to low-tax affiliates are underpriced and that sales to high-tax affiliates overpriced, which is consistent with transfer prices being used for the purpose of profit shifting. Dharmapala and Riedel (2013) examine how earnings shocks at the parent level are passed along to subsidiaries and find that earnings shocks are associated with an increase in pre-tax profits at low-tax affiliates relative to high-tax affiliates. This is again suggestive of profit shifting. Their results suggest that 2% of parent income is shifted out to lower-tax affiliates.

Early models of profit shifting, such as those in Hines and Rice (1994) and Grubert and Mutti (1991), gave the simple prediction that the declared profits of affiliate $i$ should depend negatively on the corporate tax rate in affiliate $i$'s home country, $\tau_i$. As mentioned above, a number of studies confirmed this negative relationship between reported profits and the statutory corporate tax rate. The limitations of having to use aggregate data, however,

[3]See, for example, the Ernst & Young 2012 Tax Risk and Controversy Survey.

meant that little attention was given to the role of the tax rates of the other countries in which a multinational operates. Huizinga and Laeven (2008) further solved through the Hines and Rice framework to yield the prediction that the amount of profit shifting into or out of country $i$ depends on the tax rates in all $n$ countries in which the multinational corporation operates, as well as on the tax differentials between country $i$ and all countries $k \neq i$. The main contribution of this extension is that it provides a model driven prediction of the magnitude of shifting and allows to define which countries will be "low tax" enough to be the recipient of shifted profits within a multinational. While previous papers often had to depend on using a specific reference country, so that the set of higher-tax affiliates and a set of lower-tax affiliates were defined, the result by Huizinga and Laeven allows for the flows of profits within a multinational to be modeled more generally. Overall, while there is variation in the methods used and, therefore, in the estimated elasticity of reported profits, papers have generally found evidence that supports the theory that reported profits respond to differences in corporate tax rates.

While the incentives for profit shifting have received a great deal of attention, little attention has been given to what determines the cost of profit shifting. Most theoretical models of optimal profit shifting have simply assumed that the cost of shifting depends on the amount shifted, and have ignored other, likely important, determinants of the cost.[4] As mentioned above, countries are increasingly devoting resources towards trying to prevent profit shifting through transfer pricing manipulation and the strategic use of debt. These changes in the effort and resources devoted to prevent profit shifting should translate into a change in the cost of shifting. Additionally, differences across countries in the strictness of regulation and resources available to limit shifting should change the incentives a firm faces when deciding how to shift profits between affiliates. It should be far more costly to shift profits out of a country with well-trained tax officials and high penalties for transfer pricing abuse than it is to shift profits out of a country where the tax enforcement agency has limited resources. While there have been some papers that have focused on profit shifting in developing countries, with a focus on the fact that these developing countries may be less able to detect, and therefore prevent, profit shifting, e.g.Fuest, Hebous, and Riedel (2011), the only papers in the literature on profit shifting that have explicitly included transfer-pricing enforcement effort as a factor in determining the responsiveness of reported profits to corporate tax differentials are Bartelsman and Beetsma (2003), Lohse and Riedel (2012), Beer and Loeprick (2013), and Klassen and Laplante (2012).

In Bartelsman and Beetsma (2003), transfer-pricing enforcement is not added to the

[4]These models have assumed that the cost of shifting is an increasing non-linear function of the amount shifted. This assumption means that there will be an interior solution for optimal shifting.

theoretical model of optimal profit shifting that is used to develop their empirical strategy, but they do add a rough measure of enforcement as a robustness check in their empirical section. They create an enforcement index for each country in their sample based on (1) the existence of explicit transfer pricing rules, (2) the existence of formal transfer pricing documentation rules and (3) the existence of transfer pricing specific penalties. They include this enforcement index in country $i$ as a determinant of the reported value added by the firm in country $i$. They find that the responsiveness of reported value added to tax differentials seems to be stronger for observations with lax enforcement than it is for observations with strict enforcement. While an important first step, the measure of enforcement used does not allow for a great deal of variation and their data set only includes multinational firms located in 16 different countries. Additionally, from the perspective of a government, the question when considering stricter enforcement is not simply one of if that enforcement decreases profit shifting, but rather if that stricter enforcement would be expected to increase tax revenue.

Lohse and Riedel (2012) use an index of transfer-pricing documentation requirements to proxy for enforcement, where countries are placed in one of three possible categories. While this measure captures differences in cost due to stricter documentation requirements, it has clear limitations because it does not capture how likely it is that the documentation will actually be examined or the likelihood of penalties being imposed if the transfer prices are challenged. The advantage to the measure, however, is that the information needed is available for both a large set of countries and a long time period. Using this measure of enforcement, they find, using a firm fixed-effects approach, that increased enforcement decreases reported profit, but that the effect is less negative for higher tax rate countries. They use this evidence to conclude that transfer-pricing regulation is key if a government wishes to make reported profits less responsive to increases in the corporate tax rate. Their results suggest that documentation requirements reduce the responsiveness of reported profits to the corporate tax rate by 50%. They focus on how enforcement affects profit shifting, which, although important, is only one part of the effect of enforcement on reported profits.

Beer and Loeprick (2013) look at the initial date of introduction of mandatory transfer-pricing documentation requirements across countries. Unlike other papers, they consider the time path of the response of reported profits to the mandatory requirement. The find that the interaction of a variable capturing the number of years since the implementation of the documentation requirement and the corporate income tax differential between an firm and its affiliates has a negative, but insignificant coefficient. A quadratic in the time since the introduction of the documentation requirement interacted with the same tax differential, however, has a positive and significant coefficient. They take this to indicate that it takes time

for documentation requirements to reduce profit shifting. It is difficult to tell if this lagged response is actually due to the documentation requirement taking effect or if it is the result of policies that are likely to follow the implementation of documentation requirements. Their results suggest that, within 4 years, documentation requirements lower the responsiveness of reported profits to the corporate tax rate by about 60%, similar to what is found by Lohse and Riedel. Their paper again focuses solely on how enforcement affects firms responsiveness to tax differentials rather than focusing on the full effect of enforcement.

Klassen and Laplante (2012) give more consideration to the interaction between enforcement and profit shifting by recognizing the role that enforcement in other countries plays in determining profit shifting into and out of the United States. It is the only paper to go beyond looking at the relationship between reported profits and own-country enforcement. They use a number of different measures of transfer pricing regulation for the countries in which a corporation is active and find that lower regulation in the United States is correlated with greater shifting to low-tax locations. While they find some suggestive evidence, they are unable to conclusively support the hypothesis that increases in the regulation parameter decrease shifting into the United States for firms with a high average foreign tax rate. Their paper takes the important step of considering how enforcement efforts in other countries should affect reported profit in the United States, something that is not recognized in the two papers mentioned above.

With the focus governments have placed on transfer-pricing enforcement as a way to increase tax revenues, it seems important to better understand how enforcement levels and changes in enforcement levels over time have affected profit shifting. The papers above all consider the effect that enforcement has on deterring firms from shifting profit out of a given country. This paper will show, in a simple theoretical framework, that enforcement should also be expected to affect shifting in and the cost of doing business. The major contribution that this paper makes to the literature is that it recognizes that these three effects must all be considered when weighing the costs and benefits of increased enforcement. These three effects will also result in heterogeneity in how a firm's reported profit responds to a change in enforcement. Additionally, the model gives a framework in which to consider how enforcement in other countries in which affiliates are located will affect the reported profits of the local affiliate. To capture enforcement, an index of transfer price risk developed in Mescall (2011) is used. Compared to simple measures of documentation requirements, it better captures the full set of transfer-pricing regulations that exist in a given country. The analysis that follows focuses on profit shifting through transfer-pricing manipulation and ignores profit shifting through the strategic use of debt and other mechanisms. This approach seems reasonable given the recent focus on transfer pricing by governments and the

popular press. Additionally, there is a great deal of variation in transfer-pricing enforcement across countries and over time which will allow for the estimation of the effect of increased enforcement. The theoretical framework could be adapted to apply to either method of profit shifting, but, because of the empirical focus, the framework is discussed in terms of the effect of changes in transfer-pricing enforcement.

# 3 Framework

Before moving to the question of how changes in enforcement will affect reported profit, let us first step back and consider what determines reported profits for an affiliate of a multinational corporation. Reported profits can be expressed as:

$$Reported Profits = True Profits - Outflows + Inflows - Costs of Related Party Transactions$$

The basic idea of the model that follows is that a change in enforcement will affect optimal outflows, optimal inflows, and the cost of related-party transactions. The change in outflows is likely to be the only positive effect of increased enforcement on reported profits. An increase in enforcement will increase the costs of related-party transactions. The effect of enforcement on inflows is ambiguous, for reasons discussed below, and must be considered empirically. Reported profits will fall for any firm for whom the decrease in outflows is dominated by the increase in the cost of related-party transactions. The cost of related-party transactions is likely to be composed of a number of different pieces.

Most of the papers that have looked at the effect of enforcement on profit shifting have solely looked at how enforcement affects the amount shifted, and have concluded that enforcement makes firms less responsive to tax differentials. Changes in enforcement, however, should affect outflows, inflows and the cost of shifting. In that respect, there is both a behavioral response to enforcement that must be considered, i.e. changes in optimal shifting, and a direct response, the change in the cost of shifting.

In order to consider variation in enforcement, both across countries and over time, it is necessary to move beyond standard models of profit shifting. Standard multi-country models of profit shifting allow a multinational corporation to maximize after-tax profits with respect to net inflows and outflows of profits, but do not allow the corporation to maximize with respect to gross flows between country pairs. More precisely, the corporation is allowed to select, $S_i$, the net amount of profit that is taken into or out of the affiliate in country $i$, but it is not allowed to select how much goes from country $i$ to country $j$ or from country $k$ to country $i$. The model used in Hines and Rice (1994) and Huizinga and Laeven (2008), for

example, considers a multinational corporation that maximizes:

$$\max_{S_i} \sum_{i=1}^{n} (1-\tau_i)\left(B_i + S_i - \frac{\gamma}{2}\frac{S_i^2}{B_i}\right)$$

subject to the constraint:

$$\sum_{i=1}^{n} S_i = 0$$

where $B_i$ is the true, before tax, profit of the affiliate in country $i$ and $S_i$ is the amount shifted to the affiliate in country $i$ from other affiliates. The corporation maximizes profits by setting net shifting out of country $i$, $S_i$, such that:

$$(1-\tau_i)\left(1 - \frac{\gamma_i}{B_i}S_i\right) - \lambda = 0$$

where $\lambda$ is the multiplier on the constraint that $\sum S_i = 0$. As solved for in Huizinga and Laeven, this means that the net shifting out of country $i$ depends on the corporate tax rate in country $i$ relative to the corporate tax rates in countries $k \neq i$ in the following way:

$$S_i = \frac{B_i}{\gamma(1-\tau_i)} \frac{\sum_{k\neq i}^{n} \frac{(\tau_k - \tau_i)}{(1-\tau_k)} B_k}{\sum_{k=1}^{n} \frac{B_k}{(1-\tau_k)}}$$

The multiplier on the cost of shifting, $\gamma$, can be thought of as representing, among other things, enforcement effort. A higher value of $\gamma$ reduces net shifting out of affiliate $i$.

Variation in enforcement, however, cannot be captured by simply making the multiplier country specific. In considering the profit shifting involving the affiliate in country $i$, net shifting, $S_i$, comes from some profit being shifted in from higher-tax affiliates and some profit being shifted out to lower-tax affiliates. It is not correct, then, to say that the enforcement level in firm $i$'s own country is the only thing that matters in determining the cost of $S_i$. The country that has profit shifted out is likely have a stronger incentive to try to prevent that shifting. This means that the importance of enforcement in country $i$ in determining the cost of shifting will depend on the direction of the gross flow that is being considered. It will likely be very important if we are looking at profits flowing out of country $i$ to country $j$, but it will probably be less important if we are looking at profits flowing out of country $k$ and into country $i$. Enforcement in higher-tax countries, $k$, should play a major role in determining the cost of shifting in from $k$, and enforcement in lower-tax countries, $j$ , will likely play at

least some role in determining the cost of shifting out to the affiliates in lower-tax countries. Additionally, it seems reasonable to assume that the cost of shifting depends not only on net shifting, but also on the magnitude of gross shifting flows. The cost of documentation requirements, for example, should not just depend on the amount of net shifting that a firm does, it should also depend on the number of related party transactions the firm has. A firm that shifts ten thousand dollars in and ten thousand dollars out should face some positive cost of shifting.

Consider a multinational that is active in $n$ countries and has one affiliate in each of those countries. Assume that the affiliate is indexed by the ranking of the corporate tax rate it faces, such that affiliate one faces the lowest corporate tax rate of any affiliate in the multinational corporation, affiliate three faces the third lowest corporate tax rate, etc. Assume that profit flows between countries always move in the direction of the tax differential. [5]

For affiliate $i$ then, $S_i$ is composed of two pieces, profits that flow out to lower-tax countries and profits that flow in from higher-tax countries. This means that $S_i$ can be represented as:

$$S_i = \sum_{j=1}^{i-1} S_{ij} - \sum_{k=i+1}^{n} S_{ki}$$

where $S_{ij}$ is shifting out of country $i$ to country $j$ and $S_{ki}$ is shifting out of country $k$ to country $i$.

Assume that share $\alpha$ , $0 \leq \alpha \leq 1$ , of the cost of shifting from $i$ to $j$, $c_{ij}$, is deducted in the higher-tax country and share $(1 - \alpha)$ is deducted in the lower-tax country. Since deductions have more value in the higher-tax country, it is likely that $\alpha$ is close to one, but this restriction is not imposed. In addition to the costs associated with each related-party transaction, assume, as discussed above, that affiliate $i$ faces a fixed cost of dealing with its home country's regulatory environment, $FC_i$. The inclusion of this fixed cost is intended to capture the fact that a more complex regulatory environment may necessitate hiring an accounting firm or using an accounting firm with greater intensity. This is the cost that is likely to be large, as a firm might, for example, be forced to increase the scale of operations at a low-tax affiliate in order to facilitate profit shifting, even when the direct return of that additional investment is low. This cost is not additive across transactions, although it is still possibly increasing in the number of related party transactions a firm has. This would be

[5] This will always hold if the cost of shifting between two countries only depends on the amount shifted between the two countries. In another paper, Saunders-Scott (2013b), I show that it will not always hold if the cost of shifting between $i$ and $j$ depends on both the amount shifted from $i$ to $j$ and the net amount shifted out of $i$. In this paper, I only consider a model where the gross flow is what matters in determining the cost.

the case if, for example, the fee charged by the accounting was increasing in the size of the firm. It is also possible, however, that it is the firms with complex structures that are most able to adjust to changes in regulation, in which case this cost would be lower for large firms, as those firms have more potential ways to shift profits. This cost could be related, then, to the size of the firm, the number of subsidiaries the firm has, the industry of the firm and any other factors that determine how transfer-pricing regulation affects a firm, but it is not directly a function of a firm's distribution of subsidiaries. This means that the corporation maximizes:

$$\max \sum_{i=1}^{n}(1-\tau_i)(B_i - FC_i - \sum_{j<i} S_{ij} + \sum_{k>i} S_{ki} - \sum_{j<i} \alpha c_{ij} - \sum_{k>i}(1-\alpha)c_{ki}) \tag{3.1}$$

There are a number of things that should contribute to determining the cost of shifting profit between a given pair of affiliates, $c$. In terms of thinking about how regulations affect the cost of shifting, it seems clear that some regulations, such as penalties imposed if a company is found to have manipulated its transfer prices, will mostly contribute to increasing the cost of each dollar of shifting. Other things, however, such as documentation requirements or restrictions on cost-contribution agreements or advance-pricing agreements will have an effect on the cost of doing business for firms that are not actually shifting profit between affiliates. Even an increase in audit risk is likely to increase costs for a firm that is not actually doing any shifting, as that firm will still have to put additional resources towards justifying the transfer prices used in its related party transactions.

In terms of thinking about the cost of shifting and how it relates to the amount shifted then, it seems reasonable to think of the cost as being composed of two pieces. The first piece is essentially the variable cost, $g$, which is increasing in the amount shifted between an affiliate in $i$ and an affiliate in $j$ ($S_{ij}$), the enforcement level in country $i$ ($E_i$), the enforcement level in country $j$ ($E_j$), the true profits in countries $i$ and $j$, ($B_i$ and $B_j$ respectively) and a vector of additional variables ($X_{ij}$), which includes other things that might cause variation in the cost of shifting, such as the sector of the firms. The second piece of the cost function can be thought of as the fixed cost of having related party transactions. This piece, $f$, does not depend on the amount that is shifted between the two affiliates, but does depend on the level of enforcement in each country, the size of each affiliate and other characteristics of the firms.

$$c_{ij} = g(S_{ij}, E_i, E_j, B_i, B_j, X_{ij}) + f(E_i, E_j, B_i, B_j, X_{ij}) \tag{3.2}$$

This could, of course, be rewritten as a single function, where $E_i$ and $E_j$ each appeared

both interacted with $S_{ij}$ and separately on their own, but the form above gives greater clarity to these two different components. Assuming the fixed cost of using the related party transaction is not too high, optimal shifting between the affiliate in country $i$ and country $j$ is determined by:

$$\frac{\partial g_{ij}}{\partial S_{ij}} = \frac{(\tau_i - \tau_j)}{(1 - \alpha_{ij}\tau_i - (1 - \alpha_{ij})\tau_j)} \tag{3.3}$$

where $g_{ij}$ simply indicates that the function $g$ is being evaluated at the values specific to affiliates $i$ and $j$, i.e. $g_{ij} = g(S^*_{ij}, B_i, B_j, E_i, E_j, X_{ij})$. For the firm in country $i$ then, assuming that the fixed cost of related-party transactions is low enough that profits are shifted between each affiliate pair where there is a tax incentive to do so, reported profits will be equal to:

$$\Pi_i^R = \left( B_i - FC_i - \sum_{j=1}^{i-1} S^*_{ij} + \sum_{k=i+1}^{n} S^*_{ki} - \sum_{j=1}^{i-1} \alpha c_{ij} - \sum_{k=i+1}^{n} (1 - \alpha) c_{ki} \right) \tag{3.4}$$

The question of interest in this paper is how a change in enforcement in country $i$ affects reported profits in country $i$. Additionally, we can consider how reported profits in country $i$ are affected by changes in enforcement in countries in which higher-tax affiliates are located and changes in enforcement in countries in which lower-tax affiliates are located.

## 3.1 Response to own-country enforcement

To consider the effect of increased enforcement in country $i$ on the reported profits of the affiliate in country $i$, it is necessary to consider the effect $E_i$ has on outflows, $\sum S^*_{ij}$, on inflows, $\sum S^*_{ki}$, on the cost of outflows, $\sum \alpha_{ij} c_{ij}$ , on the cost of inflows, $\sum (1 - \alpha_{ki}) c_{ki}$, and on $FC_i$. Enforcement is the interaction of many discrete policies, so clearly is not actually a continuous variable, but, for analytical tractability, it is treated as a continuous variable in this section. The actual measure of enforcement I used in the empirical analysis is described is Section 4.1.

$$\frac{d\Pi_i^R}{dE_i} = -\frac{dFC_i}{dE_i} - \sum_{j=1}^{i-1} \frac{dS^*_{ij}}{dE_i} + \sum_{k=i+1}^{n} \frac{dS_{ki}}{dE_i} - \sum_{j=1}^{i-1} \alpha_{ij} \frac{dc_{ij}}{dE_i} - \sum_{k=i+1}^{n} (1 - \alpha_{ki}) \frac{dc_{ki}}{dE_i} \tag{3.5}$$

Evaluating how $S^*_{ij}$ must change in response to an increase in $E_i$, we know that $S^*_{ij}$ must satisfy:

$$\frac{\partial g_{ij}}{\partial S_{ij}} = \frac{(\tau_i - \tau_j)}{(1 - \alpha_{ij}\tau_i - (1 - \alpha_{ij})\tau_j)}$$

Since the right-hand side is unchanged when $E_i$ changes, it must be that $S^*_{ij}$ adjusts to

leave the left-hand side unchanged. This means that:

$$\frac{\partial S_{ij}^{*}}{\partial E_i} = -\left(\frac{\partial^2 g_{ij}}{\partial E_i \partial S_{ij}}\right)\left(\frac{\partial^2 g_{ij}}{\partial S_{ij}^2}\right)^{-1}$$

Evaluating the change in reported profit with respect to a change in enforcement in country $i$ gives the following:

$$\begin{aligned}\frac{d\Pi_i^R}{dE_i} = & \underbrace{\sum_{j=1}^{i-1}\left(\frac{\partial^2 g_{ij}}{\partial E_i \partial S_{ij}}\right)\left(\frac{\partial^2 g_{ij}}{\partial S_{ij}^2}\right)^{-1}}_{A} \underbrace{-\sum_{j=1}^{i-1}\alpha\left(\frac{\partial g_{ij}}{\partial E_i}+\frac{\partial S_{ij}^{*}}{\partial E_i}\frac{\partial g_{ij}}{\partial S_{ij}}+\frac{\partial f_{ij}}{\partial E_i}\right)}_{B} \\ & \underbrace{-\sum_{k=i+1}^{n}\left(\frac{\partial^2 g_{ki}}{\partial E_i \partial S_{ki}}\right)\left(\frac{\partial^2 g_{ki}}{\partial S_{ki}^2}\right)^{-1}}_{C} \underbrace{-\sum_{k=i+1}^{n}(1-\alpha)\left(\frac{\partial g_{ki}}{\partial E_i}+\frac{\partial S_{ki}^{*}}{\partial E_i}\frac{\partial g_{ki}}{\partial S_{ki}}+\frac{\partial f_{ki}}{\partial E_i}\right)}_{D} \\ & \underbrace{-\frac{dFC_i}{dE_i}}_{E}\end{aligned} \tag{3.6}$$

While this expression looks complicated, each term simply captures that a change in enforcement in country $i$ will have an effect on profit-shifting outflows, the cost of profit-shifting outflows, profit-shifting inflows, the cost of profit-shifting inflows, and the fixed cost of doing business respectively. Summation A captures the fact that an increase in enforcement decreases the amount shifted out to each affiliate in a lower-tax country. In considering the cost of outflows, both the change in enforcement and the change in the amount shifted from country $i$ to country $j$ will have an effect on the cost. These changes in costs are captured by the three terms of the summation labeled B. All else equal, an increase in enforcement increases $g_{ij}$, this is captured by the first term of summation B. In response to an increase in enforcement though, there will be a decrease in the amount shifted from $i$ to $j$ and this will decrease $g_{ij}$, this is captured by the second term of the summation B. Finally, an increase in $E_i$ will increase the fixed cost, $f_{ij}$, of having related-party transactions between the affiliate in $i$ and the affiliate in $j$, this is captured by the third term of the summation B. Summation C captures the fact that an increase in enforcement in country $i$ will also change profit-shifting inflows from all higher-tax affiliates. If an increase in enforcement increases the cost of shifting profit in, then this term will be negative, capturing the fact that inflows will decrease and that will reduce reported profits. It is possible, however, that an increase

in enforcement actually makes shifting in less costly, in that case, this term will be positive.[6] Finally, summation D captures the fact that, to the extent that the costs of shifting from a higher-tax affiliate to the affiliate in country $i$ are actually deducted in the lower-tax country, $i$, determined by the value of $\alpha_{ki}$, the change in the cost of shifting from $k$ to $i$ will change reported profits in country $i$. Assume for now that an increase in $E_i$ increases the cost of shifting from $k$ to $i$. In that case, the first part of the summation captures the fact that the increase in the cost $g_{ki}$ that results from the increase in $E_i$ will decrease reported profits. The second piece of the summation captures the fact that the decrease in $S_{ki}$ that results from the increase in $E_i$ will decrease $g_{ki}$ and increase reported profits. Finally, the third piece of summation D captures the fact that an increase in $E_i$ will increase $f_{ki}$, which will decrease reported profit. The final term, $\frac{dFC_i}{dE_i}$, simply captures the fact that an increase in transfer-pricing regulation will increase the fixed cost of doing business in country $i$.

Simplifying the summation a bit more and grouping terms gives the following:

$$\begin{aligned}\frac{d\Pi_i^R}{dE_i} = & \sum_{j=1}^{i-1}\left(\left(1+\alpha\frac{\partial g_{ij}}{\partial S_{ij}}\right)\left(\frac{\partial^2 g_{ij}}{\partial E_i \partial S_{ij}}\right)\left(\frac{\partial^2 g_{ij}}{\partial S_{ij}^2}\right)^{-1} - \alpha\frac{\partial g_{ij}}{\partial E_i} - \alpha\frac{\partial f_{ij}}{\partial E_i}\right) - \\ & \sum_{k=i+1}^{n}\left(\left(1-(1-\alpha)\frac{\partial g_{ki}}{\partial S_{ki}}\right)\left(\frac{\partial^2 gki}{\partial E_i \partial S_{ki}}\right)\left(\frac{\partial^2 g_{ki}}{\partial S_{ki}^2}\right)^{-1} + (1-\alpha)\frac{\partial g_{ki}}{\partial E_i} + (1-\alpha)\frac{\partial f_{ki}}{\partial E_i}\right) \\ & -\frac{dFC_i}{dE_i}\end{aligned} \tag{3.7}$$

Under the assumption that an increase in enforcement also makes it more costly to shift profits in, the first term of the first summation of equation 3.7 is the only positive term in the expression. For an increase in enforcement in affiliate $i's$ home country to have a positive effect on its reported profit, it must be that this first term is large relative to the other, negative, terms. For the majority of firms, then, it seems that an increase in enforcement should actually be expected to decrease reported profits.

For a firm with only higher-tax affiliates, the effect should be unambiguously negative. For a firm with only lower-tax subsidiaries, the second summation would disappear. This means that there an increase in its home country's enforcement level would increase reported profits if the first summation is positive enough to offset the increase in the fixed cost of doing business. The only way the first summation can be positive is if, for each transaction

[6]It could be possible, for example, that increased enforcement in country $i$ means that officials in country $k$ trust the reported profits in country $i$ more, and, therefore, actually pay less attention to transactions between the affiliate in country $k$ and the affiliate in country $i$. In that case, the increase in enforcement could actually make it easier to shift from $k$ to $i$. While it still seems likely that enforcement in the lower-tax country would increase the cost of shifting to that country, the question of how enforcement maps to the cost of enforcement is ambiguous from the perspective of theory and is ultimately an empirical question.

with lower-tax affiliates, the reduction in the profit shifted out and the decrease in the cost that results from that is greater than the direct effect of enforcement on the variable cost of shifting and the direct effect of enforcement on the fixed-cost of the related-party transaction. If this is true, then it would suggest that the response of reported profits to own-country enforcement should be less negative for firms with more low-tax subsidiaries.[7] If the first summation is positive for some firms, then this leaves open the possibility that some firms would increase reported profits in response to an increase in own-country enforcement while others would decrease reported profits.

All of this analysis is for a multinational that is actually shifting profit between affiliates. In some sectors, it will be the case that the marginal cost of shifting between affiliates is high enough that no shifting occurs. For any two affiliates, it will be optimal set $S_{ij}$ to zero if Equation 3.3 is not satisfied by a positive value of $S_{ij}$. When no shifting between affiliates occurs, the only effects of an increase in enforcement are to increase the fixed cost of related-party transactions and to increase the fixed cost of doing business in that country. This means that the firm could experience a decrease in profits either because it is still uses related-party transactions to obtain goods and services, and those transactions are now more expensive, or because the increase in the cost of the related-party transaction causes the firm to switch to obtaining the good or service from an unrelated party. All firms that are not shifting profit, but that do use related-party transactions, should experience a reduction in reported profits when there is an increase in enforcement. In sectors where arm's length prices are easier to identify and, therefore, opportunities for profit-shifting are limited, we should see all firms experience a reduction in reported profits, even those firms with many lower-tax subsidiaries. For any firm that does not have international affiliates, increased transfer-pricing enforcement should have no effect on reported profits.

Together, these predictions suggest that, for a country with a relatively low corporate tax rate, an increase in enforcement would be very likely to decrease tax revenue, as many of the firms affected by the increase in enforcement will be firms with many higher-tax affiliates and few lower-tax affiliates. Even for a country with a high corporate tax rate, increased transfer-pricing enforcement can only have the potential to increase reported profits, and therefore tax revenue, if there is evidence that the reduction in outflows in response to increased enforcement is large. Together, these results suggest that an indiscriminate increase in transfer-pricing enforcement that affects all related-party transactions should only

[7]Controlling for size and other things that determine the opportunities for shifting. It is not necessarily true that a firm with five small lower-tax affiliates should respond less negatively to increased enforcement than a firm with one large lower-tax affiliate. If, on the other hand, two firms are identical in all respects outside of the fact that firm 2 has an additional lower-tax affiliate, then the response of firm 2's reported profits to increased enforcement should be less negative.

be considered in countries where transfer-pricing abuse is a real problem. A country that implements transfer-pricing regulation simply as a preventative measure is very likely to experience a reduction in tax collections. The push towards all countries implementing detailed transfer-pricing regulation, therefore, does not actually seem to be in the best interests of those countries, at least from the perspective of tax collections.

## 3.2 Response to affiliate-country enforcement

Consider now, instead, the effect of enforcement in a higher-tax country, say affiliate $k's$ home country, on reported profit in country $i$. As long as shifting is occurring between affiliate $k$ and affiliate $i$, then the change in affiliate $i's$ reported profits from the change in enforcement in affiliate $k's$ home country can be represented as:

$$\frac{d\Pi_i^R}{dE_k} = \frac{dS_{ki}^*}{dE_k} - (1-\alpha)\frac{dc_{ki}}{dE_k} - \frac{dFC_i}{dE_k}$$

Using the result above, we know that:

$$\frac{\partial S_{ki}^*}{\partial E_k} = -\left(\frac{\partial^2 g_{ki}}{\partial E_k \partial S_{ki}}\right)\left(\frac{\partial^2 g_{ki}}{\partial S_{ki}^2}\right)^{-1}$$

so the expressions can be rewritten as:

$$\frac{d\Pi_i^R}{dE_k} = -\left(\frac{\partial^2 g_{ki}}{\partial E_k \partial S_{ki}}\right)\left(\frac{\partial^2 g_{ki}}{\partial S_{ki}^2}\right)^{-1} - (1-\alpha)\left(\frac{\partial gki}{\partial E_k} + \frac{\partial S_{ki}^*}{\partial E_k}\frac{\partial g_{ki}}{\partial S_{ki}} + \frac{\partial f_{ki}}{\partial E_k}\right) - \frac{dFC_i}{dE_k} \quad (3.8)$$

or:

$$\frac{d\Pi_i^R}{dE_k} = \left((1-\alpha)\frac{\partial g_{ki}}{\partial S_{ki}} - 1\right)\left(\frac{\partial^2 g_{ki}}{\partial E_k \partial S_{ki}}\right)\left(\frac{\partial^2 g_{ki}}{\partial S_{ki}^2}\right)^{-1} - (1-\alpha)\left(\frac{\partial g_{ki}}{\partial E_k} + \frac{\partial f_{ki}}{\partial E_k}\right) - \frac{dFC_i}{dE_k} \quad (3.9)$$

Equation 3.9 should always be negative. An increase in enforcement in a higher-tax country will decrease profit-shifting inflows into affiliate $i$, which will decrease the reported profits of affiliate $i$. The decrease in shifting between affiliate $k$ and affiliate $i$ will decrease the cost of shifting between the two affiliates, but that will only increase the reported profits of the affiliate in country $i$ to the extent to which the cost of shifting is actually deducted in the lower-tax country. Additionally, the cost of shifting will be increased by the direct effect of enforcement on the variable cost of shifting between affiliate $k$ and affiliate $i$ and the direct effect of enforcement on the cost of having related-party transactions between the two affiliates. Finally, it is possible that the increase in enforcement in affiliate $k's$ home country will increase affiliate $i's$ use of accounting services or other general costs of doing

business and, therefore, increase $FC_i$, but this effect should be fairly small. Given the small effect that enforcement in affiliate $k's$ home country is likely to have on the costs that are actually deducted by affiliate $i$, the change in $i's$ reported profits will mostly be driven by the change in the amount of profit that flows between $k$ and $i$. If there is a large reduction in the inflow, then we should see firm $i's$ reported profit decrease significantly. If there is a small reduction in the inflow, then the effect on firm $i's$ reported profits will be quite small.

Finally, consider the effect of enforcement in a lower-tax country, say affiliate$j's$ home country, on affiliate $i's$ reported profits. If there is shifting between affiliate $i$ and affiliate $j$, then the change in firm $i's$ reported profits can be represented as:

$$\frac{d\Pi_i^R}{dE_j} = -\frac{dS_{ij}^*}{dE_j} - \alpha\frac{dc_{ij}}{dE_j} - \frac{dFC_i}{dE_j}$$

The response of $S_{ij}^*$ to a change in enforcement in affiliate $j's$ home country is given by:

$$\frac{\partial S_{ij}^*}{\partial E_j} = -\left(\frac{\partial^2 g_{ij}}{\partial E_j \partial S_{ij}}\right)\left(\frac{\partial^2 g_{ij}}{\partial S_{ij}^2}\right)^{-1}$$

so the response of affiliate $i$'s reported profits to a change in enforcement in affiliate $j$'s home country can be written as

$$\frac{d\Pi_i^R}{dE_j} = \left(\frac{\partial^2 g_{ij}}{\partial E_j \partial S_{ij}}\right)\left(\frac{\partial^2 g_{ij}}{\partial S_{ij}^2}\right)^{-1} - \alpha\left(\frac{\partial g_{ij}}{\partial E_j} + \frac{\partial S_{ij}^*}{\partial E_j}\frac{\partial g_{ij}}{\partial S_{ij}} + \frac{\partial f_{ij}}{\partial E_j}\right) - \frac{dFC_i}{dE_j} \tag{3.10}$$

or:

$$\frac{d\Pi_i^R}{dE_j} = \left(1 + \alpha\frac{\partial g_{ij}}{\partial S_{ij}}\right)\left(\frac{\partial^2 g_{ij}}{\partial E_j \partial S_{ij}}\right)\left(\frac{\partial^2 g_{ij}}{\partial S_{ij}^2}\right)^{-1} - \alpha\left(\frac{\partial g_{ij}}{\partial E_j} + \frac{\partial f_{ij}}{\partial E_j}\right) - \frac{dFC_i}{dE_j} \tag{3.11}$$

If $g_{ij}$ is increasing in $E_j$, then the first term represents the fact that increased enforcement in firm $j$'s home country deters some shifting from $i$ to $j$. This increases firm $i$'s reported profits. The decrease in the amount shifted from $i$ to $j$ also decreases the cost of shifting from $i$ to $j$. This also works to increase the reported profits of affiliate $i$. Increased enforcement in firm $j$'s home country, however, also has a direct effect on the cost of shifting between $i$ and $j$, so $\alpha c_{ij}$ will increase. This will decrease firm $i's$ reported profits. Additionally, changes in enforcement in affiliate $j's$ home country might affect the fixed cost firm $i$ faces of dealing with the regulatory environment. The bigger the direct effect of $E_j$ on the three costs is, the more likely it is that an increase in $E_j$ will decrease firm $i's$ reported profits.

Alternatively, it is possible that $g_{ij}$ is decreasing in $E_j$. In that case, an increase in $E_j$ would increase outflows, so the first term would capture the resulting reduction in firm $i's$

reported profits. The direct effect of $E_j$ on $g_{ij}$ would result in an increase in affiliate $i$'s reported profits. The remaining two terms could be either positive or negative depending on how $E_j$ is related to $f_{ij}$ and $FC_i$. Overall, regardless of the relationship between $g_{ij}$ and $E_j$, the effect of an increase in $E_j$ on $\Pi_i^R$ is ambiguous.

It is worth remembering that, although the above focuses on the question of how profit is reallocated across countries in response to changes in enforcement, there is second question of how enforcement efforts interact with the initial decision to invest in a given country, i.e. how do $E_i$, $E_k$ and $E_j$ affect $B_i$, the initial level of profit of affiliate $i$. As an increase in enforcement can, to some extent, be thought of as an increase in the effective tax rate, in a more general framework, higher levels of enforcement are also likely to decrease reported profits through a decrease in investment in that country. This means that the possibility of decreased tax revenue from an increase in own-country enforcement may be even more of a threat than is suggested by the model that focuses on the impact of enforcement on transfer-pricing behavior alone. The fear that increased enforcement might drive firms to locate operations in lower-enforcement countries might also explain why higher-tax countries would want to push lower-tax countries to implement regulations designed to make profit shifting more difficult.

An additional question that is not considered in this paper is how differences in enforcement across countries affect optimal shifting. Optimal shifting between any two affiliates is given by Equation 3.3. The effect of $E_i$ and $E_j$ on optimal shifting will depend on the assumptions made about the functional form of $g_{ij}$. For some forms of $g_{ij}$, differences in enforcement between firm $i's$ home country and firm $j$'s home country can even result in profit shifting that moves against the tax differential. This is a topic I consider in depth in Saunders-Scott (2013). For the purposes of this paper, however, the sign of the change in shifting in response to increased enforcement is what matters, and that will be consistent across different forms.

# 4 Data

The model above suggests that, controlling for true profits and the tax incentives to shift profits, enforcement in both the country a firm is located in and the other countries in which the firm has affiliates should affect the firm's reported profits. To test this, information on reported profits by affiliate, a proxy for true profits, corporate tax rate information for the firm and its affiliates and information on the level of transfer-pricing enforcement across countries is needed. The major focus of this paper is the role of enforcement, so the main measure of transfer-pricing enforcement that is used is described first. The country-level data

collected on corporate tax rates, GDP per capita and government deficits are then described. Finally, the firm-level data on reported profits and other firm characteristics are described. It is possible to obtain panel data on firm-level variables, as well as enforcement and corporate tax rates. This allows for the use of a firm fixed-effects specification in the empirical section. This approach accounts for unobservable characteristics of the firm. Response to changes in transfer-pricing enforcement will be identified off of changes in enforcement levels over time, so it is important that the enforcement measure used have within-country variation over time.

## 4.1 Enforcement

Transfer-pricing enforcement can take many different forms, which means that countries can differ in their transfer-pricing enforcement along many different dimensions. This means that it is very difficult to get a single measure of enforcement that will truly capture the variation in the strictness of efforts to prevent profit shifting across countries. While other papers in the area have used measures of transfer-pricing documentation requirements, this paper instead use a measure of transfer-pricing risk, *tprisk*, developed in Mescall (2011). The Mescall index, discussed in detail in Appendix A, takes values between 1.03 and 5.20 depending on the transfer-pricing regulation that is in place in a given country. The factors used in the index include: if disclosure of related party transactions is required on the tax return; the availability of information on comparable transactions; if transfer-pricing penalties can be reduced by keeping sufficient documentation; the perceived likelihood of a transfer-pricing audit; and other, more technical, details of transfer-pricing regulation in a country. This measure is better than documentation-based measures for three reasons. The first, and most important advantage, is that it captures dimensions of transfer-pricing enforcement that go beyond documentation requirements alone. The second reason that the risk measure is preferred to documentation-based measures has to do with the fact that the effect of transfer-pricing documentation on shifting should depend on how likely the paperwork is to actually be examined or challenged by individuals who have the knowledge needed to recognize transfer-pricing abuse. This means that the effect of an increase in the documentation requirement should be specific to the country that is being considered. The inclusion of audit risk as an input in the transfer-pricing risk measure at least partially captures this variation. The third reason the Mescall index is preferred is that it exhibits greater variation over time which can be exploited to estimate the effect of increased enforcement.

As mentioned earlier, past papers that have considered variation in transfer-pricing enforcement have focused on variation in transfer-pricing documentation requirements across

countries. In Appendix B, details on a documentation measure that is very similar to that developed in Lohse, Riedel, and Spengel (2012) are provided. Appendix B also reproduce some of the baseline regressions from Section 5 using the documentation measure instead of *tprisk* to represent variation in enforcement.

## 4.2 Country-level data

In order to capture the incentives for profit shifting, information on corporate tax rates is needed for the countries in which the firms in the sample and their subsidiaries are located. Data on the top statutory corporate tax rates (including local taxes) are obtained from Ernst & Young's worldwide corporate tax guides. This information is supplemented with information from KPMG's global tax database and Deloitte's taxation guides to obtain corporate tax rates for as large a set of countries as possible. Additionally, the World Bank database is used to obtain real GDP per capita for all countries that have that information available. Finally, because it seems likely that increasing enforcement is a counter-cyclical policy, information on government deficit is obtained from the World Bank database to control for the possibility that the decision to increase enforcement is a result of decreased tax collections.

## 4.3 Firm-level data

The Bureau van Dijk ORBIS database is used to obtain information on a sample of multinational corporations. ORBIS is a firm-level dataset that collects information from national and local accounts. It currently contains financial information on over 93 million active corporations. Given that the focus of this paper is how enforcement interacts with the structure of the corporation, the sample is limited to the subset of almost 3 million corporations that have information available on ownership links. To look at the effect of enforcement on reported profit, it is necessary to know reported profit at the firm level rather than at the multinational level. For this reason, the sample is further restrict to the subset of corporations in ORBIS that have unconsolidated reports available. This means that information on assets, labor and reported profit can be obtained for individual affiliates rather than for the entire corporate group. Transfer-pricing enforcement is only going to be relevant for firms that actually have related-party transactions, so the sample is additionally limited to only include firms that own a foreign subsidiary. Given the complex structure of many multinationals, it can be difficult to define ownership links. Although any cutoff used will be somewhat arbitrary, the sample used includes all firms that own at least 50% of a foreign subsidiary that is within ten tiers of the firm (i.e. it would include a firm that owns a do-

Table 4.1: Sample of Firms

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|
| **Firms** | 16,498 | 18,174 | 19,833 | 22,125 | 23,163 | 24,328 | 23,061 | 24,898 | 24,270 |
| Avg Profit (th $) | 6,531 | 7,722 | 9,583 | 9,724 | 12,204 | 10,371 | 10,975 | 11,899 | 10,619 |
| Median Profit (th $) | 765 | 874 | 812 | 1,076 | 1,378 | 1,190 | 1,040 | 1,070 | 1,092 |

Note: Sample of firms with positive earnings before interest and tax and information available on cost of employees and fixed tangible assets.

mestic firm which owns another domestic firm which owns a foreign firm). For these firms, information is obtained on both foreign subsidiaries and foreign shareholders where there is an ownership link of at least 50%.

All firms are required to have data available for at least one year between 2003 and 2011 on earnings before interest and tax, the cost of employees and fixed tangible assets. Firms are assumed to produce output using capital and labor, and so the cost of employees and fixed tangible assets are included as proxies for the true profits of the firm. Fixed tangible assets are used over other measures of assets as they are likely to be less endogenous to profit shifting than a measure that also includes intangible assets. Finally, since the paper is examining how enforcement changes the incentives for profit shifting, the statutory corporate tax rate for the country in which the firm is located is also required to be available. The incentives for profit shifting change when a firm has negative profits, so, for now, the sample is limited to firms with positive profits, as the model should do a better job of matching the behavior of these firms. Information on the number of firms in the sample for each year that meet those requirements and the average and median profits of firms in the sample are detailed in Table 4.1.

The geographic distribution of the firms in the sample is detailed in table 16.1. The firms are located across 41 countries. While the coverage of firms in ORBIS has expanded in recent years, the focus on European firms is still evident from the large share of firms in the sample that are located in Belgium, France, Italy, Spain and Sweden. Many of the countries in which firms are located are middle tax-rate countries, which, from the perspective of the model, should be the most interesting set of countries in terms of the ambiguity of the effect of increased enforcement.

The main question of interest is how reported profit responds to changes in transfer-pricing enforcement in the home country of the firm. The information needed to generate the preferred measure of transfer-pricing enforcement, $tprisk$, is currently only available from 2006 to 2011, so, in most empirical specifications, that will be the period considered. Table 4.3 details the availability of the measure for the firms in the sample. It also summarize

Table 4.2: Location of Firm (% of Sample)

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|
| Argentina | 0 | 0 | 0 | 0 | 0 | 0.004 | 0.013 | 0.012 | 0.012 |
| Austria | 0.103 | 1.326 | 1.573 | 2.721 | 2.962 | 2.684 | 2.472 | 2.35 | 2.798 |
| Belgium | 10.886 | 10.317 | 9.802 | 8.827 | 8.604 | 7.958 | 7.94 | 8.005 | 7.977 |
| Bosnia and Herzegovina | 0 | 0 | 0 | 0.199 | 0.319 | 0.296 | 0.317 | 0.257 | 0.255 |
| Brazil | 0 | 0 | 0 | 0 | 0 | 0 | 0.004 | 0.004 | 0 |
| Bulgaria | 0.249 | 0.264 | 0.247 | 0.262 | 0.307 | 0.308 | 0.299 | 0.297 | 0.326 |
| Croatia | 0.933 | 0.957 | 0.882 | 1.071 | 1.075 | 1.011 | 1.015 | 0.888 | 0.915 |
| Czech Republic | 2.085 | 2.173 | 2.133 | 2.011 | 2.068 | 1.961 | 1.951 | 1.924 | 1.842 |
| Denmark | 0 | 0 | 0 | 0 | 0.082 | 6.112 | 6.353 | 6.205 | 6.786 |
| Ecuador | 0 | 0 | 0.005 | 0.005 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| Estonia | 0.497 | 0.462 | 0.454 | 0.452 | 0.453 | 0.366 | 0.373 | 0.37 | 0.4 |
| Finland | 3.77 | 3.593 | 3.434 | 3.304 | 3.553 | 3.403 | 3.231 | 3.342 | 3.494 |
| France | 16.335 | 15.935 | 15.177 | 14.581 | 14.454 | 13.33 | 12.51 | 12.708 | 12.509 |
| Germany | 5.031 | 5.788 | 9.106 | 10.088 | 9.848 | 9.397 | 9.527 | 9.667 | 9.526 |
| Hungary | 0.455 | 0.594 | 0.575 | 0.511 | 0.527 | 0.415 | 0.421 | 0.466 | 0.42 |
| Iceland | 0.018 | 0.044 | 0.04 | 0.005 | 0.004 | 0.021 | 0.013 | 0.028 | 0.049 |
| India | 0.006 | 0.006 | 0.005 | 0 | 0 | 0.016 | 0.039 | 0.04 | 0.029 |
| Ireland | 0 | 0 | 0.045 | 0.362 | 0.591 | 0.534 | 0.503 | 0.554 | 0.564 |
| Italy | 18.299 | 19.853 | 18.469 | 18.038 | 17.83 | 16.635 | 15.55 | 15.821 | 15.863 |
| Japan | 0.285 | 0.336 | 0.333 | 0.307 | 0.268 | 0.214 | 0.238 | 0.289 | 0.231 |
| Latvia | 0.018 | 0.017 | 0.02 | 0.018 | 0.017 | 0.012 | 0.013 | 0.02 | 0.016 |
| Luxembourg | 0.273 | 0.319 | 0.424 | 0.551 | 0.548 | 0.485 | 0.75 | 0.727 | 0.63 |
| Malta | 0 | 0 | 0 | 0.009 | 0.004 | 0.016 | 0.013 | 0.024 | 0.012 |
| Montenegro | 0.006 | 0.011 | 0.03 | 0.036 | 0.043 | 0.041 | 0.052 | 0.04 | 0.033 |
| Morocco | 0 | 0 | 0.005 | 0.005 | 0.009 | 0.008 | 0.009 | 0.012 | 0.008 |
| Netherlands | 1.043 | 1.084 | 1.074 | 1.035 | 1.217 | 1.102 | 1.171 | 1.229 | 1.228 |
| New Zealand | 0 | 0 | 0.005 | 0.009 | 0.013 | 0.021 | 0.017 | 0.024 | 0.029 |
| Norway | 4.71 | 4.683 | 4.729 | 4.601 | 4.663 | 4.559 | 4.891 | 4.655 | 4.747 |
| Poland | 0.503 | 0.539 | 0.565 | 0.538 | 0.596 | 0.612 | 0.681 | 0.598 | 0.63 |
| Portugal | 1.534 | 1.453 | 1.568 | 1.451 | 1.438 | 1.278 | 1.366 | 1.325 | 1.29 |
| Romania | 0.291 | 0.281 | 0.267 | 0.221 | 0.268 | 0.275 | 0.295 | 0.237 | 0.255 |
| Serbia | 0.321 | 0.363 | 0.318 | 0.601 | 0.587 | 0.571 | 0.585 | 0.546 | 0.511 |
| Slovakia | 0.515 | 0.693 | 0.923 | 0.881 | 0.885 | 0.81 | 0.82 | 0.823 | 0.655 |
| Slovenia | 0.649 | 0.589 | 0.555 | 0.565 | 0.574 | 0.551 | 0.507 | 0.546 | 0.536 |
| South Korea | 0.327 | 0.325 | 0.323 | 0.289 | 0.272 | 0.255 | 0.299 | 0.313 | 0.313 |
| Spain | 18.875 | 17.69 | 16.392 | 15.372 | 14.29 | 13.084 | 13.447 | 13.274 | 12.423 |
| Sweden | 7.601 | 5.965 | 6.535 | 6.432 | 6.666 | 6.992 | 7.12 | 7.065 | 7.388 |
| Switzerland | 0.055 | 0.055 | 0.045 | 0.036 | 0.056 | 0.049 | 0.061 | 0.056 | 0.049 |
| Taiwan | 0.073 | 0.154 | 0.055 | 0.859 | 0.997 | 0.9 | 0.919 | 0.964 | 0.919 |
| Ukraine | 0.03 | 0.017 | 0.025 | 0.023 | 0.026 | 0.029 | 0.026 | 0.024 | 0.016 |
| United Kingdom | 4.225 | 4.116 | 3.862 | 3.724 | 3.881 | 3.679 | 4.176 | 4.253 | 4.297 |

Table 4.3: Summary of *tprisk* enforcement index for sample used

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|
| % Missing Value | 2.87% | 5.43% | 4.29% | 4.33% | 3.03% | 3.04% |
| Average | 3.81 | 3.86 | 3.83 | 4.09 | 4.16 | 4.16 |
| Minimum | 1.03 | 1.03 | 1.03 | 1.03 | 1.03 | 1.03 |
| Maximum | 4.46 | 4.69 | 5.09 | 5.09 | 4.87 | 5.20 |

**Note**: Calculation of the *tprisk* index is discussed in detail in Appendix A.

the values of the index for the firms in the sample. Although available for a relatively short period, this measure gives a lot of within-country variation over time as, given the multiple dimensions accounted for by the index, countries experience multiple changes over the relevant time period.

In order to both understand the tax incentives for shifting within a multinational, and to the capture the effects of affiliate-level enforcement predicted by the model, information on the affiliates of the firms that are in the sample is also required. For the firms in the sample, the locations of all foreign subsidiaries that are at least 50% owned by the firm and all foreign shareholders of the firm that hold a total share of at least 50% of the firm are obtained. While this will capture many of the possible paths for profit shifting, it will not capture all possible paths. This is partially due to the requirement of ownership links of greater than 50%, but is also partially due to the fact that there is not information on affiliates of a multinational that are within the same tier of the multinational corporation. Firms that are parent companies (GUOs) will suffer from the first problem, but not from the second. The issue of ownership links is discussed in more depth in Appendix C.

For the purposes of the analysis, limited information can be obtained on foreign subsidiaries and foreign shareholders. The most important piece of information for understanding the incentives for profit shifting is the location of the affiliate, as that is what makes it possible to link the affiliate with a corporate tax rate and a value for transfer-pricing risk. For some subsidiaries and shareholders, there is information available on assets and revenue, but that information is extremely limited. For firms in the sample, information on the average number of foreign affiliates, the number that are located in higher-tax countries versus lower-tax countries and the breakdown between subsidiaries and shareholders are detailed in Table 4.4. The firms in the sample have between 1 and 218 affiliates. The number of subsidiaries ranges between 1 and 218 and the number of shareholders ranges between 0 and 4. Firms have between 0 and 195 lower-tax subsidiaries and between 0 and 167 higher-tax subsidiaries. Firms have between 0 and 4 lower-tax shareholders and between 0 and 4 higher-tax shareholders. The foreign affiliates in the sample are located across 200 coun-

Table 4.4: Composition of affiliates

| | |
|---|---|
| Average number of Foreign Affiliates | 2.59 |
| Median Number of Foreign Affiliates | 1 |
| Maximum Number of Foreign Affiliates | 218 |
| Average Number of Lower-Tax Affiliates | 1.60 |
| Average Number of Higher-Tax Affiliates | .99 |
| % with just higher-tax affiliate | 27.19% |
| % with just lower-tax affiliate | 47.39% |
| % with both | 21.69% |
| % with neither | 3.73% |

**Notes**: Affiliate refers to both the subsidiaries and the shareholders of the firm in the sample. To be included in the sample, all firms had to have at least one foreign subsidiary.

tries, with heavy concentrations (defined by there being more than 1% of the total sample of subsidiaries located in that country) in Austria, Belgium, Brazil, China, the Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Mexico, the Netherlands, Norway, Poland, Portugal, Romania, Russia, Spain, Sweden, Switzerland, the United Kingdom and the United States.

While changes in the firm's home-country corporate tax rate will generally be used to capture changes in the incentives to shift profits, as the firm-level fixed effects should absorb the opportunities for shifting that are available for the firm, in some specifications the tax differential between the firm and its affiliates will be used instead. The tax differential is defined simply to be the difference between the tax rate that the firm faces and the (unweighted) average of the tax rates faced by all affiliates. If, for example, firm 1 has four affiliates: A1, B1, C1 and D1 then

$$\text{avgtaxdiff}_1 = \tau_1 - \frac{(\tau_{A1} + \tau_{B1} + \tau_{C1} + \tau_{D1})}{4}$$

This measure can also be used to get a sense for how the tax rates of the firms in the sample compare to those of their affiliates. A positive value indicates that a firm is high tax relative to its subsidiaries. Although the weighting should also account for differences in size between the firm and its affiliates, as an approximation, firms with positive values would be expected an incentive to shift out on net. A negative value indicates that a firm is low tax relative to its subsidiaries. These firms would be expected to shift in on net.

The model predicts that the enforcement efforts of the countries in which higher-tax affiliates and lower-tax affiliates are located should also affect reported profit. For each firm, then, in an attempt to capture the level of transfer-pricing enforcement in the countries where subsidiaries are located, the average level of the transfer-pricing risk measure across

Table 4.5: Subsidiary Characteristics by Firm

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|
| avg tax diff | 0.038 | 0.036 | 0.024 | 0.024 | 0.024 | 0.025 |
| min tax diff | -0.267 | -0.284 | -0.242 | -0.25 | -0.235 | -0.233 |
| max tax diff | 0.372 | 0.372 | 0.340 | 0.35 | 0.35 | 0.35 |
| AvgRiskHiWeight | .201 | .212 | .199 | .204 | .214 | .220 |
| -std dev | .161 | .175 | .148 | .152 | .155 | .156 |
| AvgRiskLoWeight | .239 | .219 | .189 | .192 | .230 | .251 |
| -std dev | .182 | .147 | .136 | .134 | .150 | .160 |

**Notes**: For each firm in the sample, the tax difference in a given year is calculated as the tax rate faced by the firm minus the (unweighted) average of the tax rates faced by its subsidiaries. The calculation of the average risk score is discussed in the text.

affiliates is calculated. Reported profit should respond differently to enforcement in higher-tax countries and enforcement in lower-tax countries, so the measure of average enforcement is calculated separately for higher-tax affiliates and for lower-tax affiliates. The exact form of the affiliate enforcement terms will depend on the assumptions made about the functions $f$, $g$ and $FC$. For now, the terms used imposes the assumption that the importance of affiliate-country enforcement depends on the tax differential. For higher-tax subsidiaries, for example, the weighted measure of $tprisk$ is calculated as:

$$AvgRiskHiWeight \quad = \quad \frac{\sum_{k=1}^{i-1}(\tau_k - \tau_i)tprisk_k}{(i-1)}$$

This measure will suffer from the problem that the value will change not only with changes in enforcement in the countries in which subsidiaries are located, but also with changes in own-country or subsidiary-country corporate tax rates. The importance of affiliate-country enforcement clearly should depend on the size of the affiliate, but the limited data available on affiliates preclude that at this time. Table 4.5 summarizes the tax differences and subsidiary enforcement characteristics for the firms in the sample.

# 5 Empirical

## 5.1 Baseline Results

The model predicts that the response to own-country enforcement will vary based on firm characteristics. This means that the response of reported profits to changes in the level of own-country enforcement is potentially ambiguous, but, given the model, it would not be

surprising to find a negative relationship. First then, consider a simple firm fixed-effects regression of log reported profits on *tprisk*. In the first column of Table 5.1, the log of fixed tangible assets and the log employee compensation are included as regressors. These controls are included to capture variation in the true profits of the firm. Both variables have positive and statistically significant coefficients, which is consistent with expectations.The coefficient on *tprisk* is -0.101 and is statistically significant. The value of the coefficient indicates that an increase in a country's *tprisk* index of 0.5, roughly the change that a country would experience if its transfer-pricing audit risk increased by one category, would decrease reported profits by 5%. In the second column, country level controls (log GDP per capita, log GDP per capita squared, and government deficit) and industry (1 digit NACE code) by year fixed effects are included. This lowers the coefficient on *tprisk* to -0.0267, but it is still negative and significant. In the third column, the corporate tax rate faced by the firm is included to control for the fact that we might expect a country to increase its enforcement at the same as it increases its corporate tax rate. This has little effect on the coefficient on *tprisk*. The coefficients in columns (2) and (3) indicate that an increase of one category in audit risk (an increase in *tprisk* of .559) would decrease reported profits by approximately 1.5%.

The firm fixed-effects setting means that the effect of enforcement on reported profits is being estimated off of variation in *tprisk* within a country over time. The estimates will capture both the immediate response to changes in enforcement and any potential delayed response. While the fixed-effects approach reduces concern about the endogeneity across countries of efforts to prevent profit-shifting and reported profits, there is still a concern that changes in *tprisk* over time are correlated with other government policies that also affect reported profits. If that is the case, then the decrease in reported profits found in Table 5.1 cannot actually be attributed to changes in transfer-pricing enforcement. To test for this, firms that should be unaffected by changes in transfer-pricing regulation, i.e. firms with no international affiliates, are selected from ORBIS.[8] Controlling for changes in other country-level factors, columns (2) and (3) of Table 5.2 indicate that changes in transfer-pricing risk do not have a statistically significant effect on the reported profits of firms in this sample. The sample, however, is very small, so it would not be possible to reject the hypothesis that the coefficient for the placebo group is the same as the coefficient for the full sample. Given that this sample still contains firms whose names reflect a likely link to a multinational corporation, e.g. Netflix Ireland, this result probably indicates that a different data source likely needs to be used to establish a true placebo group.

[8]Specifically, I select firms that have no subsidiaries and that are less than 5% owned by shareholders. The results are similar if I instead select firms that are less than 10% owned by shareholders.

Table 5.1: Effect of Transfer-Pricing Enforcement

| | (1)<br>Log EBIT | (2)<br>Log EBIT | (3)<br>Log EBIT |
|---|---|---|---|
| tprisk | -0.101***<br>(0.00834) | -0.0267***<br>(0.00915) | -0.0269***<br>(0.00916) |
| Tax Rate | | | -0.0607<br>(0.186) |
| Log Assets | 0.0591***<br>(0.00638) | 0.0730***<br>(0.00662) | 0.0730***<br>(0.00663) |
| Log Labor | 0.404***<br>(0.0119) | 0.401***<br>(0.0123) | 0.401***<br>(0.0123) |
| Log GDP | | -0.374<br>(1.083) | -0.390<br>(1.085) |
| Log GDP$^2$ | | 0.191<br>(0.149) | 0.194<br>(0.149) |
| Deficit | | -0.00320<br>(0.00201) | -0.00333<br>(0.00204) |
| | | | |
| Observations | 136,421 | 135,051 | 135,051 |
| Within R-squared | 0.047 | 0.061 | 0.061 |
| Number of Firms | 34,502 | 34,219 | 34,219 |
| | | | |
| Industry-Year F.E. | | ✓ | ✓ |

**Notes**: Firm fixed-effects regressions. Standard errors clustered at the firm level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The dependent variable in all columns is the log of reported profit before interest and taxes. tprisk=index of transfer-pricing risk described in Section 4.1. Tax Rate=corporate tax rate in the firm's home country. Log Assets=log(fixed tangible assets). Log Labor=log(employee compensation). Log GDP=log(per capita GDP). Log GDP$^2$=log(per capita GDP)$^2$. Deficit=government deficit/surplus as a percentage of GDP.

Table 5.2: Placebo Group

| | (1) Log EBIT | (2) Log EBIT | (3) Log EBIT |
|---|---|---|---|
| tprisk | -0.113*** | -0.0297 | -0.0291 |
| | (0.0228) | (0.0261) | (0.0260) |
| Tax Rate | | | 0.524 |
| | | | (1.039) |
| Log Assets | 0.0629*** | 0.0651*** | 0.0654*** |
| | (0.0175) | (0.0178) | (0.0178) |
| Log Labor | 0.256*** | 0.242*** | 0.242*** |
| | (0.0409) | (0.0415) | (0.0416) |
| Log GDP | | -1.984 | -1.962 |
| | | (2.917) | (2.916) |
| Log GDP$^2$ | | 0.601 | 0.587 |
| | | (0.463) | (0.465) |
| Deficit | | -0.0130** | -0.0140** |
| | | (0.00534) | (0.00574) |
| | | | |
| Observations | 15,888 | 15,855 | 15,855 |
| Within R-squared | 0.021 | 0.039 | 0.039 |
| Number of Firms | 4,518 | 4,509 | 4,509 |
| | | | |
| Industry-Year F.E. | | ✓ | ✓ |

**Note**s: Firm fixed-effects regressions. Standard errors clustered at the firm level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The dependent variable in all columns is the log of reported profit before interest and taxes. tprisk=index of transfer-pricing risk described in Section 4.1. Tax Rate=corporate tax rate in the firm's home country. Log Assets=log(fixed tangible assets). Log Labor=log(employee compensation). Log GDP=log(per capita GDP). Log GDP$^2$=log(per capita GDP)$^2$. Deficit=government deficit/surplus as a percentage of GDP.

As mentioned in Section 4.3, the firms in the sample are heavily concentrated in Denmark, France, Italy, Spain and Sweden. Of these countries, Spain experienced a large change in *tprisk* over the sample period. In column (1) of Table 5.3, to ensure that it is not the response of firms in Spain to that change in enforcement that is driving the result, firms that are located in Spain are excluded. The exclusion of these firms actually results in an even more negative relationship between reported profits and the index of transfer-pricing risk. In column (2), firms that are located in France, Italy and Spain are excluded.[9] Again, the response to *tprisk* is negative, and even larger in magnitude than in the baseline case. Interestingly, the statistically insignificant coefficient on the corporate tax rate in column (3) of Table 5.1 seems to be driven by Italian firms. Excluding Italian firms results in a coefficient on *Tax Rate* of -.52, which suggests that a 10% increase in the corporate tax rate decreases reported profits by 5.2%. It is possible that, through the early part of the sample, Italian firms were still responding to the changes in corporate taxation that occurred in 2004. Column (3) of Table 5.3 only includes firms that are their own global ultimate owner, while Column (4) only includes firms that are not their own global ultimate owner. GUOs are different from non-GUOs both in the fact that more complete affiliate information is included for GUOs and in the fact that the incentives for shifting might be different for parent firms.[10] The relatively small sample of GUOs means that the estimates are noisy, but the magnitude of the coefficient on *tprisk* is very similar across the two groups. Although insignificant, the positive coefficient on the corporate tax rate in column (3) is consistent with corporations being reluctant to shift profits away from the parent firm.

These baseline results suggest that increased transfer-pricing enforcement has a negative effect on reported profits. The fact that this effect is not seen for a group of firms that should be unaffected by transfer-pricing regulation is consistent with the interpretation that the results are reflecting a change in transfer-pricing enforcement. The relatively large magnitude of the effect of increased enforcement may indicate that the results are capturing both an increase in the cost of doing business, and the longer-run relocation of investment to lower-enforcement locations.

## 5.2 Heterogenous response to own-country enforcement

The model predicted that a positive response of reported profits to transfer-pricing enforcement was most likely for firms that have lower-tax affiliates. A negative response of reported profits to transfer-pricing enforcement was most likely for firms with few lower-tax affiliates and many higher-tax affiliates. The most basic test for this is to see if firms with low-tax

[9]The three countries that had the highest concentration of firms.

[10]See, for example, Dischinger, Knoll, and Riedel (2010).

Table 5.3: Robustness Checks

| | (1) Log EBIT | (2) Log EBIT | (3) Log EBIT | (4) Log EBIT |
|---|---|---|---|---|
| tprisk | -0.0380*** | -0.0706*** | -0.0236 | -0.0265** |
| | (0.0141) | (0.0155) | (0.0160) | (0.0112) |
| Tax Rate | -0.186 | -0.639*** | 0.182 | -0.180 |
| | (0.196) | (0.229) | (0.346) | (0.221) |
| Log Assets | 0.0711*** | 0.0698*** | 0.0951*** | 0.0641*** |
| | (0.00722) | (0.00914) | (0.0111) | (0.00816) |
| Log Labor | 0.391*** | 0.372*** | 0.396*** | 0.405*** |
| | (0.0133) | (0.0166) | (0.0188) | (0.0161) |
| Log GDP | -0.277 | -1.150 | -1.806 | 0.261 |
| | (1.085) | (1.109) | (1.829) | (1.347) |
| Log GDP$^2$ | 0.168 | 0.171 | 0.444* | 0.0838 |
| | (0.150) | (0.153) | (0.255) | (0.184) |
| Deficit | -0.00742*** | 0.00232 | 0.000404 | -0.00488** |
| | (0.00267) | (0.00302) | (0.00356) | (0.00249) |
| | | | | |
| Observations | 115,736 | 73,291 | 44,471 | 90,580 |
| Within R-squared | 0.059 | 0.055 | 0.066 | 0.059 |
| Number of Firms | 29,592 | 19,841 | 11,488 | 22,731 |
| | | | | |
| Industry-Year F.E. | ✓ | ✓ | ✓ | ✓ |

**Note**s: Firm fixed-effects regressions. Standard errors clustered at the firm level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The dependent variable in all columns is the log of reported profit before interest and taxes. tprisk=index of transfer-pricing risk described in Section 4.1. Tax Rate=corporate tax rate in the firm's home country. Log Assets=log(fixed tangible assets). Log Labor=log(employee compensation). Log GDP=log(per capita GDP). Log GDP$^2$=log(per capita GDP)$^2$. Deficit=government deficit/surplus as a percentage of GDP. Column (1) excludes firms that are located in Spain. Column (2) excludes firms that are located in France, Italy and Spain. Column (3) only includes firms that are GUOs. Column (4) only includes firms that are not GUOs.

affiliates respond differently to changes in transfer-pricing risk than firms that do not have low-tax affiliates. The model predicts that the effect of increased transfer-pricing enforcement should be less negative for firms that do actually have lower-tax affiliates, as these are the firms where increased enforcement can have a deterrent effect and can, therefore, serve to decrease outflows and increase reported profits. Table 5.4 shows evidence that is consistent with this hypothesis. Column (1) replicates the baseline specification for firms that have lower-tax affiliates, while Column (2) replicates the same specification for firms that do not have lower-tax affiliates. The response of reported profits to an increase in enforcement is significantly more negative for firms that do not have lower-tax affiliates. Columns (3) and (4) indicate that firms with higher-tax affiliates also exhibit a more negative response to increased enforcement than firms that do not have higher-tax affiliates, this is also consistent with the predictions of the model.

Another basic test for the prediction of the model is to see if the response of reported profit to transfer-pricing enforcement is less negative for firms facing a higher corporate tax rate. Although, in a given country, there will still be variation across firms in terms of the distribution of high-tax subsidiaries versus low-tax subsidiaries, the higher corporate tax rate a country has, the more likely it is that the majority of a firm's subsidiaries will be lower tax. Looking at Column (1) of Table 5.5, there is a positive coefficient on the interaction of the transfer-pricing enforcement measures and corporate tax rate, although the coefficient is not statistically significant. This indicates that, for higher-tax rate countries, the response of reported profit to increased enforcement is less negative than for lower-tax countries. Given that enforcement makes shifting out more costly, it makes sense that countries which experience greater outflows, higher-tax countries, would see a more positive effect of enforcement. Similar results are found if the firm-specific average tax difference is used instead of the corporate tax rate. The model also predicts that having low-tax affiliates should make a firm's response to an increase in transfer-pricing enforcement less negative. Column (2) includes interactions between the transfer-pricing risk measure and both the number of lower-tax affiliates a firm has and the number of higher-tax affiliates a firm has. The positive coefficient on the interaction of the number of lower-tax affiliates and *tprisk* is consistent with enforcement serving to reduce profit-shifting outflows. The fact that *tprisk* continues to maintain its negative coefficient, however, still suggests that the compliance costs of dealing with increased enforcement are large. In Column (3) of Table 5.5, both the number of lower-tax affiliates and higher-tax affiliates the firm has interacted with *tprisk* and indicators for if the firm has at least one lower-tax affiliate and at least one higher-tax affiliate interacted with *tprisk* are included. The results suggest that having a lower-tax affiliate makes a firm's response to increased enforcement less negative, which is consistent

Table 5.4: Type of Affiliates

| | (1) Log EBIT | (2) Log EBIT | (3) Log EBIT | (4) Log EBIT |
|---|---|---|---|---|
| tprisk | -0.0080 | -0.0549*** | -0.0298** | -0.0163 |
| | (0.0115) | (0.0164) | (0.0126) | (0.0135) |
| Tax Rate | -0.149 | -0.150 | 1.067*** | -0.545** |
| | (0.218) | (0.620) | (0.390) | (0.263) |
| Log Assets | 0.0690*** | 0.0780*** | 0.0803*** | 0.0675*** |
| | (0.00781) | (0.0146) | (0.0111) | (0.00895) |
| Log Labor | 0.405*** | 0.382*** | 0.418*** | 0.373*** |
| | (0.0155) | (0.0232) | (0.0199) | (0.0160) |
| Log GDP | 2.488* | -2.546 | -1.257 | 2.455 |
| | (1.409) | (1.684) | (1.509) | (1.623) |
| Log GDP$^2$ | -0.178 | 0.420* | 0.219 | -0.115 |
| | (0.194) | (0.235) | (0.210) | (0.220) |
| Deficit | -0.00352 | 0.00192 | -0.00354 | -0.00476 |
| | (0.00274) | (0.00333) | (0.00277) | (0.00328) |
| | | | | |
| Observations | 98,454 | 36,597 | 63,638 | 71,413 |
| Within R-squared | 0.060 | 0.065 | 0.065 | 0.056 |
| Number of Firms | 26,536 | 12,454 | 19,388 | 20,770 |
| | | | | |
| Year-Industry F.E. | ✓ | ✓ | ✓ | ✓ |
| | | | | |
| Sample of firms | Firms with lower-tax aff. | Firms with no lower-tax aff. | Firms with higher-tax aff. | Firms with no higher-tax aff. |

**Notes**: Firm fixed-effects regressions. Standard errors clustered at the firm level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The dependent variable in all columns is the log of reported profit before interest and taxes. tprisk=index of transfer-pricing risk described in Section 4.1. Tax Rate=corporate tax rate in the firm's home country. Log Assets=log(fixed tangible assets). Log Labor=log(employee compensation). Log GDP=log(per capita GDP). Log GDP$^2$=log(per capita GDP)$^2$. Deficit=government deficit/surplus as a percentage of GDP.

with the story above. More surprisingly, it appears that having at least one higher-tax affiliate also makes the response of reported profits to increased enforcement less negative. This could capture the fact that having a higher-tax affiliate might be an indicator that the firm is part of a multinational where profit shifting occurs.

## 5.3 Response to affiliate-country enforcement

In addition to predicting differences across firms in the response of reported profit to own-country enforcement, the model also predicts that reported profit should be decreasing in the enforcement levels of the countries in which higher-tax affiliates are located and that the enforcement levels of countries in which lower-tax affiliates are located should have an ambiguous effect on reported profit. The first column of Table 5.6 adds two additional terms to the specification, the average level of enforcement in the countries of higher-tax affiliates, where *tprisk* for each affiliate is weighted by the tax differential between that country and the firm's home country, and the average level of enforcement in the countries of lower-tax affiliates, where *tprisk* for each affiliate is again weighed by the tax differential between the firm's home country and the tax rate faced by that affiliate. The sign on $AvgRiskHi$ is consistent with the predictions of the model, but the results are not statistically significant. Partially, this could be due to the fact that the size of the subsidiary is also important in determining the response of reported profit to a change in *tprisk* in that subsidiary's country. The opportunities for shifting are likely to be greater with larger subsidiaries, but currently, for any given tax differential, subsidiaries all receive the same weight due to the extremely limited information available on subsidiary size. In the future, affiliate *tprisk* should be weighted by affiliate-level assets for the subset of affiliates for which this information is available.

Another problem with the regression is that, by including both average risk for higher-tax affiliates and average risk for lower-tax affiliates, only the small subset of firms that have both high-tax and low-tax affiliates is used. To take into account the effect of using this subset of firms, each measure of affiliate transfer-pricing enforcement is considered separately. Only limiting the sample to firms that have at least one higher-tax affiliate, Column (2) of Table 5.6 shows that the coefficient on AvgRiskHiWeight continues to be negative, but statistically insignificant. Only limiting the sample to firms that have at least one higher-tax affiliate, Column (3) of Table 5.6 provides weak evidence that stricter enforcement in the countries where lower-tax affiliates are located decreases reported profit. Since a firm will have an incentive to deduct the compliance costs of transactions in the higher-tax country, this would be consistent with transfer-pricing regulation having a relatively large effect on compliance

Table 5.5: Variation in distribution of affiliates

| | (1) Log EBIT | (2) Log EBIT | (3) Log EBIT |
|---|---|---|---|
| tprisk | -0.112* | -0.109* | -0.110* |
| | (0.0619) | (0.0622) | (0.0621) |
| Tax Rate | -1.224 | -1.165 | -0.922 |
| | (0.884) | (0.894) | (0.897) |
| tprisk*Tax Rate | 0.292 | 0.258 | 0.215 |
| | (0.215) | (0.216) | (0.217) |
| tprisk*NumLo | | 0.00540* | 0.00504 |
| | | (0.00324) | (0.00320) |
| tprisk*HasLo | | | 0.0110*** |
| | | | (0.000406) |
| tprisk*NumHi | | 0.00521 | -0.000235 |
| | | (0.00349) | (0.00327) |
| tprisk*HasHi | | | 0.0133*** |
| | | | (0.00393) |
| Log Assets | 0.0730*** | 0.0729*** | 0.0729*** |
| | (0.00663) | (0.00664) | (0.00664) |
| Log Labor | 0.401*** | 0.401*** | 0.401*** |
| | (0.0123) | (0.0123) | (0.0123) |
| Log GDP | -0.423 | -0.307 | -0.165 |
| | (1.085) | (1.086) | (1.086) |
| Log GDP$^2$ | 0.198 | 0.180 | 0.159 |
| | (0.149) | (0.149) | (0.149) |
| Deficit | -0.00228 | -0.00229 | -0.00237 |
| | (0.00210) | (0.00211) | (0.00211) |
| NumLo | | -0.00761 | -0.0174 |
| | | (0.0167) | (0.0166) |
| NumHi | | 0.00583 | -0.00699 |
| | | (0.0172) | (0.0167) |
| | | | |
| Observations | 135,051 | 135,051 | 135,051 |
| Within R-squared | 0.061 | 0.061 | 0.061 |
| Number of Firms | 34,219 | 34,219 | 34,219 |
| | | | |
| Year-Industry F.E. | ✓ | ✓ | ✓ |

**Notes**: Firm fixed-effects regressions. The dependent variable in all columns is the log of reported profit before interest and taxes. tprisk=index of transfer-pricing risk described in Section 4.1. Tax Rate=corporate tax rate in the firm's home country. NumLo=number of lower-tax affiliates. HasLo=1 if the firm has at least one lower-tax affiliate. NumHi=number of higher-tax affiliates. HasHi=1 if the firm has at least one higher-tax affiliate. Log Assets=log(fixed tangible assets). Log Labor=log(employee compensation). Log GDP=log(per capita GDP). Log GDP$^2$=log(per capita GDP)$^2$. Deficit=government deficit/surplus as a percentage of GDP. *** p<0.01, ** p<0.05, * p<0.1.

costs and a relatively small effect on the actual amount shifted out. As discussed briefly in section 4.3, the measures used in these regressions to capture enforcement in the countries in which affiliates are located will all suffer from the problem that they will also partially be capturing the effect of changes in corporate tax rates that change the weighting of $tprisk$ across affiliates and that the precise form of the term will depend on the assumptions that are made about the cost functions.

# 6 Conclusions

This paper considers the effect of transfer-pricing enforcement on reported profits using a model of optimal profit shifting to capture how profit-shifting flows respond to changes in enforcement. The model recognizes that there are three effects of increased transfer-pricing enforcement. It deters shifting out; it can potentially deter shifting in; and it increases the cost of doing business for any firm with related-party transactions. Policy makers often seem to suggest that increased transfer-pricing regulation is always a good thing, but this indicates that they are implicitly focusing on only the first of these effects. Using a firm fixed-effects estimation strategy, the results in this paper suggest that increased transfer-pricing enforcement has a negative effect on reported profit, although the effect is less negative for firms that are located in higher-tax countries. Consistent with the predictions of the model, the effect of enforcement is also less negative for firms with low-tax affiliates, which indicates that enforcement does deter shifting out. These results mean that, even if increased regulation is costless from the perspective of the government, increased enforcement should not be automatically assumed to increase tax collections.

Both individual countries and international groups such as the OECD are increasingly focusing on preventing profit shifting. While measures to make profit shifting more costly may seem appealing, it is necessary to recognize that these measures have many effects beyond simply decreasing the amount of profit that corporations shift out. Especially for countries with relatively low corporate tax rates, the increased compliance costs that result from increased regulation and the decrease in the incentive for shifting in mean that implementing transfer-pricing regulation is likely to decrease corporate tax revenue. The empirical results suggest that, even for relatively high-tax countries, the increase in the cost of doing business for all corporations with related-party transactions may mean that many forms of increased transfer-pricing regulation do more harm than good. Forms of enforcement like documentation requirements, that are unlikely to have a large effect on the marginal cost of shifting, but are likely to result in a significant fixed cost for any firm that has transactions with its affiliates, are especially likely to decrease reported profits and, therefore, decrease

Table 5.6: Effect of Affiliate-Level Enforcement

| | (1) Log EBIT | (2) Log EBIT | (3) Log EBIT |
|---|---|---|---|
| AvgRiskHi | -0.217 | -0.122 | |
| | (0.141) | (0.0827) | |
| AvgRiskLo | -0.168 | | -0.130** |
| | (0.112) | | (0.0528) |
| tprisk | -0.0237 | -0.0350** | -0.0174 |
| | (0.0271) | (0.0149) | (0.0156) |
| tprisk*NumHi | 0.00290 | -0.000793 | 0.00585 |
| | (0.00789) | (0.00334) | (0.00684) |
| tprisk*NumLo | 0.00283 | 0.00555 | 0.00246 |
| | (0.00357) | (0.00338) | (0.00334) |
| Tax Rate | 0.957 | 0.399 | 0.0811 |
| | (0.844) | (0.526) | (0.296) |
| Log Assets | 0.0685*** | 0.0799*** | 0.0715*** |
| | (0.0164) | (0.0112) | (0.00852) |
| Log Labor | 0.446*** | 0.419*** | 0.400*** |
| | (0.0339) | (0.0201) | (0.0170) |
| Log GDP | 3.038 | -1.563 | 4.145* |
| | (3.641) | (1.557) | (2.205) |
| Log GDP$^2$ | -0.445 | 0.263 | -0.408 |
| | (0.494) | (0.216) | (0.298) |
| Deficit | -0.0124** | -0.00342 | -0.00525* |
| | (0.00525) | (0.00280) | (0.00307) |
| NumHi | -0.0419 | -0.0237 | -0.0267 |
| | (0.0345) | (0.0189) | (0.0294) |
| NumLo | -0.0316 | -0.0350* | -0.00869 |
| | (0.0208) | (0.0190) | (0.0187) |
| | | | |
| Observations | 28,459 | 62,891 | 86,117 |
| Within R-squared | 0.069 | 0.065 | 0.058 |
| Number of Firms | 8,951 | 19,114 | 24,820 |
| | | | |
| Industry-Year F.E. | ✓ | ✓ | ✓ |

**Notes**: Firm fixed-effects regressions. Standard errors clustered at the firm level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The dependent variable in all columns is the log of reported profit before interest and taxes. AvgRiskHiWeight =weighted (by tax differential) average of the *tprisk* index of the countries of all higher-tax affiliates. AvgRiskLoWeight=weighted (by tax differential) average of the same index for the countries of all lower-tax affiliates. tprisk=index of transfer-pricing risk described in Section 4.1. Tax Rate=corporate tax rate in the firm's home country. NumLo=number of lower-tax affiliates the firm has. NumHi=number of higher-tax affiliates the firm has. Log Assets=log(fixed tangible assets). Log Labor=log(employee compensation). Log GDP=log(per capita GDP). Log GDP$^2$=log(per capita GDP)$^2$. Deficit=government deficit/surplus as a percentage of GDP.

tax revenues. Partially, this may suggest that the best approach to deterring profit shifting is to improve the targeting of transfer-pricing investigations rather than forcing all firms to comply with detailed documentation requirements. The more these efforts can be targeted towards the firms that are actually shifting large amounts of profit out, the more likely these measures should be to have a positive effect on tax revenue. This paper does not touch on the separate issue of how differences in enforcement across countries would be expected to affect optimal shifting between affiliates. Given that weaker efforts to prevent profit shifting are probably attractive to a firm, however, this is likely to provide further support for increased own-country enforcement reducing reported profits and, therefore, tax collections.

## Chapter 2:
## Shifting Against the Tax Differential

# 7 Introduction

In order to maximize after-tax profits, a multinational corporation that has related firms (affiliates) located across a number of countries with differing corporate tax rates has an incentive to shift profits from affiliates that face a high corporate tax rate to affiliates that face a lower corporate tax rate. Given that the end goal of profit shifting is to minimize tax payments, it is generally assumed that profits will only ever move from a higher-tax country to a lower-tax country. This paper shows that differences across countries in the cost of profit shifting can actually create an incentive to shift profits from a lower-tax affiliate to a higher-tax affiliate, provided that this shifting facilitates shifting on to an affiliate that is even lower tax than the original source country. This incentive to shift from a middle-tax affiliate to a higher-tax affiliate is especially strong if the middle-tax country targets its attempts at preventing profit shifting towards transactions with lower-tax affiliates. While this shifting against the tax differential may seem counterintuitive at first, in many ways, moving profits through a higher-tax country in order to take advantage of lax enforcement, is no different than moving profits through a higher-tax country in order take advantage of a beneficial tax treaty. This behavior has consequences both in terms of thinking about how profit shifting should be modeled and in terms of thinking about optimal government policies to try to limit profit shifting.

To understand why shifting against the tax differential may occur, consider an extreme example. Suppose that a multinational corporation is composed of three firms, where firm A is located in the highest-tax country, firm B is located in the middle-tax country and firm C is located in the lowest-tax country. All three firms have positive profits. Assume that the only thing that the tax-collection agency in firm A's home country cares about is that the reported profits of firm A match the profits that firm A has actually earned. In that case, anything shifted to firm A can be shifted out costlessly. As long as shifting from B to C via A results in higher after-tax profits than shifting directly from B to C, then the optimal strategy for the corporation involves moving profits against the tax differential.[11]

[11]The corporation will shift from B to A as long as the marginal cost of shifting from B to A is less than

While this is an extreme case, it captures two of the characteristics that must hold for shifting against the tax differential to be optimal. First, the high-tax country must be relatively focused on net shifting, i.e. deviations between earned profits and reported profits. Second, the middle-tax country must focus more of its attention on transactions between firm B and its lower-tax affiliate, firm C, than it does on transactions between firm B and its higher-tax affiliate, firm A.

This potential for profit shifting against the tax differential has not been recognized up to this point because past models of profit shifting have followed one of two approaches.[12] The first class of models, used in papers such as Hines and Rice (1994) and Huizinga and Laeven (2008), have allowed a corporation to be active in many countries and have modeled the net shifting (outflows minus inflows) into or out of each firm. The focus on net shifting means that the path of profit-shifting flows cannot be considered in the framework of these models, as all that can be established is the total amount that is shifted into or out of each affiliate. This framework also does not allow the cost of profit shifting to depend on the route that the profits follow.

The second class of models, used in papers such as Haufler and Schjelderup (2000) and Lohse and Riedel (2012), have considered a corporation that is active in only two countries. In the two-country setting, there are no intermediate tax rate countries, so these models do not have the potential to capture the more complex incentives for shifting that occur in a multi-country setting. Overall, no paper has considered affiliate-to-affiliate (gross) flows in a setting with more than two countries. This means that these papers have not had the potential to capture the possibility of gross profit-shifting against the tax differential.

This paper considers gross flows in a three-country setting, where the determinants of the cost of profit shifting are allowed to vary across countries. Allowing variation in the cost of profit shifting across countries opens up the possibility of gross profit-shifting flows that go against the tax differential. While predictions about the sign of net shifting will still hold, high-tax affiliates will see profits shifted out on net and low-tax affiliates will see profits shifting in on net, gross shifting does not necessarily have to occur in the direction of the tax differential. If a multinational has an affiliate in a high-tax country whose enforcement efforts are targeted at deviations between expected profits and reported profits, the model shows that this can induce a country to shift profits to that country from a lower-tax affiliate. This

both the marginal cost of shifting from B to C and the marginal benefit of shifting, i.e. the tax differential between B's home country and C's home country.

[12]Note that this paper is looking at shifting that goes against the effective tax rate differential, not just the statutory tax rate differential. Given that the marginal benefit of shifting is determined by the difference in effective tax rates, there are many scenarios where a corporation would optimally want to shift from a firm that faces a lower statutory corporate tax rate to a firm that faces a higher statutory corporate tax rate.

shifting occurs because shifting profits to the high-tax affiliate enables further profit shifting out. Considering profit shifting in this framework opens up the possibility of a specific type of high-tax country being used as a flow through entity for profit-shifting purposes. The enforcement of the middle-tax country is also important in determining the direction of profit-shifting flows. If the tax agency in that country assumes that profit shifting will move in the direction of the tax differential, then this will encourage profit shifting against the tax differential.

The remainder of the paper is structured as follows. The second section introduces a simple setting in which a corporation will optimally shift against the tax differential. The third section discuss the more general conditions under which we would and would not see gross profit shifting against the tax differential. The fourth section briefly discusses why some countries might choose to have lax enforcement. The fifth section discusses how the cost of profit shifting has been modeled in the literature. It also discusses how profit shifting against the tax differential could affect different strategies for empirically estimating the magnitude of profit shifting. The sixth section concludes.

# 8 Shifting Against the Tax Differential with Non-Convex Costs

Consider a multinational that has three affiliates, A, B and C, where affiliate $A$ faces an effective corporate tax rate of $\tau_A$, affiliate $B$ faces an effective corporate tax rate of $\tau_B$ and affiliate $C$ faces an effective corporate tax rate of $\tau_C$. For this simple example, assume that the cost of shifting profit is linear in the amount shifted and that the cost is not deductible.[13] The cost of shifting differs across affiliate pairs. This allows for the possibility that the affiliates' home countries put different amounts of effort towards enforcement, which results in the cost of shifting being different across countries. It also allows for the possibility that it is more costly to shift to an affiliate in a lower-tax country than it is to shift to an affiliate in a higher-tax country. Assume that the cost of shifting one dollar from affiliate $i$ to affiliate $j$ is $\gamma_{ij}$.

For a corporation that seeks to maximize after-tax profits, the end goal is to get profits to affiliate $C$. This means that the corporation will never optimally shift profits out of affiliate $C$. In terms of getting profits to affiliate $C$, however, the corporation has a number of possible paths: (1) it can shift from $A$ to $C$ directly and from $B$ to $C$ directly, (2) it can shift from $A$ to $B$ and then from $B$ to $C$ or (3) it can shift from $B$ to $A$ and then from $A$

[13] These assumptions will be relaxed in the next section.

to $C$. It is also possible that shifting might be costly enough that the corporation does not shift anything out of one or more of the higher-tax countries.

The marginal benefit of shifting from $A$ to $C$ is the tax differential between affiliate $A$'s home country and affiliate $C$'s home country, $\tau_A - \tau_C$. The marginal benefit of shifting from $B$ to $C$ is the tax differential between affiliate $B$'s home country and affiliate $C$'s home country, $\tau_B - \tau_C$. The marginal cost of shifting will depend on the path the profit follows. The corporation can shift from $A$ to $C$ directly with a marginal cost of $\gamma_{AC}$. It can shift from $B$ to $C$ directly with a marginal cost of $\gamma_{BC}$. Alternatively, to get profits from $A$ to $C$, the corporation could shift from $A$ to $B$ and then $B$ to $C$ at a marginal cost of $\gamma_{AB} + \gamma_{BC}$. To get profits from $B$ to $C$, the corporation could instead shift from $B$ to $A$ and then from $A$ to C at a marginal cost of $\gamma_{BA} + \gamma_{AC}$.

In this setting, the corporation will shift everything out of affiliate $A$ as long as the marginal cost of shifting is less than that marginal benefit. The profits will be shifted along the path that results in the lower marginal cost. This means the corporation will shift from $A$ to $C$ directly if $\gamma_{AC} < \tau_A - \tau_C$ and $\gamma_{AC} \leq \gamma_{AB} + \gamma_{BC}$. It will shift from $A$ to $B$ and then from $B$ to $C$ if $\gamma_{AB} + \gamma_{BC} < \tau_A - \tau_C$ and $\gamma_{AB} + \gamma_{BC} < \gamma_{AC}$. If $\gamma_{AC} \geq \tau_A - \tau_C$ and $\gamma_{AB} + \gamma_{BC} \geq \tau_A - \tau_C$, then the corporation won't shift anything out of affiliate $A$.

In terms of shifting out of affiliate $B$, the corporation will shift everything out of $B$ as long as the marginal cost of shifting either from $B$ to $C$ directly or from $B$ to $A$ and then from $A$ to $C$ is less than the marginal benefit. This means the corporation shifts from $B$ to $C$ directly if $\gamma_{BC} < \tau_B - \tau_C$ and $\gamma_{BC} \leq \gamma_{BA} + \gamma_{AC}$. It will first shift to the higher-tax country, $A$, and then shift on from $A$ to $C$ if $\gamma_{BA} + \gamma_{AC} < \tau_B - \tau_C$ and $\gamma_{BA} + \gamma_{AC} < \gamma_{BC}$. If $\gamma_{AB} \geq \tau_A - \tau_B$ and $\gamma_{BA} + \gamma_{AC} \geq \tau_A - \tau_B$ then the corporation won't shift anything out of affiliate $B$.

> **Proposition 1**: If the marginal cost of gross shifting is constant, then, assuming the corporation shifts profit out of affiliate $B$**,** the corporation will shift those profits against the tax differential as long as $\gamma_{BA} + \gamma_{AC} < \gamma_{BC}$.

Even in this simple setup, then, there is a situation where gross profit-shifting flows go against the tax differential. If $\gamma_{BA} + \gamma_{AC} < \gamma_{BC}$ and $\gamma_{BA} + \gamma_{AC} < \tau_B - \tau_C$ then, even though all profits earned by affiliate $B$ will, in the end, be shifted to affiliate $C$, the shifting that actually occurs is from affiliate $B$ to its higher-tax affiliate, affiliate $A$. This situation would be consistent with a setting where affiliate $A$'s home country is high tax but low enforcement and where affiliate $B$'s home country focuses its enforcement efforts at transactions with the lower-tax affiliate, while putting less effort towards preventing shifting to the higher-tax affiliate. If affiliate $A$'s home country has lax enforcement then that would translate into

$\gamma_{AC}$ being relatively small. If affiliate $B$'s home country focuses its resources on transactions with lower-tax affiliates, then that would mean that $\gamma_{BC}$ would be large relative to $\gamma_{BA}$. This is consistent with a country with limited resources focusing on transactions made with tax havens, but paying little attention to transactions with higher-tax affiliates, an approach many countries seem to follow in practice.[14] This simple example, however, shows that if these higher-tax affiliates are located in low-enforcement countries, then this targeting may be risky as it may encourage shifting through the higher-tax country instead. The country may, incorrectly, assume that it has cut down on profit shifting, when its actions have instead simply changed the route the corporation uses to shift profits. In the end, the high-tax country essentially functions as an enforcement haven. Although this is an extreme example, where the corporation either shifts everything or nothing, the next section shows that the intuition behind the example carries over to other, less extreme, settings.

Net shifting has been the focus of most empirical papers in the profit-shifting literature. This means that it is also important to understand how allowing for the possibility of gross profit shifting against the tax differential might affect the predicted relationship between tax differentials and net shifting. This example has demonstrated the potential for gross profit shifting against the tax differential, but, in this simple setting, shifting against the tax differential generally does not affect predictions about the magnitude of net profit-shifting flows.[15] Regardless of the direction of the profit shifting, if shifting occurs, then all profits are shifted out of the higher-tax countries. In the more general examples discussed in the next section, the direction of the gross shifting can, in fact, affect the magnitude of net shifting. Section 5 briefly discusses how empirical estimates of the magnitude of profit shifting might be affected by this potential for shifting against the tax differential.

# 9 General Model

## 9.1 Setup

The example above was an extreme case, where the linear cost of shifting meant that, as long as the marginal cost of shifting was less than the marginal benefit, then all profits would be shifted out of higher-tax countries. In reality, multinationals do not generally report zero profits in high-tax locations and extremely high profits in low-tax locations. They instead

[14] Looking at transfer-pricing guides from the Big Four accounting firms, it is quite common for countries to state that transactions with affiliates located in known tax havens will face additional scrutiny. See, for example, Ernst & Young (2006-2013).

[15] Unless the costs and tax rates are such that $\gamma_{BA} + \gamma_{AC} < (\tau_B - \tau_C) < \gamma_{BC}$. In that scenario, nothing would be shifted out of affiliate $B$ if shifting is only allowed in the direction of the tax differential, but everything will be shifted out if profits can be moved against the tax differential.

report lower than expected profits in high-tax countries and higher than expect profits in low-tax countries. The relationship between reported profits and the tax rate indicates that shifting occurs, but the amount of shifting must be limited by some kind of non-linear cost function. This means that is important to understand if the incentive for shifting against the tax differential can also carry over to a model of profit shifting that yields interior solutions.

This section shows that shifting against the tax differential can, under certain circumstances, be optimal whenever we allow for the possibility that shifting from $B$ to $A$ enables shifting out of affiliate $A$, i.e. lowers the marginal cost of shifting out of $A$. How likely we are to see shifting against the tax differential will depend on the relative responsiveness of the cost of shifting in affiliate $A$'s home country and affiliate $B$'s home country to net shifting, as well as the interaction of other cost parameters. The model introduced below allows the cost of shifting between any two affiliates to depend on how much is being shifted between the two (gross shifting), and also on how much is being shifted into or out of the affiliate in total (net shifting).

Before considering which types of cost functions can result in shifting against the tax differential, consider first a setting in which the cost functions will only yield shifting that moves in the direction of the tax differential. Any model of profit shifting that assumes that the cost of shifting between two affiliates is only a function of the amount of profit shifted between those two affiliates will give the result that shifting will only ever occur in the direction of the tax differential.[16] In order for there to be the possibility for profit-maximizing shifting to a higher-tax affiliate, that shifting must facilitate shifting on to an even lower-tax affiliate. In a model where the cost of shifting only depends on gross shifting, shifting profits to an affiliate does not have this positive effect of enabling additional shifting out. When the cost depends solely on gross shifting, there are only two marginal effects of moving a dollar between affiliates: (1) the tax rate faced by that dollar changes, and (2) the cost of shifting goes up. The only way there will be a positive net benefit from shifting then, is if the dollar is moved to an affiliate that faces a lower tax rate. Shifting from a lower-tax affiliate to a higher-tax affiliate would both increase the tax rate faced by that dollar and would incur a cost, so such shifting could never be optimal.

Things change, however, when the cost of shifting between two affiliates is assumed to depend on both gross shifting and the net shifting (i.e. outflows minus inflows) into or out of the source affiliate. Consider again a multinational that has three affiliates, each located in a different country. If the cost of shifting between any two affiliates depends on both gross shifting and net shifting, then, even when the corporation does not optimally shift everything out of affiliate $A$, it can be optimal for the multinational to shift from $B$ to $A$

[16] Assuming that the model yields an interior solution.

instead of from $A$ to $B$. This is because, if the cost of shifting is assumed to depend on net shifting, then there are now four effects of shifting from affiliate $A$ to affiliate $B$. It will change the tax rate the profits face from $\tau_A$ to $\tau_B$, it will increase $c_{AB}$ both because it increases $S_{AB}$ and because it increases $S_A$, it will increase $c_{AC}$ because it increases $S_A$ and it will decrease $c_{BC}$ because it decreases $S_B$. If the corporation instead shifted from $B$ to $A$, there would also be four effects. It would increase the tax rate from $\tau_B$ to $\tau_A$, it would increase $c_{BA}$, it would increase $c_{BC}$ and it would decrease $c_{AC}$. The decrease in $c_{AC}$ means that there is now a positive benefit of shifting from $B$ to $A$. If it is large enough, then it can actually induce shifting against the tax differential, as it can make the net benefit of shifting from $B$ to $A$ both positive and higher than the net benefit of shifting from $A$ to $B$. Generally, this shifting against the tax differential is likely to occur when the cost of shifting in the higher-tax country places more weight on net shifting than the cost of shifting in the lower-tax country.

## 9.2 Conditions for Optimal Shifting

Again consider a multinational corporation that has three affiliates, $A$, $B$ and $C$. They are located across three different countries, where $A$'s home country has the highest corporate tax rate and $C$'s home country has the lowest corporate tax rate, $\tau_A > \tau_B > \tau_C$. Affiliate $i$ earns true profit of $B_i$. In determining its optimal profit shifting, the corporation is selecting between two possible maximizations. The first option is that it can shift from $A$ to $B$, from $A$ to $C$ and from $B$ to $C$. In this case it selects the amount to shift from $A$ to $B$ ($S_{AB}$), the amount to shift from $A$ to $C$ ($S_{AC}$), and the amount to shift from $B$ to $C$ ($S_{BC}$), to maximize:

$$\max_{S_{AB}\geq 0, S_{AC}, S_{BC}} (1-\tau_A)(B_A - S_A - c_{AB} - c_{AC}) + (1-\tau_B)(B_B - S_B - c_{BC}) + (1-\tau_C)(B_C - S_C)$$

where:

$$\begin{aligned} S_A &= S_{AB} + S_{AC} \\ S_B &= S_{BC} - S_{AB} \\ S_C &= -S_{AC} - S_{BC} \end{aligned}$$

Alternatively, it can shift from $B$ to $A$, from $A$ to $C$ and from $B$ to $C$. In this case it selects the amount to shift from $B$ to $A$ ($S_{BA}$), the amount to shift from $A$ to $C$ ($S_{AC}$), and

the amount to shift from $B$ to $C$ ($S_{BC}$), to maximize:

$$\max_{S_{BA}\geq 0, S_{AC}, S_{BC}} (1-\tau_A)(B_A - S_A - c_{BA} - c_{AC}) + (1-\tau_B)(B_B - S_B - c_{BC}) + (1-\tau_C)(B_C - S_C)$$

where:

$$\begin{aligned} S_A &= S_{AC} - S_{BA} \\ S_B &= S_{BC} + S_{BA} \\ S_C &= -S_{AC} - S_{BC} \end{aligned}$$

In both maximizations, the cost of a given path of shifting, $c_{ij}$, is assumed to take a form such that it depends on both the amount shifted from $i$ to $j$, $S_{ij}$, and the net shifting out of affiliate $i$, $S_i$, i.e. $c_{ij} = f_{ij}(S_{ij}, S_i)$. This setup also imposes the assumption that the cost of shifting between $i$ and $j$ is fully deductible and is always deducted by the higher-tax affiliate.[17]

If the corporation shifts a positive amount from $A$ to $B$, then that shifting must satisfy the three first-order conditions below:

$$\tau_A - \tau_B = (1-\tau_A)\left(\frac{\partial c_{AB}}{\partial S_{AB}} + \frac{\partial c_{AB}}{\partial S_A} + \frac{\partial c_{AC}}{\partial S_A}\right) - (1-\tau_B)\left(\frac{\partial c_{BC}}{\partial S_B}\right) \tag{9.1}$$

$$\tau_A - \tau_C = (1-\tau_A)\left(\frac{\partial c_{AB}}{\partial S_A} + \frac{\partial c_{AC}}{\partial S_{AC}} + \frac{\partial c_{AC}}{\partial S_A}\right) \tag{9.2}$$

$$\tau_B - \tau_C = (1-\tau_B)\left(\frac{\partial c_{BC}}{\partial S_{BC}} + \frac{\partial c_{BC}}{\partial S_B}\right) \tag{9.3}$$

The right-hand side of equation (9.1) reflects the fact that, in addition to the direct cost of shifting, moving profits from $A$ to $B$ increases the cost of shifting from $A$ to $C$ and decreases the cost of shifting from $B$ to $C$. Similarly, the right-hand side of equation (9.2) captures that shifting profits from $A$ to $C$ increases the cost of moving profits from $A$ to $B$.

If the corporation shifts a positive amount from $B$ to $A$, then that shifting must instead

[17] In future work, it would be interesting to also treat the decision of where to deduct costs as a strategic choice. As higher costs mean lower reported profits, it seems likely that the cost of shifting would also affect the likelihood of a firm being audited, as it would increase the gap between expected profits and reported profits. Differences across countries in terms of responsiveness to deviations between expected profits and reported profits could then influence the decision about where to actually deduct the costs.

satisfy:

$$\tau_B - \tau_A = (1-\tau_A)\left(\frac{\partial c_{BA}}{\partial S_{BA}} + \frac{\partial c_{BA}}{\partial S_B} - \frac{\partial c_{AC}}{\partial S_A}\right) + (1-\tau_B)\left(\frac{\partial c_{BC}}{\partial S_B}\right) \quad (9.4)$$

$$\tau_A - \tau_C = (1-\tau_A)\left(\frac{\partial c_{AC}}{\partial S_{AC}} + \frac{\partial c_{AC}}{\partial S_A}\right) \quad (9.5)$$

$$\tau_B - \tau_C = (1-\tau_A)\left(\frac{\partial c_{BA}}{\partial S_B}\right) + (1-\tau_B)\left(\frac{\partial c_{BC}}{\partial S_{BC}} + \frac{\partial c_{BC}}{\partial S_B}\right) \quad (9.6)$$

The right-hand side of equation (9.4) reflects the fact that there is not only a direct cost of shifting profits from $B$ to $A$, but that doing so also increases the cost of shifting profits from $B$ to $C$, but reduces the cost of shifting profits from $A$ to $C$.

Just from comparing these sets of first order conditions, it is clear that shifting from $B$ to $A$ allows for additional shifting from $A$ to $C$, but less shifting from $B$ to $C$. The additional shifting from $A$ to $C$ can be seen from the additional term in equation (9.2) that does not appear in equation (9.5). This is because shifting from $A$ to $C$ increased the cost of shifting from $A$ to $B$ but does not affect the cost of shifting from $B$ to $A$. The reduced shifting from $B$ to $C$ can be seen from the additional term in equation (9.6) that does not appear in equation (9.3). This is because shifting from $B$ to $C$ affects the cost of shifting from $B$ to $A$, but did not affect the cost of shifting from $A$ to $B$.

Because the cost of shifting between $A$ and $B$ depends on the direction the profits are going, the first maximization is restricted to $S_{AB} \geq 0$, this means that the first maximization will actually be solved by setting $S_{AB} = 0$ if, at $S_{AB} = 0$:[18]

$$(\tau_A - \tau_B) - (1-\tau_A)\left(\frac{\partial c_{AB}}{\partial S_{AB}} + \frac{\partial c_{AB}}{\partial S_A} + \frac{\partial c_{AC}}{\partial S_A}\right) + (1-\tau_B)\left(\frac{\partial c_{BC}}{\partial S_B}\right) \leq 0 \quad (9.7)$$

Likewise, the second maximization will actually be solved by setting $S_{BA} = 0$ if, at $S_{BA} = 0$:[19]

$$(\tau_B - \tau_A) - (1-\tau_A)\left(\frac{\partial c_{BA}}{\partial S_{BA}} + \frac{\partial c_{BA}}{\partial S_B} - \frac{\partial c_{AC}}{\partial S_A}\right) - (1-\tau_B)\left(\frac{\partial c_{BC}}{\partial S_B}\right) \leq 0 \quad (9.8)$$

If, for all values of $S_{AC}$ and $S_{BC}$, (9.7) holds, and (9.8) does not, then the corporation will maximize profits by shifting a positive amount from $B$ to $A$, i.e. it will shift profits against the tax differential. Under the reasonable assumption that $\frac{\partial c_{AB}}{\partial S_A} = 0$ when $S_{AB} = 0$ and that $\frac{\partial c_{BA}}{\partial S_B} = 0$ when $S_{BA} = 0$, then these conditions for shifting against the tax differential

[18] This assumes that the profit function is strictly concave in $S_{AB}$.

[19] This assumes that the profit function is strictly concave in $S_{BA}$

to be optimal can be written as:

$$(\tau_A - \tau_B) - (1 - \tau_A)\frac{\partial c_{AC}}{\partial S_A} + (1 - \tau_B)\frac{\partial c_{BC}}{\partial S_B} \leq (1 - \tau_A)\frac{\delta c_{AB}}{\delta S_{AB}} \tag{9.9}$$

at $S_{AB} = 0$, and

$$(\tau_A - \tau_B) - (1 - \tau_A)\frac{\partial c_{AC}}{\partial S_A} + (1 - \tau_B)\frac{\partial c_{BC}}{\partial S_B} < -(1 - \tau_A)\frac{\delta c_{BA}}{\delta S_{BA}} \tag{9.10}$$

at $S_{BA} = 0$. If (9.10) holds, then (9.9) is guaranteed to hold. This condition indicates that shifting against the tax differential is most likely to be optimal if the tax difference between A and B is small, if the cost of shifting from B to A is small, if the cost of shifting out of A is very responsive to net shifting, and if the cost of shifting out of B is relatively unresponsive to net shifting.

Condition (9.10) holding for all values of $S_{AC}$ and $S_{BC}$ when $S_{BA} = 0$ is a sufficient condition for profit shifting against the tax differential, but it is not necessary. Shifting from $B$ to $A$ will be optimal anytime the after-tax profits from shifting from $A$ to $B$, evaluated at $S^*_{AB}$, $S^*_{AC}$, $S^*_{BC}$:[20]

$$(1 - \tau_A)(B_A - S_A - c_{AB} - c_{AC}) + (1 - \tau_B)(B_B - S_B - c_{BC}) + (1 - \tau_C)(B_C - S_C)$$

are less than the after-tax profits from shifting from $B$ to $A$ evaluated at $\hat{S}_{BA}$, $\hat{S}_{AC}$, $\hat{S}_{BC}$:[21]

$$(1 - \tau_A)(B_A - S_A - c_{BA} - c_{AC}) + (1 - \tau_B)(B_B - S_B - c_{BC}) + (1 - \tau_C)(B_C - S_C)$$

It is not possible, however, to further assess this condition for when shifting against the tax differential will be optimal without imposing assumptions on the forms of the cost functions.

> **Proposition 2**: If after-tax profits are strictly concave in the amount shifted between affiliate $A$ and affiliate $B$, then if $(\tau_A - \tau_B) - (1 - \tau_A)\frac{\partial c_{AC}}{\partial S_A} + (1 - \tau_B)\frac{\partial c_{BC}}{\partial S_B} < -(1 - \tau_A)\frac{\partial c_{BA}}{\partial S_{BA}}$ for all values of $S_{AC}$ and $S_{BC}$ when $S_{BA} = 0$, then this is sufficient to guarantee that shifting against the tax differential will be optimal.

[20] Where $S^*_{AB}$, $S^*_{AC}$, $S^*_{BC}$ satisfy first-order conditions (1), (2), and (3), and the requirement that $S^*_{AB} \geq 0$.
[21] Where $\hat{S}_{BA}$, $\hat{S}_{AC}$, $\hat{S}_{BC}$ satisfy first-order conditions (4), (5), and (6) and the requirement that $\hat{S}_{BA} \geq 0$.

## 9.3 Special Case: Initially no shifting between $A$ and $B$

A special case of the scenario just discussed can be considered if it is assumed that (1) the corporation starts from a point where it is not initially shifting profits between affiliate $A$ and affiliate $B$ and that (2) when it first begins to shift between affiliate $A$ and affiliate $B$, is not initially able to adjust the amount it shifts from affiliate $A$ to affiliate $C$ and from affiliate $B$ to affiliate $C$. This could occur if, for example, the corporation has an opportunity to manipulate transfer prices because it begins to sell goods and services between affiliate $A$ and affiliate $B$ for the first time. With this setup, it is relatively straightforward to establish a condition for when it will be optimal for the corporation, when it first begins shifting between affiliate $A$ and affiliate $B$, to shift against the tax differential. Consider conditions (9.2) and (9.3) when $S_{AB} = 0$. The optimal amount of shifting from $A$ to $C$ ($S^*_{AC}$) must satisfy:

$$\begin{aligned}\tau_A - \tau_C &= (1-\tau_A)\left(\frac{\partial c_{AB}(S_{AB}=0, S_A = S^*_{AC})}{\partial S_A} + \frac{\partial c_{AC}(S_{AC} = S^*_{AC}, S_A = S^*_{AC})}{\partial S_{AC}}\right. \\ &\quad \left. + \frac{\partial c_{AC}(S_{AC} = S^*_{AC}, S_A = S^*_{AC})}{\partial S_A}\right) \end{aligned} \tag{9.11}$$

The optimal amount of shifting from $B$ to $C$ ($S^*_{BC}$) must satisfy:

$$\tau_B - \tau_C = (1-\tau_B)\left(\frac{\partial c_{BC}(S_{BC} = S^*_{BC}, S_B = S^*_{BC})}{\partial S_{BC}} + \frac{\partial c_{BC}(S_{BC} = S^*_{BC}, S_B = S^*_{BC})}{\partial S_B}\right) \tag{9.12}$$

Now consider the optimal shifting from $A$ to $C$ when shifting from $B$ to $A$, $S_{BA}$, is equal to zero. That optimal shifting, $\hat{S}_{AC}$, must satisfy condition (9.5) evaluated at $S_{BA} = 0$:

$$\tau_A - \tau_C = (1-\tau_A)\left(\frac{\partial c_{AC}(S_{AC} = \hat{S}_{AC}, S_A = \hat{S}_{AC})}{\partial S_{AC}} + \frac{\partial c_{AC}(S_{AC} = \hat{S}_{AC}, S_A = \hat{S}_{AC})}{\partial S_A}\right) \tag{9.13}$$

The optimal shifting from $B$ to $C$ when $S_{BA} = 0$ ($\hat{S}_{BC}$) must satisfy:

$$\begin{aligned}\tau_B - \tau_C &= (1-\tau_A)\left(\frac{\partial c_{BA}(S_{BA}=0, S_B = \hat{S}_{BC})}{\partial S_B}\right) + \\ &\quad (1-\tau_B)\left(\frac{\partial c_{BC}(S_{BC} = \hat{S}_{BC}, S_B = \hat{S}_{BC})}{\partial S_{BC}} + \frac{\partial c_{BC}(S_{BC} = \hat{S}_{BC}, S_B = \hat{S}_{BC})}{\partial S_B}\right) \end{aligned} \tag{9.14}$$

Again imposing the reasonable assumption that $\frac{\partial c_{AB}}{\partial S_A} = 0$ when $S_{AB} = 0$ and $\frac{\partial c_{BA}}{\partial S_B} = 0$ when $S_{BA} = 0$, equation (9.11) will be the same as equation (9.13) and equation (9.12) will be the same as equation (9.14). This means that $S^*_{AC} = \hat{S}_{AC}$ and $S^*_{BC} = \hat{S}_{BC}$. Initially then, after-tax profits are the same for both profit functions. As long as shifting from $B$ to

$A$ increases profits, and shifting from $A$ to $B$ does not, then the corporation will optimally shift against the tax differential.

For shifting from $B$ to $A$ to increase profits, it must be that the derivative of profits with respect to $S_{BA}$ at $S_{BA} = 0$, $S_{AC} = S^*_{AC}$ (given $S_{BA} = 0$), $S_{BC} = S^*_{BC}$ (given $S_{BA} = 0$) is greater than zero. This means that it must be the case that:

$$(\tau_B - \tau_A) - (1 - \tau_A)\left(\frac{\partial c_{BA}}{\partial S_{BA}} - \frac{\partial c_{AC}}{\partial S_A}\right) - (1 - \tau_B)\frac{\partial c_{BC}}{\partial S_B} > 0$$

or

$$(\tau_A - \tau_B) - (1 - \tau_A)\frac{\partial c_{AC}}{\partial S_A} + (1 - \tau_B)\frac{\partial c_{BC}}{\partial S_B} < -(1 - \tau_A)\frac{\partial c_{BA}}{\partial S_{BA}} \tag{9.15}$$

As long as $\frac{\partial c_{BA}}{\partial S_{BA}} > 0$ at $S_{BA} = 0$, then this holding will guarantee that shifting from $A$ to $B$ will not increase profits. This is because, for shifting from $A$ to $B$ to increase profits, it has to be the case that:

$$(\tau_A - \tau_B) - (1 - \tau_A)\frac{\partial c_{AC}}{\partial S_A} + (1 - \tau_B)\frac{\partial c_{BC}}{\partial S_B} > (1 - \tau_A)\frac{\partial c_{AB}}{\partial S_{AB}}$$

at $S_{AB} = 0$, $S_{AC} = S^*_{AC}$ (given $S_{AB} = 0$) and $S_{BC} = S^*_{BC}$ (given $S_{AB} = 0$). This condition follows the same intuition as the condition in the previous section. If the tax difference between $A$ and $B$ is relatively small, the cost of shifting $S^*_{AC}$ from $A$ to $C$ is significantly reduced by profits being shifted to affiliate $A$, the cost of shifting $S^*_{BC}$ from $B$ to $C$ is relatively unaffected by profit being shifted out of $B$, and the cost of shifting from $B$ to $A$ is relatively low, then, starting from the situation where there is no shifting between affiliate $A$ and affiliate $B$, the corporation will maximize profits by shifting from $B$ to $A$. Once allowed to adjust $S_{AC}$ and $S_{BC}$, however, this result does not guarantee that profits will still be maximized by shifting from $B$ to $A$. In the current setup, there is nothing that prevents there from being some other combination of $S_{AC}$ and $S_{BC}$ and a positive value of $S_{AB}$ that give a higher value of after-tax profits than $S^*_{AC}$, $S^*_{BC}$ and $S^*_{BA} > 0$.

## 9.4 Examples with Specific Cost Functions

In order to gain more understanding of when shifting against the tax differential will be profit maximizing, this section considers a few specific forms of the general cost functions used in the last section. First, consider again the case, discussed briefly in the introduction, where profit-shifting enforcement in country $A$ is such that the cost of total shifting out of country $A$ only depends on the net amount shifted, i.e. outflows minus inflows. In country $B$, on the other hand, enforcement is such that the cost of shifting to another country is

solely a function of how much is shifted to that country, i.e. the gross flow, and does not depend on net shifting at all. These assumptions are represented by the cost functions:

$$\begin{aligned} c_{AC} &= f(S_A) \\ c_{AB} &= f(S_A) \\ c_{BA} &= g(S_{BA}) \\ c_{BC} &= h(S_{BC}) \end{aligned}$$

Given that the cost of shifting out of country $A$ depends only on the net amount shifted, then, at any given level of $S_A$, the marginal cost of shifting another dollar from $A$ to $B$ is the same as the marginal cost of shifting another dollar from $A$ to $C$. The marginal benefit, i.e. the tax savings, of shifting from $A$ to $C$ is greater than the marginal benefit of shifting from $A$ to $B$, so the corporation will not shift any profit from $A$ to $B$. If the corporation is considering the first maximization, then, where it is only able to shift from affiliate $A$ to affiliate $B$, it will set optimal shifting from $A$ to $C$ ($S^*_{AC}$) such that:

$$f'(S^*_{AC}) = \frac{(\tau_A - \tau_C)}{(1 - \tau_A)} \tag{9.16}$$

Optimal shifting from $B$ to $C$ in this setting, $S^*_{BC}$, will satisfy the condition:

$$h'(S^*_{BC}) = \frac{(\tau_B - \tau_C)}{(1 - \tau_B)} \tag{9.17}$$

If it only has the option of shifting from $A$ to $B$ then, the corporation will shift from $A$ to $C$ and from $B$ to $C$. The corporation does, however, also has the option of shifting from $B$ to $A$, from $A$ to $C$, and from $B$ to $C$. In that case, the corporation faces the second maximization and will set $\hat{S}_{BA}$, $\hat{S}_{AC}$, and $\hat{S}_{BC}$ such that:

$$(f'(\hat{S}_{AC} - \hat{S}_{BA}) - g'(\hat{S}_{BA})) = \frac{(\tau_A - \tau_B)}{(1 - \tau_A)} \tag{9.18}$$

$$f'(\hat{S}_{AC} - \hat{S}_{BA}) = \frac{(\tau_A - \tau_C)}{(1 - \tau_A)} \tag{9.19}$$

$$h'(\hat{S}_{BC}) = \frac{(\tau_B - \tau_C)}{(1 - \tau_B)} \tag{9.20}$$

Optimal shifting from $B$ to $C$ remains unchanged, regardless of if the corporation sets $S_{AB} = 0$ or $S_{BA} = \hat{S}_{BA}$. This can be seen from the fact that equation (9.20) is identical to equation (9.17). This holds because the cost of shifting from $B$ to $C$ has been assumed

to only depend on the gross shifting between $B$ and $C$. If the corporation shifts from $B$ to $A$, then optimal shifting from $A$ to $C$ will be higher than it was with $S_{AB} = 0$. This is because shifting from $B$ to $A$ enables further shifting out of affiliate $A$. Because the amount of shifting between $B$ and $C$ remains unchanged, the cost of shifting from $B$ to $C$ remains the same, regardless of the direction of shifting between $A$ and $B$. Comparing equations (9.16) and (9.19), it must always be the case that $\hat{S}_{AC} = S^*_{AC} + \hat{S}_{BA}$, i.e. anything that is shifted from $B$ to $A$ is then shifted on to $C$. This perfect pass through occurs because the cost of shifting from $A$ to $C$ has been assumed to only depend on net shifting. This means that $S^*_A = \hat{S}_A$, i.e. net shifting out of $A$ is the same across the two scenarios, and $f(S^*_A) = f(\hat{S}_A)$.

Because the cost of shifting from $B$ to $C$ and the cost of shifting out of $A$ are unchanged across the two scenarios, assessing if the corporation has higher after-tax profits shifting from $B$ to $A$ or from $A$ to $B$ is relatively simple. It is only necessary to weigh the benefit, the additional profit that can be shifted from the high-tax affiliate $A$ to the low-tax affiliate $C$, against the cost of shifting that profit from $B$ to $A$. Comparing the benefit of this shifting to the cost, the corporation will optimally shift from $B$ to $A$ if:

$$(\tau_B - \tau_C)\hat{S}_{BA} > (1 - \tau_A) f(\hat{S}_{BA})$$

Because all profits shifted from $B$ to $A$ are then shifted on to $C$, the end benefit of shifting $S_{BA}$ from $B$ to $A$ is that it goes from facing a tax rate of $\tau_B$ to a tax rate of $\tau_C$. If that benefit is higher than the cost of shifting $S_{BA}$ dollars from $B$ to $A$, then it is optimal for the corporation to do so. So, simply by introducing a higher-tax affiliate that is located in a country where the only focus of enforcement is deviations between true profit and reported profit, we have an outcome where, if the corporation shifts anything between the affiliate in country $A$ and the affiliate in country $B$, then that shifting will always move from $B$ to $A$, i.e. against the tax differential. This condition can be further rewritten as:

$$\frac{g(\hat{S}_{BA})}{\hat{S}_{BA}} < \frac{\tau_B - \tau_C}{1 - \tau_A}$$

Combining equations (9.18) and (9.19), optimal shifting from $B$ to $A$ will satisfy the condition:

$$g'(\hat{S}_{BA}) = \frac{\tau_B - \tau_C}{1 - \tau_A}$$

This means that any cost function where $\frac{g(S_{BA})}{S_{BA}} < g'(S_{BA})$ will always result in shifting against the tax differential. This would, for example, hold if $g(S_{BA})$ takes the form $\gamma_{BA} *$

$(S_{BA})^n$ for any value of $n > 1$. If the incentives to shift against the tax differential do exist, then this means that, compared to a scenario where the corporation is assumed to shift in the direction of the tax differential, affiliate $A$'s home country will experience the same amount of net shifting, but net shifting for the affiliates in countries $B$ and $C$ will change. The affiliate in country $B$ will see greater outflows and therefore lower reported profit, and the affiliate in country $C$ will experience greater inflows and so will have higher reported profit than it did in the scenario where profit shifting always occurred in the direction of the tax differential. In this case, shifting against the tax differential is partially induced by affiliate $A$'s home country's focus on net profit shifting, this is in contrast to the linear case, where shifting against the tax differential was due to lax enforcement in affiliate $A$'s home country.

As a less extreme case, consider what happens when the cost of shifting out of affiliate $B$ is instead assumed to depend on both gross shifting and net shifting. The cost of shifting out of affiliate $A$ is still assumed to depend only on net shifting. If the corporation shifts a positive amount of profit from affiliate $A$ to affiliate $B$ then it faces the maximization:

$$\max_{S_{AB}\geq 0, S_{AC}, S_{BC}} (1-\tau_A)(B_A - S_A - f(S_A)) + (1-\tau_B)(B_B - S_B - h(S_{BC}) - l(S_B)) + (1-\tau_C)(B_C - S_C)$$

where:

$$\begin{aligned} S_A &= S_{AB} + S_{AC} \\ S_B &= S_{BC} - S_{AB} \\ S_C &= -S_{AC} - S_{BC} \end{aligned}$$

If it instead shifts a positive amount from affiliate $B$ to affiliate $A$ then it faces the maximization:

$$\max_{S_{BA}\geq 0, S_{AC}, S_{BC}} \quad (1-\tau_A)(B_A - S_A - f(S_A) - g(S_{BA})) + (1-\tau_B)(B_B - S_B - h(S_{BC}) - l(S_B)) \\ +(1-\tau_C)(B_C - S_C)$$

where:

$$\begin{aligned} S_A &= S_{AC} - S_{BA} \\ S_B &= S_{BC} + S_{BA} \\ S_C &= -S_{AC} - S_{BC} \end{aligned}$$

Positive profit shifting from affiliate $A$ to affiliate $B$ must satisfy:

$$\begin{aligned}(\tau_A - \tau_B) - (1-\tau_A)f'(S_A) + (1-\tau_B)l'(S_B) &= 0\\ (\tau_A - \tau_C) - (1-\tau_A)f'(S_A) &= 0\\ (\tau_B - \tau_C) - (1-\tau_B)l'(S_B) - (1-\tau_B)h'(S_{BC}) &= 0\end{aligned}$$

In this setup, although shifting from $A$ to $B$ now has an additional marginal benefit, in that it decreases the cost of shifting out of $B$, it is still the case that the corporation will optimally set shifting from $A$ to $B$ equal to zero. This is because shifting from $B$ to $C$ will be set such that the tax differential between $A$ and $B$ plus the reduction in the cost of shifting out of $B$ will still be less than the tax differential between $A$ and $C$. This means that the optimal values of shifting given the first maximization must satisfy:

$$S^*_{AB} = 0 \tag{9.21}$$

$$f'(S^*_{AC}) = \frac{\tau_A - \tau_C}{1-\tau_A} \tag{9.22}$$

$$l'(S^*_{BC}) + h'(S^*_{BC}) = \frac{\tau_B - \tau_C}{1-\tau_B} \tag{9.23}$$

If the corporation shifts a positive amount of profit from affiliate $B$ to affiliate $A$ then that shifting must satisfy:

$$\begin{aligned}(\tau_B - \tau_A) + (1-\tau_A)f'(S_A) - (1-\tau_B)l'(S_B) - (1-\tau_A)g'(S_{BA}) &= 0\\ (\tau_A - \tau_C) - (1-\tau_A)f'(S_A) &= 0\\ (\tau_B - \tau_C) - (1-\tau_B)l'(S_B) - (1-\tau_B)h'(S_{BC}) &= 0\end{aligned}$$

or

$$\frac{1-\tau_A}{1-\tau_B}f'(\hat{S}_{AC} - \hat{S}_{BA}) - l'(\hat{S}_{BA} + \hat{S}_{BC}) - \frac{1-\tau_A}{1-\tau_B}g'(\hat{S}_{BA}) = \frac{\tau_A - \tau_B}{1-\tau_B} \tag{9.24}$$

$$f'(\hat{S}_{AC} - \hat{S}_{BA}) = \frac{\tau_A - \tau_C}{1-\tau_A} \tag{9.25}$$

$$l'(\hat{S}_{BA} + \hat{S}_{BC}) + h'(\hat{S}_{BC}) = \frac{\tau_B - \tau_C}{1-\tau_B} \tag{9.26}$$

Because firm $A$'s home country is still assumed to only care about net shifting, it continues to be the case that anything shifted from $B$ to $A$ will then be shifted on to affiliate $C$. This can be seen by comparing equations (9.22) and (9.25). This means that $\hat{S}_{AC} = S^*_{AC} + \hat{S}_{BA}$. Through substitution, it can be shown that, in the second scenario, the corporation will shift

from $B$ to $A$ and from $B$ to $C$ until:

$$\frac{1-\tau_A}{1-\tau_B}g'(\hat{S}_{BA}) = h'(\hat{S}_{BC})$$

If the enforcement agency in country $B$ targets enforcement at transactions with firm $C$, then this is likely to make $h'$ large relative to $f'$. This would result in the corporation shifting a lot from $B$ to $A$, because shifting through $A$ would have a low marginal cost relative to shifting directly to $C$.

In comparing how shifting from $B$ to $C$ will change when the corporation shifts a positive amount from $B$ to $A$, it must be the case that:

$$l'(S^*_{BC}) + h'(S^*_{BC}) = l'(\hat{S}_{BA} + \hat{S}_{BC}) + h'(\hat{S}_{BC})$$

This means that the reduction in the amount shifted from $B$ to $C$, or $S^*_{BC} - \hat{S}_{BC}$, is $\hat{S}_{BA}\frac{l''}{h''+l''}$. Because enforcement in affiliate $A$'s home country allows for perfect pass through, the corporation now shifts $\hat{S}_{BA}$ from $B$ to $C$ via $A$. The perfect pass through occurs because the cost of shifting out of affiliate $A$ only depends on gross shifting. This perfect pass through guarantees that, on net, more profit is now shifted from affiliate $B$ to affiliate $C$. In a setting where enforcement in $A$'s home country did not allow for perfect pass through, only some fraction of the amount shifted from $B$ to $A$ would be passed on. In that setting, the total amount shifted from $B$ to $C$ would increase by less, or could even actually decrease, with shifting via $A$. The change in shifting from $A$ to $C$ would still be relatively large as long as the cost of shifting out of $A$ was very responsive to net shifting.

Overall, then, the total change in the amount shifted from $B$ to $C$ is $(1 - \frac{l''}{h''+l''})\hat{S}_{BA}$, or $\frac{h''}{h''+l''}\hat{S}_{BA}$. The benefit of shifting against the tax differential is that this amount now faces a tax rate of $\tau_C$ instead of $\tau_B$. The reduction in tax payments with shifting from $B$ to $A$ is:

$$(\tau_B - \tau_C)\frac{h''}{h''+l''}\hat{S}_{BA} \tag{9.27}$$

The less responsive affiliate $B$'s home country is to net shifting, the smaller $l''$ should be, and the larger the increase in total shifting from $B$ to $C$ will be. This makes it more likely that shifting against the tax differential will be profit maximizing. The increase in cost between the first scenario and the second is:

$$(1-\tau_B)\Big(l(\hat{S}_{BA} + \hat{S}_{BC}) - l(S^*_{BC}) + h(\hat{S}_{BC}) - h(S^*_{BC})\Big) + (1-\tau_A)g(\hat{S}_{BA}) \tag{9.28}$$

There is no change in the cost of shifting from $A$ to $C$ because net shifting out of firm $A$

remains the same. The corporation will shift against the tax differential if (9.27) is greater than (9.28). It is again difficult to evaluate this condition without imposing assumptions on the forms of the cost functions, but it is possible to assess what characteristics of the cost functions will make it more likely for shifting against the tax differential to be profit maximizing.

If the cost of net shifting in affiliate $B$'s home country, $l$, increases slowly with net shifting, then the cost of shifting from $B$ to $A$ will be relatively small. Intuitively, the less responsive the cost of shifting in affiliate $B$'s home is to net shifting, the lower the cost of shifting more profits out of $B$. This makes it less costly to shift from $B$ to $C$ via $A$. It was shown earlier that $S^*_{BC} > \hat{S}_{BC}$. If the cost of gross shifting from $B$ to $C$ is increasing quickly in the amount shifted, then this will also serve to make it more likely that shifting against the tax differential is profit maximizing, as it makes shifting from $B$ to $C$ via $A$ more attractive. Finally, the smaller the direct cost of shifting from $B$ to $A$, $g(S_{BA})$, is, the more likely it is that the corporation will shift profits against the tax differential.

Both scenarios discussed in this section provide similar intuition for when shifting against the tax differential will be profit maximizing. If the cost of shifting out of the high-tax country is very responsive to net shifting, the cost of shifting out of the middle-tax country is relatively unresponsive to net shifting, and the cost of shifting from the middle-tax country to the high-tax country is low relative to the cost of shifting from the middle-tax country to the low-tax country, then the corporation will find that it is profit maximizing to move profits from $B$ to $C$ via affiliate $A$.

# 10 Optimal Enforcement

One interesting result indicated by the examples above is that it is not necessary for the high-tax country to have lax enforcement to create an incentive for shifting against the tax differential. The incentive can also be created if a high-tax country simply focuses its attention on deviations between reported profits and expected profits, a strategy that seems to be in line with what many countries actually do in practice.[22]

The fact that the enforcement policy of a high-tax country can change the direction of profit shifting flows may create an incentive for high-tax countries to choose enforcement policies that facilitate shifting profits through that country. As long as there are benefits that are associated with having profits flow through, then it might be optimal, for example, for a high-tax country's enforcement policy to consciously focus on just net profit shifting. The role enforcement can play in determining profit shifting flows emphasizes the importance

[22]See the audit risks discussed in Ernst & Young (2006-2013).

of thinking about enforcement, not as an exogenous factor, but instead as a policy decision. This is discussed in papers such as Altshuler and Grubert (2005).

There are likely differences between the type of high-tax country that would see profits flow through because of lax enforcement and the type of high-tax country that would see profits flow through because of a focus on net profit shifting. Generally, high-tax countries probably would not find it attractive to have lax profit shifting enforcement, as lax enforcement would result in large profit shifting outflows and an associated decrease in tax revenue. Having profits flow through might be an unexpected benefit of lax enforcement in a high-tax country where the expertise and resources for better enforcement are unavailable, but, given the necessary resources, most high-tax countries probably would not want to make the choice to have lax enforcement overall. Having enforcement that is focused on net shifting, however, should be attractive to most high-tax countries, as it is unlikely to change overall shifting. A policy focused on net shifting would mean that these high-tax countries would see profits flow through as long as middle-tax countries continued to focus their enforcement efforts towards transactions with lower-tax countries.

# 11 Models and Estimates of Profit Shifting

## 11.1 Modeling the cost of profit shifting

As mentioned in the introduction, the way that the cost of profit shifting had been modeled in the literature meant that it was not possible to recognize the potential for gross profit shifting against the tax differential. Past models have focused on either two-country models or have focused on estimating optimal net shifting in an n-country setting. Neither of these setups allows for the consideration of the direction or magnitude of affiliate-to-affiliate profit shifting flows. Allowing for the possibility of a more general cost function is important in order to better understand the incentives for profit shifting that exist. Not only does a more general model capture the potential for shifting against the tax differential, but it also allows for variation in the cost of shifting across affiliate pairs. Generally speaking, as documented by surveys of transfer-pricing regulation by the Big Four accounting firms, countries have been increasing their focus on transfer-pricing regulation as a way to prevent profit shifting.[23] Additionally, as discussed in Buettner, Overesch, Schreiber, and Wamser (2006), thin capitalization rules to limit the strategic use of debt have also become more common. Countries still greatly differ, however, in both the level of effort they put towards preventing profit shifting and the actual ability they have to prevent profit shifting. This

[23]See, for example, Ernst & Young (2006-2013) or Deloitte (2006-2010).

means that it is important to have a model that can account for variation in the cost of profit shifting depending on the origin of the shifted profits.

The increases in enforcement discussed briefly above should clearly affect the cost of profit shifting. Generally speaking, however, enforcement has not been integrated into models of profit shifting in order to understand how differences in enforcement affect the incentives for profit shifting. Two-country models, such as the one used in Haufler and Schjelderup (2000), allow for the discussion of what would happen to the cost of shifting if a country increased its enforcement, but, the two-country setting means that the effect of enforcement on other profit-shifting paths cannot be considered. These models, therefore, give the simple prediction that, if a country increases its enforcement effort, then that will decrease the amount of profit that is shifted out of that country. Given that multinationals generally have affiliates located across many countries, however, a two-country setting cannot give an accurate picture of the incentives for profit shifting that exist between each pair of affiliates. In Saunders-Scott (2013a), countries are allowed to differ in their enforcement efforts, but the focus is on how local reported profits are affected by a change in enforcement effort, rather than how differences in enforcement across countries affect optimal flows.

A few papers have, in an empirical setting, considered the effect of efforts to prevent profit shifting. Using a measure that captures variation in transfer-pricing rules, documentation requirements and penalties, Bartelsman and Beetsma (2003) find evidence that stricter enforcement in a firm's home country is associated with lower responsiveness to tax differentials. Lohse and Riedel (2012) takes a closer look at documentation requirements and find similar results, transfer-pricing regulation lessens firms responsiveness to tax differentials. Saunders-Scott (2013a) finds that increases in transfer-pricing enforcement have actually decreased the reported profits of local affiliates of multinational corporations. Empirical papers provide evidence that enforcement affects the cost of profit shifting. What is still unclear, however, is how the relationship between enforcement and the cost of shifting should be modeled in a theoretical framework.

If looking at the amount that a corporation shifts from an affiliate in Italy to an affiliate in Ireland, should the cost be determined by how much is shifted between those two affiliates, or should the cost also depend on how much has been shifted into or out of the Italian firm from other affiliates? Should only Italian efforts to prevent profit shifting matter, or should Irish efforts to prevent profit shifting also play a role in determining the cost? This paper takes the step of expanding the model of the cost of profit shifting to consider what happens when the cost of profit shifting is allowed to depend on the amount shifted between two affiliates and the total amount shifted out of the source affiliate. The cost is assumed to depend on both the source and destination country, which allows enforcement to vary

both by the source country and by where the profits are shifted, although no functional form is imposed on the relationship between the cost and the enforcement efforts of the two countries. The relationship between the cost, net shifting, and gross shifting is also allowed to vary by country, which is important because there does seem to be variation across countries in terms of likely audit triggers. Some countries focus on unexpectedly low profits, while others focus on corporations that have transactions with affiliates in tax havens. This paper demonstrates that, in extreme cases, this variation across countries in the determinants of the cost of profit shifting can create incentives for gross shifting that goes against the tax differential. Even in less extreme cases, however, variation in enforcement levels and audit triggers can change the magnitude of expected profit shifting flows by changing the costs of and incentives for shifting. This means that tax differentials alone do not give an accurate picture of the incentives a corporation faces to shift profits.

## 11.2 Does the Cost Function Affect Empirical Estimates of Profit Shifting?

This paper has demonstrated that the form and determinants of the cost function can affect the magnitude and even the direction of profit shifting flows. Papers that have empirically estimated the extent of profit shifting flows, however, have generally ignored the role of enforcement in determining the incentives for profit shifting and have assumed that gross profit shifting flows always move in the direction of the tax differential. This section considers how the assumptions made about the cost function and the direction of profit shifting flows affect these estimates of profit shifting.

In the early 1990s, economists began to focus on empirically estimating the extent of profit shifting. Using aggregate BEA data on affiliates of U.S. multinational corporations, Grubert and Mutti (1991) looked at reported profit and found empirical evidence that was consistent with profit shifting in response to tax incentives.Hines and Rice (1994) was the first paper to consider a model of optimal profit shifting. It models net profit shifting, assuming that the cost of net shifting in a given country is quadratic in the net shifting into or out of that country. They use this model to develop a predicted relationship between reported profits, true profits, and the tax rate of the country in which an affiliate is located. Turning to the data, they find evidence for the expected negative relationship between reported profit and a country's statutory corporate tax rate. While the interpretation of the estimate will depend on the assumptions made about the cost function, the predicted sign of the relationship between the tax rate and reported profits will not. This means that these studies that focus on aggregate profits will not be hugely affected by alternative specifications of the cost

function or by the potential for shifting against the tax differential.

A number of other papers, using a variety of techniques, have found evidence consistent with profit shifting. Bartelsman and Beetsma (2003) focus on the incentives for profit shifting between OECD countries. They use the fact that profit shifting will result in a reported value added that is different from real value added. This gives a predicted relationship between nominal (reported) value added and corporate tax rates. Using aggregate industry-level data on value added, they find evidence that suggests that significant profit shifting occurs between affiliates in OECD countries. This relationship should again depend largely on net shifting, so it is again the interpretation of the estimate, rather than the magnitude of the estimate that will be affected by the assumptions that are made about the cost of profit shifting. Huizinga and Laeven (2008) use the model developed in Hines and Rice (1994) to further solve through the model to determine if a given affiliate in a multinational corporation would expect to see positive inflows of profit or negative outflows of positive. This enables them to not only predict a negative relationship between the corporate tax rate and reported profit at a country level, but, using firm-level data from ORBIS, to actually generate a tax-differential term determining shifting incentives that is specific to an affiliate in a given country that is a member of a specific multinational. This term, should, in reality, depend on the enforcement efforts of the countries in which the affiliates are located, and the exclusion of these terms likely biases the estimate of the coefficient on the tax differential term. The exclusion of enforcement is also likely to affect the estimates of tax revenue effects that are developed in the paper. Dharmapala and Riedel (2013) estimate profit shifting by looking at how earnings shocks at a parent firm are passed along to higher-tax and lower-tax affiliates. They do this by looking at how pretax profits change at the affiliate level. This will again reflect net shifting, so the estimation strategy should be relatively unaffected by the assumptions that are made about the cost function.

So far, all of the papers discussed have estimated profit shifting flows off of reported profits (or value added) and so have focused on estimating net profit shifting flows. This limits the importance of ignoring the potential for gross profit-shifting flows that move against the tax differential, as this shifting against the differential has little effect on the magnitude of net profit shifting flows. Ignoring the possibility of gross profit shifting against the tax differential, however, is especially important if considering papers, such as Clausing (2003), where the estimation depends on comparing transactions with lower-tax affiliates to transactions with higher-tax affiliates. If some shifting actually flows towards higher-tax affiliates, then this approach would underestimate the true magnitude of profit shifting flows. Attempts to find evidence for shifting against the tax differential in the data would likely need to use similar data on intra-firm trade flows, as they are one of the only ways to get some sense for

gross profit-shifting flows. If shifting against the tax differential occurs, then a transaction between an affiliate in a high-tax country and an affiliate in medium-tax country should be priced lower by a corporation that only has those two affiliates than it is by a corporation that also has an affiliate in a low-tax country.

# 12 Conclusions

The literature that has focused on modeling and estimating the profit shifting behavior of multinational corporations has generally only looked at optimal net profit shifting. This means that little attention has been paid to optimal country-to-country, or gross, profit-shifting flows. This paper shows that a corporation can have an incentive to shift profits from a middle-tax affiliate to a higher-tax affiliate if this shifting enables shifting on to an even lower-tax affiliate. This shifting against the tax differential is most likely to occur when the high-tax affiliate is located in either a low-enforcement country or in a country whose enforcement efforts focus on deviations between expected profits and reported profits. Shifting against the tax differential is also more likely if the low-tax affiliate is located in a country that focuses its enforcement efforts at lower-tax countries rather than higher-tax countries.

While gross profit shifting against the tax differential will not affect predictions about the sign of net profit shifting, it is relevant from a policy perspective, as it may call into question policies that focus on transactions with affiliates located in tax havens. It is difficult to capture if multinational corporations do in fact shift profits against the tax differential, as gross profit shifting flows are rarely observed. Corporations clearly do, however, move profits to the Netherlands in order to take advantage of beneficial tax regulations and tax treaties. This makes it seems likely that, to facilitate shifting to a low-tax affiliate, corporations would also be willing to move profits through high-tax countries that either have lax enforcement or that have enforcement policies focused on net profit shifting.

## Chapter 3:
## Does Information Exchange Affect Profit Shifting?

# 13 Introduction

In recent years, there has been a move towards bilateral tax treaties and agreements that focus on information exchange between the treaty parties. Specifically, there has been growth in treaties and agreements that require a country to collect information at the request of its treaty partner, even if the country does not need or want to collect the information for its own tax purposes. These information exchange clauses can be contained in both tax information exchange agreements (TIEAs) and double taxation conventions (DTCs). While TIEAs focus on the exchange of information, DTCs are generally intended to have two goals: (1) to improve cooperation so that individuals and firms are less likely to face double taxation and (2) to facilitate information exchange so as to limit tax avoidance and evasion. Given that earlier agreements were often DTCs, and so focused more on the first goal of eliminating double taxation, past studies of how bilateral tax treaties and agreements affect multinational corporations have focused on how these treaties and agreements affect investment, while giving less thought to how these agreements might affect profit shifting. Although there is a continued focus on information exchange as a way to limit tax evasion, there has been little evidence provided to support the claim that information exchange agreements can limit tax evasion and avoidance by multinational corporations. This paper looks for evidence that the exchange of information has had an effect on the profit-shifting behavior of multinational corporations.

It might, at first glance, seem that the effect of information exchange on profit shifting should be straight forward. The exchange of information should increase the cost of moving profits from an affiliate in a higher-tax country to an affiliate in a lower-tax country. This increase in cost occurs because information exchange may force low-tax countries to collect tax information which helps to prove that a multinational corporation has shifted profits to an affiliate in that country; information the low-tax country would not collect without the arrangement in place. What is not clear, of course, is if this information will actual be of very high quality or very useful, since the lower-tax country has little incentive to detect profit shifting. This is especially true given that many low-tax countries are motivated to sign

information exchange agreements by a desire to avoid being placed on lists of uncooperative tax havens. Even in a simple setting, then, considering a multinational with two affiliates, one in a high-tax country and one in a low-tax country, it is not clear that information exchange would necessarily result in the affiliate in the high-tax country reporting higher profits and the affiliate in the lower-tax country reporting lower profits. It is entirely possible that there would instead be no effect on the reported profits of either affiliate.

If information exchange does affect profit shifting, then the sign and magnitude of the effect should depend on the overall structure of the multinational. For a firm with only higher-tax affiliates, the effect of information exchange should be straight forward. As more information exchange agreements are signed with the home countries of its higher-tax affiliates, the reported profits of the firm should decrease, as less profit can be shifted in.[24] Things are more complicated, however, if we consider a firm with both higher and lower-tax affiliates, or even a firm with multiple lower-tax affiliates.

For illustrative purposes, consider a multinational that has a high-tax affiliate located in France and a low-tax affiliate located in the British Virgin Islands. When France signs a tax information exchange agreement with the British Virgin Islands, this should reduce profit shifting from France to the British Virgin Islands, as the cost of this shifting is now higher with additional information being sent from the British Virgin Islands to France. What is not clear, however, is if the multinational corporation will now simply shift less out of the French affiliate, or if it will instead alter its profit shifting patterns and shift from the affiliate in France to some other low-tax affiliate. In this scenario, it seems clear that the affiliate in the British Virgin Islands should have lower reported profits after the information exchange agreement goes into place. The effect of information exchange on the French affiliate, however, is ambiguous. If the effect of information exchange is to change the destination of shifted profits, then there should be little to no effect on the reported profits of the French affiliate. If, on the other hand, information exchange does simply decrease the amount shifted from the French affiliate to the affiliate in the British Virgin Islands, without affecting the amount shifted to other affiliates, then the profits of the French affiliate should increase after the information exchange agreement goes into effect. There is an additional level of ambiguity, as it might be that part of the value of holding or earning profits in France was the prior lack of information exchange between France and the British Virgin Islands. If that is the case, then there could also be a reduction in the profits earned by or shifted to the French affiliate. Overall, this suggests that the response of a firm to a new information exchange agreement going into force with the home country of a lower-tax

[24] Assuming that the scale of the operations of the low-tax affiliate are not increased in order to facilitate shifting.

affiliate will depend on both if that firm has multiple lower-tax affiliates that are not covered by information exchange and also on if the firm has higher-tax affiliates.

This paper presents a theoretical framework that shows the patterns that would be expected across firms if information exchange does in fact cause a change in profit shifting behavior. Data on the unconsolidated reported profits of affiliates of multinational corporations are then used to see if the changes in reported profits after information exchange agreements go into force match these patterns. Overall, there is evidence that firms experience a decrease in reported profits after information exchange agreements go into force with the home countries of higher-tax affiliates. Things are less clear when looking at the response of a firm's reported profits to a new information exchange agreement with lower-tax affiliates. The effect of increased information exchange with lower-tax affiliates on reported profits is not statistically significant, but there is limited evidence that the response varies with firm characteristics in a way that is consistent with information exchange having some effect on profit shifting. Together, these results suggest that information exchange may have a limited effect on the profit-shifting behavior of multinational corporations, but there is no evidence that the increase in information sharing has resulted in a dramatic change in total profit-shifting outflows. While an information exchange agreement between a higher-tax country and a lower-tax country may limit profit shifting to that lower-tax country, it is not clear that it actually reduces the total amount of profit shifted out of the high-tax country.

The remainder of the paper is structured as follows. Section 2 contains additional information on bilateral tax treaties and information exchange agreements. Section 3 considers the effect of increased information exchange in a simple framework. Section 4 describes the firm-level data and the data on information exchange arrangements that will be used to capture the effect of information exchange on the reported profits of affiliates of multinational corporations. Section 5 contains the empirical results. The conclusions that can be drawn are discussed in Section 6.

# 14 Information Exchange

## 14.1 Background on Information Exchange

Starting in 1998, the OECD began to focus its attention on trying to find ways to limit "harmful tax practices." The push for increased tax information exchange has been a major piece of this effort. The expansion of information sharing is discussed in detail in Keen and Ligthart (2006). In 2000, the OECD released the first draft of its Model Agreement on Exchange of Information on Tax Matters. While there were, prior to that date, some bilateral

information exchange treaties that contained provisions for the collection of information on request, the number of bilateral tax treaties with provisions for the collection of information on request has increased dramatically since 2000. In Germany, for example, the OECD Exchange of Information portal shows that only two bilateral agreements prior to 2000 had provisions for the collection of additional information on request. Since 2000, it has signed 45 agreements that contain such a provision. While some agreements contain both information exchange provisions and double taxation agreements, agreements that are aimed solely at information exchange have also grown in popularity. These information exchange agreements are especially common with countries that have been identified as tax havens. This is in part because tax havens have faced pressure to sign information exchange agreements in order to avoid appearing on lists of uncooperative tax havens. In addition to these bilateral agreements, there has also been some progress in implementing multilateral information exchange arrangements. While some papers, such as Bacchetta and Espinosa (2000), have considered the question of why countries would agree to information exchange, little work has been done to understand the effect that the information exchange component of tax arrangements has had on the behavior of multinational corporations.

## 14.2 Effect on FDI

There is a past literature that has focused on capturing the effect of bilateral tax treaties on foreign direct investment between the treaty partners, with the prior that tax treaties decrease the uncertainty of tax treatment and should, therefore, facilitate investment. Early papers, such as Blonigen and Davies (2004), found little evidence that bilateral tax treaties had any effect on aggregate FDI flows between the United States and treaty partners. They took this finding to suggest that U.S. tax treaties might be focused more on limiting tax evasion than on facilitating FDI. Davies, Norbäck, and Tekin-Koru (2009) used data on Swedish multinationals to show that bilateral tax treaties seem to have an effect on entry, i.e. it becomes more likely that an affiliate will be formed or acquired, but that they do not seem to affect investment in existing foreign affiliates. The reduction in tax position uncertainty is the main mechanism through which bilateral tax treaties should encourage investment. Certain characteristics of firms should determine the extent to which they are exposed to tax uncertainty. Blonigen, Oldenski, and Sly (2013), use firm-level BEA data to attempt to exploit the fact that firms vary in the degree to which they face tax position uncertainty. Presumably, those firms that face the most tax uncertainty should benefit the most from the reduction in uncertainty that comes with a bilateral tax treaty. They find evidence that bilateral tax treaties signed by the United States do in fact increase foreign

affiliate sales for firms in sectors that trade differentiated inputs that are difficult to price, i.e. firms for which the increased tax certainty would be most valuable. Presumably, these firms would be the same firms that would be most able to shift profits, which raises the possibility that the increase in sales could also be a means through which to facilitate continued profit shifting. It is something of an open question, therefore, if this additional investment would actually be expected to increase the profits of the domestic firm in the United States. All of the papers discussed above consider a mix of some bilateral tax agreements that contain information exchange provisions and some that do not. This paper is the first to attempt to isolate the effect of information exchange by focusing solely on treaties with provisions for the exchange of information.

# 15 Theoretical Framework

There are number of ways in which the exchange of information could affect the behavior of a multinational corporation. Information exchange has the potential to affect both how the multinational shifts profits and its real investment. As discussed above, past studies of bilateral tax treaties and agreements have focused on how these treaties and agreements affect investment. The existence of multiple margins for response means that the overall effect of information exchange agreements is likely to be ambiguous in a theoretical framework. Additionally, it means that it may be difficult to separate potential changes in investment from changes in profit shifting. This section presents a simple framework for thinking about the response of the reported profits of an affiliate of a multinational corporation to newly signed information exchange agreements. In a simple setting, the framework looks at how characteristics such as industry and the distribution of the other affiliates in the multinational corporation would affect reported profits if the response is being driven by profit shifting. It is likely that the response of reported profits to these tax treaties and agreements is being driven by both changes in investment and changes in profit shifting, but the theoretical framework will provide a way of understanding what patterns would be expected if changes in profit shifting are contributing to the overall response.

When the reported profits of an affiliate of a multinational corporation are observed, it is the combination of the actual profits earned by the affiliate and any profit shifting that has taken place. Reported profits, then, can be thought of as:

$$Reported\,Profits = Earned\,Profits - Outflows + Inflows - Cost\,of\,Shifting$$

To understand the effect of the exchange of information on the reported profits of firm

$i$, it is necessary to think about how the exchange of information is likely to affect each piece. The response of a firm is considered in two different scenarios: (1) if the information exchange arrangement is signed between the firm's home country and the home country of a higher-tax affiliate and (2) if the information exchange arrangement is signed between the firm's home country and the home country of a lower-tax affiliate. It is possible that firm $i$ has only higher-tax affiliates, both higher and lower-tax affiliates, or only lower-tax affiliates, the response is again considered for each possible situation.

## 15.1 Information Exchange Agreement with Higher-Tax Country

If firm $i's$ home country signs an information exchange agreement with the home country of one of its higher-tax affiliates, then this can affect the reported profits of firm $i$ in a number of ways. On the profit shifting front, if the information exchange agreement serves to increase the cost of profit shifting, then this new agreement should decrease the amount of profit that flows into the firm. This means that inflows should be reduced and the reported profits of firm $i$ will decrease. The cost of shifting could either increase or decrease, depending on if the increase in the cost is offset by the reduction in the amount shifted. The corporation will have an incentive to deduct this cost in the higher-tax country, however, so this should have little effect on the reported profits of firm $i$. Given that information exchange agreements often also provide for greater tax certainty, it is possible that a new information exchange agreement will facilitate investment in firm $i$. This would cause an increase in the earned profits of firm $i$ and, therefore, an increase in the reported profits of firm $i$. Tax certainty may not be the only incentive for increased investment. It is also possible that the higher-tax affiliate would have an incentive to invest in firm $i$ in order to facilitate profit shifting, as the information exchange agreement could mean that greater effort now needs to be made to disguise the shifting. Overall then, an information exchange agreement with the home country of a higher-tax affiliate should reduce firm $i$'s reported profits if the effect on profit shifting is large. The information exchange agreement should increase firm $i$'s reported profits if the effect of investment and, therefore, earned profits is large.

On the empirical side, a negative relationship between the share of higher-tax affiliates that are covered by information exchange and reported profits would suggest that information exchange has the effect of limiting profit shifting. This negative relationship should hold regardless of if a firm has only higher-tax affiliates or both higher and lower-tax affiliates. In either case, the increase in information exchange coverage should limit profit shifting inflows to that firm. In reality, however, given that there are likely to be simultaneous changes to the coverage of higher-tax affiliates and the coverage of lower-tax affiliates, this effect is likely

to be most obvious for firms that have only higher-tax affiliates.

For increased information exchange to limit profit shifting, there needs to initially be profit shifting between firm $i$ and the higher-tax affiliate. This should create variation in response by industry, as the industry of the firm and its affiliate partially determine the likelihood and ease of profit shifting. Firms in industries where profit shifting is more difficult should be less likely to see a reduction in reported profits when information exchange coverage increases and firms in industries where profit shifting is easier should be more likely to see a reduction in profits. In reality, however, characteristics that determine the ease of profit shifting are also likely to be correlated with the change in tax certainty. This means that firms in industries where inputs are difficult to price would be the most likely to see a large negative response to information exchange through the reduction in inflows if they currently use transfer-pricing uncertainty in order to shift profits. If they are not currently taking advantage of the transfer-pricing uncertainty, however, they might also be the most likely to exhibit a positive response to information exchange, as the reduction in uncertainty could serve to facilitate investment.

## 15.2 Information Exchange Agreement with Lower-Tax Country

If firm $i$'s home country signs an information exchange agreement with the home country of one of its lower-tax affiliates, then this could also have a number of different effects on firm $i$'s reported profits. Assuming that profit shifting occurs between firm $i$ and that lower-tax affiliate, the information exchange agreement is likely to decrease the amount of profit that firm $i$ shifts to that specific affiliate. What is unclear, however, is if this will results in a significant decrease in firm $i$'s total profit shifting.

If the profits are now kept in firm $i$'s home country, then there should be an increase in firm $i$'s reported profits when this information exchange agreement is signed. The size of the increase, however, is likely to depend on how the cost of shifting changes when the information exchange agreement goes into force. Alternatively, it is possible that profits will now instead be shifted from firm $i$ to some other low-tax affiliate. In this case, the information exchange agreement should have little effect on firm $i$'s reported profits. Given that this new route for profit shifting was not the one originally chosen, it is likely that, if the profit shifting is redirected, then the cost of the shifting will be higher. This means that firm $i$'s reported profits could even potentially decrease in response to the new information exchange agreement.

The above discussion suggests that there should be a difference between how a firm with multiple lower-tax affiliates and a firm with a single lower-tax affiliate responds to the

implementation of an information exchange agreement with the home country of a lower-tax affiliate. A firm with a single lower-tax affiliate should be more likely to increase its reported profits in response to a new information exchange agreement with the home country of its lower-tax affiliate than a firm that has other lower-tax affiliates that are not covered by information exchange agreements. This is because the second firm has the opportunity to redirect its shifting.

It is also possible that firm $i$'s earned profits and profit shifting inflows will change when $i$'s home country signs an information exchange agreement with the home country of a lower-tax affiliate. This could occur if, for example, part of the value of earning or declaring profits in affiliate $i$ was the lack of information exchange with, and therefore ability to shift profit to, the lower-tax country. If this is the case, then, for firms that also have higher-tax affiliates, there is an additional negative effect of an increase in information exchange with lower-tax affiliates.

In summary, the effect of a new information exchange agreement with the home country of a lower-tax affiliate on firm $i$'s reported profits is ambiguous. It should be the case, however, that if the agreement is affecting profit shifting, then the structure of the multinational of which firm $i$ is an affiliate should influence the response of firm $i$'s reported profits. If firm $i$ has no higher-tax affiliates and only a single lower-tax affiliate, then a new information exchange agreement with the home country of that lower-tax affiliate should increase firm $i$'s reported profits. The increase could, however, be small depending on the relative magnitudes of the reduction in outflows and the increase in the cost of shifting. If, instead, firm $i$ does has have other lower-tax affiliates available that still are not covered by information exchange, then the response should be less positive, as profit shifting outflows can be redirected to a different low-tax affiliate. Similarly, if firm $i$ does in fact have higher-tax affiliates, then this would also be expected to make the response less positive, as the information exchange agreement may discourage shifting in.

# 16 Data

There are total of 34 countries for which both firm-level data and information on bilateral tax treaties and agreements can be obtained. The availability of the firm-level data limits the period the sample period to 2003-2012. The panel data on firm-level variables such as reported profits, assets, and employment will allow for a firm fixed-effects estimation strategy, where changes in fixed tangible assets and the cost of employees will be used to

proxy for changes in earned profits.[25] The firm-level data also includes information on the distribution of a firm's affiliates. This means it is possible to determine if a firm has been affected by a new information exchange arrangement in a given year. This allows for the estimation of both a country-by-year fixed effect, which will capture country-level changes that affect all firms, and the effect of new information exchange arrangements.

## 16.1 Firm-Level Data

The Bureau van Dijk ORBIS database is used to obtain information on a sample of multinational corporations. ORBIS is a firm-level dataset that collects information from national and local accounts. It currently contains financial information on over 93 million active corporations. Given that the theoretical framework suggests that the structure of the corporation will affect how a firm responds to exchange of information arrangements, the sample is limited to the subset of almost 3 million corporations that have information available on ownership links. The response to the recent increase in exchange of information arrangements is likely to be driven by both changes in investment patterns and changes in profit shifting. To see how these factors affect the corporation, it is necessary to further limit the sample to firms for which unconsolidated reports available. This means that information on assets, labor and reported profit can be obtained for individual affiliates rather than for the entire corporate group. The dependent variable of interest in most specifications will be the log of a firm's profits before interest and taxes, which should capture the distribution of profits across affiliates after any profit shifting has occurred. A firm is only included in years where its earnings before interest and taxes, tangible assets, and cost of employees are all available and positive. Information is also collected on the firm's industry, which will allow for the inclusion of industry-by-year fixed effects in the empirical section.

To isolate firms that have the ability to invest in, or shift profits to, an affiliate, the sample is limited to only include firms which own at least 50% of at least one foreign subsidiary.[26] The response of an individual firm's reported profits to an increase in information exchange will depend on the ownership structure of its corporate group. Given the complex structure of many multinationals, it can be difficult to define ownership links. Although any cutoff used will be somewhat arbitrary, any foreign subsidiaries and foreign shareholders of the firm where there is an ownership link of at least 50% will be considered to be part of that firm's corporate group.

[25]This assumes a Cobb-Douglas production function in capital and labor. This method is used to proxy for true profits in Hines and Rice (1994) and other papers in the profit-shifting literature.

[26]Where the foreign subsidiary must be within 10 tiers of the firm, i.e. the sample would still include a firm if it owns 100% of a domestic firm and that domestic firm then owns more than 50% of a foreign firm.

The geographic distribution of the firms in the sample is detailed in Table 16.1. The firms are located across 34 countries. While the coverage of firms in ORBIS has expanded in recent years, the focus on European firms is still evident from the large share of firms in the sample that are located in Belgium, France, Italy, Spain and Sweden.

On average, firms in the sample have 2.75 affiliates.[27] The average number of lower-tax affiliates is 1.63 and the average number of higher-tax affiliates is 0.98. The median firm has a single affiliate. The information available from ORBIS on a firm's subsidiaries and shareholders is static. This means that there is only information on when the existence of an affiliate was confirmed, but not information on when that affiliate first became a subsidiary or shareholder of the firm. The empirical section will assume that the distribution of subsidiaries and shareholders recorded in ORBIS holds for all years the firm appears in the sample between 2003 and 2012. This is potentially problematic if information exchange induces the creation or acquisition of a subsidiary in that country. Unfortunately, with the static data on ownership that is available, it is not possible to account for this margin.

## 16.2 Growth of Information Exchange Agreements

Data on information exchange agreements and tax treaties that have provisions for the exchange of information is obtained from the Exchange of Information Portal of the OECD Global Forum on Transparency and Exchange of Information. This database contains information on both the date double tax conventions and tax information exchange agreements were signed and the date that these treaties and agreements actually entered into force. It additionally records if the agreement meets OECD standards and if it contains paragraphs that require the provision of information that has not otherwise been collected by a country's tax agency. Given that the focus of this paper is the effect of information exchange on profit shifting, only agreements that have these requirements for the provision of additional information are included. Generally speaking, all tax information exchange agreements (TIEA) contain these requirements, but these requirements are only included in a subset of double tax conventions.[28]

Of the 34 countries captured in the sample, Table 16.2 shows that there is a great deal of variation in terms of both the number of arrangements that meet this requirement and the change in the number of these arrangements over the sample period.

The goal of this paper is to estimate the effect of information exchange on reported profits

[27] Affiliate refers to any firm that is a subsidiary which is at least 50% owned by the firm or is a shareholder that holds 50% ownership in the firm.

[28] In the sample used, the only exception is Norway, which has some TIEAs that do not contain these provisions. For Norway, only TIEAs which require the provision for the collection of additional information are included.

Table 16.1: Location of Firm (% of Sample)

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | - | - | - | - | - | 0.00 | 0.01 | 0.01 | 0.01 | 0.02 |
| Austria | 0.11 | 1.35 | 1.60 | 2.81 | 3.07 | 2.78 | 2.56 | 2.43 | 2.86 | 1.60 |
| Belgium | 11.10 | 10.53 | 9.99 | 9.13 | 8.93 | 8.24 | 8.23 | 8.28 | 8.75 | 11.29 |
| Brazil | - | - | - | - | - | - | 0.00 | 0.00 | - | - |
| Colombia | - | - | - | - | - | - | 0.00 | - | 0.01 | 0.02 |
| Czech Republic | 2.13 | 2.22 | 2.17 | 2.08 | 2.15 | 2.03 | 2.02 | 1.99 | 1.78 | 1.24 |
| Denmark | - | - | - | - | 0.09 | 6.33 | 6.59 | 6.42 | 6.97 | 12.38 |
| Estonia | 0.51 | 0.47 | 0.46 | 0.47 | 0.47 | 0.38 | 0.39 | 0.38 | 0.51 | 0.50 |
| Finland | 3.84 | 3.67 | 3.50 | 3.42 | 3.69 | 3.53 | 3.35 | 3.46 | 3.45 | 5.44 |
| France | 16.66 | 16.27 | 15.46 | 15.08 | 15.00 | 13.81 | 12.97 | 13.14 | 12.17 | 13.02 |
| Germany | 5.13 | 5.91 | 9.28 | 10.43 | 10.22 | 9.73 | 9.88 | 10.00 | 9.32 | 4.53 |
| Hungary | 0.46 | 0.61 | 0.59 | 0.53 | 0.55 | 0.43 | 0.44 | 0.48 | 0.44 | 0.59 |
| Iceland | 0.02 | 0.04 | 0.04 | 0.00 | 0.00 | 0.02 | 0.01 | 0.03 | 0.07 | 0.01 |
| India | 0.01 | 0.01 | 0.01 | - | - | 0.02 | 0.04 | 0.04 | 0.20 | 0.01 |
| Ireland | - | - | 0.05 | 0.37 | 0.61 | 0.55 | 0.52 | 0.57 | 0.63 | 0.29 |
| Italy | 18.66 | 20.27 | 18.82 | 18.65 | 18.51 | 17.23 | 16.12 | 16.36 | 15.66 | 16.57 |
| Japan | 0.29 | 0.34 | 0.34 | 0.32 | 0.28 | 0.22 | 0.25 | 0.30 | 0.39 | 0.35 |
| Liechtenstein | - | - | - | - | - | - | - | 0.01 | 0.01 | - |
| Luxembourg | 0.28 | 0.33 | 0.43 | 0.57 | 0.57 | 0.50 | 0.78 | 0.75 | 0.66 | 0.26 |
| Malta | - | - | - | 0.01 | 0.00 | 0.02 | 0.01 | 0.02 | 0.02 | 0.01 |
| Netherlands | 1.06 | 1.11 | 1.09 | 1.07 | 1.26 | 1.14 | 1.21 | 1.27 | 1.59 | 0.87 |
| New Zealand | - | - | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 |
| Norway | 4.80 | 4.78 | 4.82 | 4.76 | 4.84 | 4.72 | 5.07 | 4.81 | 4.75 | 5.82 |
| Poland | 0.51 | 0.55 | 0.58 | 0.56 | 0.62 | 0.63 | 0.71 | 0.62 | 0.75 | 0.18 |
| Portugal | 1.56 | 1.48 | 1.60 | 1.50 | 1.49 | 1.32 | 1.42 | 1.37 | 1.36 | 2.16 |
| Slovakia | 0.53 | 0.71 | 0.94 | 0.91 | 0.92 | 0.84 | 0.85 | 0.85 | 0.67 | 0.53 |
| Slovenia | 0.66 | 0.60 | 0.57 | 0.58 | 0.60 | 0.57 | 0.53 | 0.56 | 0.51 | 0.02 |
| South Korea | 0.53 | 0.33 | 0.33 | 0.30 | 0.28 | 0.26 | 0.31 | 0.32 | 0.31 | 0.52 |
| Spain | 19.24 | 18.06 | 16.70 | 15.90 | 14.83 | 13.55 | 13.94 | 13.73 | 12.57 | 5.99 |
| Sweden | 7.75 | 6.09 | 6.66 | 6.65 | 6.92 | 7.24 | 7.38 | 7.31 | 8.78 | 11.68 |
| Switzerland | 0.06 | 0.06 | 0.05 | 0.04 | 0.06 | 0.05 | 0.06 | 0.06 | 0.05 | 0.05 |
| Turkey | - | - | - | - | - | - | - | - | 0.00 | 0.01 |
| United Kingdom | 4.31 | 4.20 | 3.94 | 3.85 | 4.03 | 3.81 | 4.33 | 4.40 | 4.72 | 4.04 |
| Uruguay | - | - | - | - | - | - | 0.00 | 0.00 | - | - |
| Total # of Firms | 16,181 | 17,799 | 19,465 | 21,395 | 22,317 | 23,487 | 22,246 | 24,079 | 25,441 | 13,275 |

Note: A "-" indicates that there are no firms in that country that had recorded positive profits, tangible fixed assets and cost of employees in that year.

Table 16.2: Number of Exchange of Information Arrangements in Force

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 6 | 12 |
| Austria | 14 | 14 | 16 | 17 | 18 | 19 | 19 | 23 | 26 | 30 |
| Belgium | 7 | 7 | 7 | 7 | 9 | 10 | 10 | 10 | 10 | 10 |
| Brazil | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| Colombia | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 |
| Czech Republic | 5 | 5 | 7 | 7 | 8 | 9 | 10 | 10 | 11 | 21 |
| Denmark | 6 | 6 | 6 | 6 | 6 | 8 | 13 | 19 | 36 | 48 |
| Estonia | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 4 | 5 | 7 |
| Finland | 7 | 7 | 7 | 7 | 10 | 14 | 17 | 25 | 41 | 49 |
| France | 15 | 15 | 15 | 15 | 17 | 17 | 19 | 33 | 44 | 48 |
| Germany | 6 | 6 | 6 | 7 | 7 | 8 | 10 | 17 | 31 | 39 |
| Hungary | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 9 |
| Iceland | 2 | 2 | 2 | 2 | 2 | 5 | 7 | 8 | 15 | 33 |
| India | 8 | 8 | 8 | 8 | 8 | 8 | 10 | 12 | 21 | 30 |
| Ireland | 4 | 4 | 4 | 4 | 4 | 6 | 8 | 20 | 30 | 38 |
| Italy | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Japan | 4 | 4 | 4 | 5 | 6 | 7 | 9 | 10 | 15 | 16 |
| Liechtenstein | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 14 | 26 |
| Luxembourg | 20 | 20 | 21 | 22 | 23 | 23 | 24 | 29 | 31 | 31 |
| Malta | 6 | 6 | 7 | 8 | 8 | 9 | 10 | 14 | 15 | 23 |
| Netherlands | 10 | 10 | 10 | 11 | 12 | 14 | 18 | 25 | 41 | 47 |
| New Zealand | 1 | 1 | 1 | 2 | 3 | 6 | 7 | 12 | 17 | 18 |
| Norway | 10 | 10 | 11 | 11 | 12 | 13 | 17 | 23 | 40 | 50 |
| Poland | 6 | 6 | 6 | 8 | 9 | 9 | 9 | 9 | 12 | 15 |
| Portugal | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 11 | 17 |
| Slovakia | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| Slovenia | 2 | 2 | 2 | 3 | 3 | 4 | 5 | 7 | 9 | 13 |
| South Korea | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 7 |
| Spain | 2 | 2 | 2 | 4 | 5 | 6 | 11 | 17 | 27 | 31 |
| Sweden | 6 | 6 | 6 | 7 | 7 | 8 | 12 | 18 | 26 | 30 |
| Switzerland | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 24 | 28 | 32 |
| Turkey | 0 | 0 | 1 | 1 | 2 | 2 | 2 | 3 | 6 | 10 |
| United Kingdom | 16 | 16 | 16 | 18 | 20 | 24 | 29 | 36 | 48 | 55 |
| Uruguay | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 10 |

using within country variation in the set of firms that are impacted by a given information exchange agreement. Table 16.3 details, by country, the percentage of firms in the sample that are impacted by a new information exchange agreement in each year.

# 17 Results

The availability of the annual unconsolidated financial reports of the firms in the sample for the period between 2003 and 2012 means that it is possible to use a firm fixed effects specification to estimate the effect of the increase in information exchange agreements. The effect of information exchange is identified by variation across firms within a country, since the effect of a given information exchange agreement on a firm depends on if that firm has an affiliate in the country that is newly covered by information exchange. An information exchange agreement between France and the British Virgin Islands, for example, will only affect French firms that actually have a foreign affiliate in the British Virgin Islands. The existence of firms that are not affected by a new information exchange agreement in a given year, means that it is possible to use these firms to control for country-specific conditions and policy changes.

Countries often sign multiple agreements that have provisions for information exchange in a given year, so the main variable used to capture the variation over time in information exchange coverage is the share of a firm's affiliates that are covered by an information exchange agreement in a given year. Given that the response to an information exchange agreement with a higher-tax affiliate is expected to be quite different from the response to an information exchange agreement with a lower-tax affiliate, this share is calculated separately for the set of a firm's higher-tax affiliates and the set of a firm's lower-tax affiliates.

Table 17.1 regresses a firm's unconsolidated reported profits on these shares, while controlling for changes in a firm's fixed tangible assets and cost of employees to proxy for changes in true profits. All columns include both country-by-year and industry-by-year fixed effects to allow for industry and country specific changes in conditions and policies. The results in Column (1) indicate a negative relationship between the share of higher-tax affiliates covered by information exchange and the reported profits of the firm. This is consistent with the intuition that this should reduce profit shifting inflows, but the coefficient is not statistically significant. Column (2) indicates that the effect of the share of lower-tax affiliates covered by information exchange agreements on reported profits is near zero. Given that this effect was expected to depend on the structure of the firm's multinational group, this weak relationship is not surprising. Column (3) includes both the share of higher-tax affiliates covered by information exchange and the share of lower-tax affiliates covered by information exchange

Table 16.3: Percentage of firms that face new Information Exchange Arrangement

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|
| Argentina | - | - | - | - | 0 | 0 | 0 | 66.67 | 0 |
| Austria | 0 | 0.32 | 17.77 | 31.20 | 1.23 | 0 | 6.67 | 4.57 | 1.89 |
| Belgium | 0 | 0 | 0 | 12.59 | 2.53 | 0 | 0 | 0 | 0 |
| Brazil | - | - | - | - | - | 0 | 0 | - | - |
| Colombia | - | - | - | - | - | 0 | - | 0 | 0 |
| Czech Republic | 0 | 1.65 | 0 | 7.10 | 0 | 0 | 0 | 0 | 21.95 |
| Denmark | - | - | - | - | 2.36 | 1.16 | 0.65 | 0.73 | 9.43 |
| Estonia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.49 |
| Finland | 0 | 0 | 0 | 1.58 | 0.24 | 0 | 6.25 | 7.67 | 1.11 |
| France | 0 | 0 | 0 | 8.97 | 0 | 20.49 | 0.64 | 4.28 | 0.12 |
| Germany | 0 | 0 | 0.81 | 0 | 0.13 | 0.18 | 0.96 | 21.76 | 14.45 |
| Hungary | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.78 | 0 |
| Iceland | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| India | 0 | 0 | - | - | 0 | 0 | 0 | 0 | 0 |
| Ireland | - | 0 | 0 | 0 | 0 | 0 | 2.17 | 1.46 | 20.51 |
| Italy | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Japan | 0 | 0 | 25.00 | 9.68 | 1.92 | 0 | 0 | 16.07 | 0 |
| Liechtenstein | - | - | - | - | - | - | 0 | 0 | - |
| Luxembourg | 0 | 2.38 | 0 | 22.83 | 0 | 1.16 | 0 | 0 | 0 |
| Malta | - | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Netherlands | 0 | 0 | 0 | 0 | 0.37 | 0 | 1.96 | 12.79 | 0 |
| New Zealand | - | 0 | 0 | 33.33 | 0 | 0 | 33.33 | 14.29 | 0 |
| Norway | 0 | 1.49 | 0 | 1.85 | 0 | 0.09 | 0.43 | 8.68 | 0.65 |
| Poland | 0 | 0 | 2.52 | 15.94 | 0 | 0 | 0 | 1.31 | 20.83 |
| Portugal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.64 | 2.44 |
| Slovakia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Slovenia | 0 | 0 | 17.95 | 0 | 4.48 | 0 | 0 | 0 | 0 |
| South Korea | 0 | 0 | 1.56 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spain | 0 | 0 | 0.71 | 0.64 | 4.50 | 1.03 | 0.39 | 3.58 | 11.95 |
| Sweden | 0 | 0 | 8.76 | 0 | 0 | 0.18 | 0.40 | 0.06 | 0 |
| Switzerland | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Turkey | - | - | - | - | - | - | - | 0 | 0 |
| United Kingdom | 0 | 0 | 1.96 | 7.23 | 1.12 | 17.76 | 2.74 | 25.41 | 0 |
| Uruguay | - | - | - | - | - | 0 | 0 | - | - |
| Total (all countries) | 0 | 0.12 | 1.57 | 4.37 | 1.10 | 3.69 | 0.87 | 5.46 | 3.11 |

Table 17.1: Response to information exchange with higher-tax and lower-tax affiliates

| VARIABLES | (1)<br>log EBIT | (2)<br>log EBIT | (3)<br>log EBIT |
|---|---|---|---|
| Share IE high | -0.0490 | | -0.0414 |
| | (0.0318) | | (0.0438) |
| Share IE low | | 0.00649 | 0.00741 |
| | | (0.0248) | (0.0414) |
| Log Assets | 0.0868*** | 0.0903*** | 0.0838*** |
| | (0.00802) | (0.00603) | (0.0113) |
| Log Labor | 0.442*** | 0.435*** | 0.495*** |
| | (0.0147) | (0.0113) | (0.0236) |
| | | | |
| Observations | 94,803 | 147,802 | 45,164 |
| Within R-squared | 0.120 | 0.115 | 0.135 |
| Number of Firms | 22,368 | 29,472 | 10,731 |
| | | | |
| Country-by-Year F.E. | Y | Y | Y |
| Industry-by-Year F.E. | Y | Y | Y |

**Notes**: Firm fixed-effects regressions. Standard errors clustered at the firm level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The dependent variable in all columns is the log of reported profits before interest and taxes. ShareIEhigh=share of higher-tax affiliates covered by information exchange agreements. ShareIElow=share of lower-tax affiliates covered by information exchange agreements. Log Assets=log(fixed tangible assets). Log Labor=log(employee compensation). Column 1 contains all firms that have at least one higher-tax affiliate. Column 2 contains all firms that have at least one lower-tax affiliate. Column 3 contains all firms that have at least one higher-tax affiliate and one lower-tax affiliate.

as regressors. This has the advantage of controlling for the fact that changes in Share IE high and Share IE low are likely to correlated, as a country may have specific years that it is especially active in terms of signing information exchange agreements. This specification limits the sample to only firms that have both higher-tax affiliates and lower-tax affiliates, but the results found are very similar to those in Columns (1) and (2).

These results suggest that information exchange agreements with higher-tax affiliates limit profit-shifting inflows, but they are not conclusive. In order to further isolate the effect of an increase in the share of higher-tax affiliates, without limiting the sample to firms with both higher and lower-tax affiliates, Tables 17.2 and 17.3 isolate firms that are only affected by new information exchange agreements with higher-tax affiliates over the sample period. Table 17.2 does this by only including firms with higher-tax affiliates, while Table 17.3 additionally includes firms that have lower-tax affiliates, as long as they do not have a new information exchange agreement come into force between 2003 and 2012 with the home countries of these lower-tax affiliates. Column (1) of both tables provides further support

for a negative relationship between the share of higher-tax affiliates covered by information exchange and the firm's reported profits. The coefficient is still insignificant for the smaller sample used in Table 17.2, but becomes statistically significant with the extended sample used in Table 17.3. This result provides at least some evidence that increased information exchange coverage could be limiting profit shifting.

The second column of both tables looks at what happens if an indicator variable for a change in the coverage is used, instead of estimating the effect of information exchange off of the share of affiliates covered. The variable ChangeIEhigh will treat an observation where a firm goes from 7 of its 10 higher-tax affiliates being covered to 8 of its 10 affiliates being covered the same as a firm that goes from 0 of its 1 higher-tax affiliates being covered to 1 of its 1 affiliates being covered. This could be helpful if the effect of going from .7 to .8 is actually very similar to the effect of going from 0 to 1, as estimating off of the share would bias the coefficient towards zero. The coefficient on this regressor is positive in both Tables 17.2 and 17.3, although it is insignificant in Table 17.3, and only weakly significant in Table 17.2. While initially surprising, this coefficient is being estimated solely off of how reported profits change in the year in which the information exchange agreement goes into force, not the years that follow, when the firm has had additional time to adjust. If the reported profits drop in the years that follow the information exchange agreement, then the reported profits in the year it goes into force will in fact appear to have deviated above the average level. When included, lagged values of this indicator do in fact appear with a negative coefficient, which provides support for this interpretation.

Thus far, all specifications have only considered firms with positive reported profits. If information exchange agreements prevent profit-shifting inflows, however, firms with negative profits should be no different than those with positive profits. When information exchange goes into force, less profit can be shifted to these firms, and thus profits will be even more negative. Column (3) of both tables considers firms with sustained losses by using the dependent variable of the log of negative profits. This variable will only exist for firms with profits below zero. If information exchange prevents shifting in, then an increase in the share of higher-tax affiliates covered by information exchange should make profits even more negative, and thus should increase the value of the log of negative profits. The limited number of firms that have multiple years with negative profits over the period limits the power of this specification, the coefficient in Table 17.2 is of the expected sign, but is insignificant, while the coefficient in Table 17.3 is negative and insignificant.

By construction, the largest changes in ShareIEhigh will occur for the firms that have the fewest higher-tax affiliates. This could bias the estimates if the number of higher-tax affiliates also influences how reported profits respond to changes in ShareIEhigh. Consider what would

happen in the following scenario. Suppose that firms with one higher-tax affiliate are unlikely to see a large change in reported profits when information sharing goes into effect because little profit shifting is occurring between the higher-tax affiliate and the firm. Suppose that firms with many higher-tax affiliates are also unlikely to see a large change in reported profits when information sharing goes into effect because the shifting can be directed to the firm through some other affiliate. In this case, then, it would be the firms with a few higher-tax affiliates, and thus firms that experience moderate changes in ShareIEhigh, that would experience the largest decrease in reported profits. This would results in a non-linear relationship between the share of higher-tax affiliates covered by information exchange and reported profits. Table 17.4 tests for this kind of non-linear relationship by interacting the share of higher-tax affiliates covered with the number of higher-tax affiliates that a firm has. The results suggest that the number of higher-tax affiliates does in fact seem to be correlated with the response of reported profits to an increase in the share of higher-tax affiliates covered by information exchange. Allowing for the interaction of the number of higher-tax affiliates and ShareIEhigh results in a negative, statistically significant coefficient on ShareIEhigh, both for the sample of firms with no lower-tax affiliates, and for the sample of firms with lower-tax affiliates that do not face new IE agreements with those lower-tax affiliates between 2003 and 2012. The variable, CountHi, which measures the number of higher-tax affiliates, has a statistically insignificant effect on reported profits. In the fixed effects framework, the effect is being estimated off of changes in the number of higher-tax affiliates that a firm has. As discussed earlier, archival data on ownership structure is not available, so changes in the number of higher-tax affiliates will only occur when a firm's home country, or the home country of an affiliate, changes its corporate tax rate.

Overall then, the results suggest that information exchange limits profit-shifting inflows. If information exchange is affecting profit shifting inflows, then it should, presumably, also affect profit shifting outflows. As discussed in Section 3.2, however, things become more complicated when considering the expected effect of increased information exchange with lower-tax affiliates. While outflows may change, the response of reported profits to the increase in coverage will depend on if there is a reduction in total outflows or simply a reallocation of where the profits go. This means that the response of reported profits to an increase in information exchange with lower-tax affiliates is likely to depend on how many other lower-tax affiliates the firm has, how many of those other lower-tax affiliates are covered by information exchange, and even if the firm also has higher-tax affiliates. Tables 17.5 and 17.6 explore these different dimensions of variation.

Column (1) of Table 17.5 simply replicates Column (2) of Table 17.1. Using the full sample of firms that have lower-tax affiliates, increased information exchange with lower-tax

Table 17.2: Response to IE with Higher-Tax Affiliates: Firms with no lower-tax affiliates

| VARIABLES | (1)<br>log EBIT | (2)<br>log EBIT | (3)<br>log (-EBIT) |
|---|---|---|---|
| ShareIEhigh | -0.0591 | | 0.0553 |
| | (0.0625) | | (0.140) |
| ChangeIEhigh | | 0.0960** | |
| | | (0.0461) | |
| Log Assets | 0.0860*** | 0.0837*** | 0.0564*** |
| | (0.0118) | (0.0132) | (0.0155) |
| Log Labor | 0.386*** | 0.392*** | 0.399*** |
| | (0.0187) | (0.0199) | (0.0202) |
| | | | |
| Observations | 49,639 | 42,568 | 18,617 |
| Within R-squared | 0.112 | 0.100 | 0.142 |
| Number of Firms | 13,639 | 12,558 | 7,923 |
| | | | |
| Country-by-Year F.E. | Y | Y | Y |
| Industry-by-Year F.E. | Y | Y | Y |

**Notes**: Firm fixed-effects regressions. Standard errors clustered at the firm level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. These results include all firms that do not have any lower-tax affiliates. The dependent variable in the first two columns is the log of reported profits before interest and taxes. Column three considers firms with losses, so the dependent variable is the log of negative reported profits before interest and taxes. ShareIEhigh=share of higher-tax affiliates covered by information exchange agreements. ChangeIEhigh=indicator variable equal to one if a firm has a newly signed information exchange agreement with the home country of a higher-tax affiliate. Log Assets=log(fixed tangible assets). Log Labor=log(employee compensation).

Table 17.3: Response to IE with High-Tax Affiliates: Firms with no new low-tax IE

| VARIABLES | (1)<br>log EBIT | (2)<br>log EBIT | (3)<br>log (-EBIT) |
|---|---|---|---|
| Share IE high | -0.0962**<br>(0.0463) | | -0.105<br>(0.108) |
| Change IE high | | 0.0313<br>(0.0304) | |
| Log Assets | 0.0858***<br>(0.00905) | 0.0753***<br>(0.0102) | 0.0598***<br>(0.0125) |
| Log Labor | 0.418***<br>(0.0165) | 0.425***<br>(0.0180) | 0.402***<br>(0.0161) |
| | | | |
| Observations | 74,965 | 63,709 | 28,196 |
| Within R-squared | 0.115 | 0.097 | 0.133 |
| Number of Firms | 18,374 | 16,683 | 11,203 |
| | | | |
| Country-by-Year F.E. | Y | Y | Y |
| Industry-by-Year F.E. | Y | Y | Y |

**Notes**: Firm fixed-effects regressions. Standard errors clustered at the firm level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. These results include all firms that either do not have any lower-tax affiliates or that do not have a new information exchange agreement come into force with a lower-tax affiliates between 2003 and 2012. The dependent variable in the first two columns is the log of reported profits before interest and taxes. Column three considers firms with losses, so the dependent variable is the log of negative reported profits before interest and taxes. ShareIEhigh=share of higher-tax affiliates covered by information exchange agreements. ChangeIEhigh=indicator variable equal to one if a firm has a newly signed information exchange agreement with the home country of a higher-tax affiliate. Log Assets=log(fixed tangible assets). Log Labor=log(employee compensation).

Table 17.4: Controlling for the number of higher-tax affiliates

| VARIABLES | (1)<br>Log EBIT | (2)<br>Log EBIT |
|---|---|---|
| ShareIEhigh | -0.300***<br>(0.109) | -0.195***<br>(0.0691) |
| ShareIEhigh*CountHi | 0.202***<br>(0.0727) | 0.0867*<br>(.0451) |
| CountHi | 0.0035<br>(0.0432) | -0.0185<br>(.0132) |
| Log Assets | 0.0861***<br>(0.0118) | 0.0843***<br>(.00914) |
| Log Labor | 0.386***<br>(0.0186) | 0.421***<br>(0.0165) |
| | | |
| Observations | 49,639 | 73,951 |
| Within R-squared | 0.112 | 0.115 |
| Number of Firms | 13,639 | 17,919 |
| | | |
| Country-by-Year F.E. | Y | Y |
| Industry-by-Year F.E. | Y | Y |
| | | |
| Sample | Firms with only higher-tax affiliates | Firms with no new IE with lower-tax aff |

**Notes**: Firm fixed-effects regressions. Standard errors clustered at the firm level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The results in column 1 include all firms that do not have any lower-tax affiliates. The results in columns 2 include any firm that either has no lower-tax affiliates or that has no new information exchange agreement come into force with a lower-tax affiliate between 2003 and 2012. The dependent variable both columns is the log of reported profits before interest and taxes. ShareIEhigh=share of higher-tax affiliates covered by information exchange agreements. ShareIEhigh*CountHi=ShareIEhigh multiplied by the number of higher-tax affiliates the firm has. CountHi=Number of higher-tax affiliates. Log Assets=log(fixed tangible assets). Log Labor=log(employee compensation).

affiliates seems to have little effect on reported profits. The regressor used, Share IE low, has a couple of important limitations that may bias this estimate. The first limitation is similar to that discussed earlier, for Share IE high. By construction, the largest changes in share will occur for firms that have the fewest affiliates, i.e. 1 new information exchange agreement for a firm with a single affiliate will increase share IE low by 1, whereas it will only increase Share IE low by .1 for a firm with 10 affiliates. This means that the size of the change in the share is correlated with the number of lower-tax affiliates that a firm has, a variable that may also be playing a role in determining the magnitude of the response. This is likely to create a non-linear relationship between changes in the share and changes in reported profits. Columns (2) of Table 17.5 controls for this by interacting Share IE low with the number of lower-tax affiliates that the firm has.

The second limitation of using the share of lower-tax affiliates covered is that it will treat a change from a share of 0 to .1 and a change from .8 to .9 as being the same. This is likely not true, as the firm that experiences a change from 0 to .1 can easily change where it shifts its profits, while the firm that experiences a change from .8 to .9 has more limited options. The first firm, then, would likely show little change in its reported profits, while the second firm would be more likely to show an increase in reported profits. The average effect for a given change in share (in the above example, 0.1) will depend on the composition of firms that experience a change of that magnitude. This will likely mean that the average response is not particularly informative. The results in column (4) attempt to control for this by interacting Share IE low with a variable that is equal to 1 if more than 50% of a firm's lower-tax affiliates are covered by an information exchange agreement. This allows a given increase to have a different effect for firms that have other shifting options available relative to those that do not. Column (4) controls for both of these limitation by including both interactions. The sign of the coefficient on the interaction between Share IE low and the coverage variable is consistent with reported profits being more likely to increase if a firm has limited options for alternative profit shifting paths, but none of the terms are statistically significant.

One concern with Table 17.5 is that these firms may also be experiencing a change in the share of their higher-tax affiliates that are covered by information exchange agreements. Table 17.6 considers the same specifications for a sample that is limited to firms that do not have any higher-tax affiliates. The results are similar, although many of the coefficients are much closer to being statistically significant. Overall, the results provide little evidence that the share of lower-tax affiliates covered by information exchange affects a firm's reported profits.

All of the results show in this section assume that a firm responds to information ex-

Table 17.5: Response to Information Exchange with Lower-Tax Affiliates

| VARIABLES | (1)<br>Log EBIT | (2)<br>Log EBIT | (3)<br>Log EBIT | (4)<br>Log EBIT |
|---|---|---|---|---|
| Share IE low | 0.00649 | 0.00974 | -0.0455 | -0.047 |
| | (0.0248) | (0.0280) | (0.0853) | (.0892) |
| Share IE low*CountLo | | -0.00169 | | -0.00149 |
| | | (0.00869) | | (.00881) |
| Share IE low*IE Coverage >50% | | | 0.0352 | 0.0398 |
| | | | (0.1104) | (0.113) |
| Log Assets | 0.0903*** | 0.0903*** | 0.0904*** | 0.0903*** |
| | (0.00603) | (0.00603) | (0.00603) | (0.00603) |
| Log Labor | 0.435*** | 0.435*** | 0.435*** | 0.435*** |
| | (0.0113) | (0.0113) | (0.0113) | (0.0113) |
| | | | | |
| Observations | 147,802 | 147,802 | 147,802 | 147,802 |
| Within R-squared | 0.115 | 0.115 | 0.115 | 0.115 |
| Number of Firms | 29,472 | 29,472 | 29,472 | 29,472 |
| | | | | |
| Country-by-Year F.E. | Y | Y | Y | Y |
| Industry-by-Year F.E. | Y | Y | Y | Y |
| | | | | |
| Sample | Firms with lower-tax affiliates | Firms with lower-tax affiliates | Firms with lower-tax affiliates | Firms with lower-tax affiliates |

**Notes**: Firm fixed-effects regressions. Standard errors clustered at the firm level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. These results include all firms that have at least one lower-tax affiliate. The dependent variable in all columns is the log of reported profits before interest and taxes. Share IE low=share of lower-tax affiliates covered by information exchange agreements. Share IE low*CountLo= Share IE low multiplied by the number of lower-tax affiliates that the firm has. Share IE low*IE Coverage>50%= Share IE low multiplied by a dummy variable that equals one if more than 50% of a firms lower-tax affiliates are covered by an information exchange agreement. Log Assets=log(fixed tangible assets). Log Labor=log(employee compensation).

Table 17.6: Response to Information Exchange with Lower-Tax Affiliates (No Higher-Tax Affiliates)

| VARIABLES | (1)<br>log EBIT | (2)<br>log EBIT | (3)<br>log EBIT | (4)<br>log EBIT |
|---|---|---|---|---|
| shareIEloaff | 0.00127<br>(0.0296) | 0.0497<br>(0.0477) | -0.256<br>(0.204) | -0.3144<br>(0.215) |
| Share IE low*NoHigh | 0.0117<br>(0.0351) | | | |
| Share IE low*CountLo | | 0.00112<br>(0.0227) | | 0.00333<br>(0.0228) |
| Share IE low*IE Coverage>50% | | | 0.234<br>(0.261) | 0.315<br>(0.269) |
| Log Assets | 0.0903***<br>(0.00603) | 0.0839***<br>(0.00723) | 0.0839***<br>(0.00723) | 0.0839***<br>(0.00723) |
| Log Labor | 0.435***<br>(0.0113) | 0.396***<br>(0.0130) | 0.396***<br>(0.0130) | 0.396<br>(0.0130) |
| | | | | |
| Observations | 147,802 | 102,638 | 102,638 | 102,638 |
| Within R-squared | 0.115 | 0.104 | 0.104 | 0.104 |
| Number of Firms | 29,472 | 23,032 | 23,032 | 23,032 |
| | | | | |
| Country-by-Year F.E. | Y | Y | Y | Y |
| Industry-by-Year F.E. | Y | Y | Y | Y |
| | | | | |
| Sample | All firms with lower-tax affiliates | Firms with no higher-tax affiliates | Firms with no higher-tax affiliates | Firms with no higher-tax affiliates |

**Notes**: Firm fixed-effects regressions. Standard errors clustered at the firm level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The results in column 1 include all firms that have at least one lower-tax affiliate. The results in columns 2,3 and 4 only include firms that do not have any higher-tax affiliates. The dependent variable in all columns is the log of reported profits before interest and taxes. Share IE low=share of lower-tax affiliates covered by information exchange agreements. Share IE low*NoHigh= Share IE low multiplied by a dummy variable that equals 1 if a firm does not have any higher-tax affiliates. Share IE low*CountLoAff=1=Share IE low multiplied by a dummy variable that equals one if the firm has only one lower-tax affiliates. Share IE low*CountLo= Share IE low multiplied by the number of lower-tax affiliates that the firm has. Share IE low*IE Coverage>50%= Share IE low multiplied by a dummy variable that equals one if more than 50% of a firms lower-tax affiliates are

covered by an information exchange agreement. Log Assets=log(fixed tangible assets). Log Labor=log(employee compensation).

change agreements when they actually go into force. It is, alternatively, possible that a firm begins responding to information exchange agreements earlier. In order to avoid attracting the attention of tax authorities or in order to shift real activity, it is possible that a firm would begin adjusting its profit shifting behavior and activities a number of years before an information exchange agreement actually goes into force. Replicating table 17.4, but instead including, first, the share of higher-tax affiliates covered by information exchange one year later, and second, the share of higher-tax affiliates covered by information exchange two years later, there does not seem to be a relationship between reported profits and future information exchange agreements. Replicating table 17.6, but including the share of lower-tax affiliates covered by information exchange both one year in the future and two years in the future, again seems to indicate little relationship between reported profits and future information exchange agreements. These results, available on request, do not appear to suggest that firms adjust their behavior prior to information exchange agreements actually entering force, but more work would need to be done to fully establish the timing of the response.

The results in this section seem to suggest that information exchange has a relatively limited effect on reported profits, which suggests that it has a relatively limited effect on profit shifting. These results might be biased, however, by the lack of archival information on a firm's ownership structure. It is possible that an information exchange agreement being signed with the home country of a lower-tax affiliate would cause a firm to sever ties with that lower-tax subsidiary. These firms would not be captured in the sample of firms affected by the information exchange agreement, as the available data would make it appear as though the firm did not have an affiliate in that country. If the firms that are most actively shifting profits are the most likely to drop their subsidiaries, then that would mean that the effect of information exchange is being estimated off of a group of firms that are less active profit shifters to begin with. This could bias the results towards zero, and might, partially, explain the relatively limited effects found above.

# 18 Conclusions

Overall, this paper finds evidence that the reported profits of a firm decrease when the firm's home country signs a tax information exchange agreement with the home country of a higher-tax affiliate. This is consistent with tax information exchange agreements reducing profit-shifting inflows. There is little evidence, however, that a firm's reported profits increase when that firm's home country signs a tax information exchange agreement with the home country of a lower-tax affiliate. This is not surprising given that a high-tax affiliate will often have a number of lower-tax affiliates. This means that information exchange agreements may

simply change the destination of shifted profits rather than reduce profit shifting outflows. The reported profits of firms with few lower-tax affiliates and firms that have information exchange in place with a high share of lower-tax affiliates show a more positive, although still statistically insignificant, response to changes in information exchange coverage. From a policy perspective, this is relevant, as policy makers tend to view information exchange agreements as way to increase tax revenue. These results suggest that information exchange agreements with key tax havens may not be enough to reduce profit-shifting outflows, as these agreements may simply serve to change the route of profit shifting.

# Appendices

## A Details on Transfer-Pricing Risk Measure

The Mescall transfer-pricing risk measure is created by regressing experts' perceptions of transfer-pricing risk on observable characteristics of transfer-pricing regulation. To create the measure, he collected data in 2010 from 76 transfer pricing experts on their perceptions of transfer-pricing risk for 27 different countries, and also information on if they believed certain characteristics of transfer-pricing policy would serve to increase or decrease transfer-pricing risk. They were asked about 14 different components of transfer-pricing regulation, 13 of which are available from Deloitte's annual transfer pricing survey and 1 of which, the use of secret comparables, is available from KPMG's annual transfer pricing survey. [29] In his survey he also asked the experts to assess the enforcement level for each of the countries that he was interested in. Using the survey results, he regressed the perception of transfer-pricing risk, obtained from the experts, on the 14 components of transfer-pricing regulation and the experts' measure of transfer-pricing enforcement. The 15 characteristics considered and the variable used to capture each of these characteristics are described in Table A.1. Mescall's results suggest that only nine of the fifteen factors are statistically significant in determining the level of transfer-pricing risk. From his results, he estimates the following relationship:

$$\begin{aligned} \text{tprisk} \;=\; & 1.027 + (0.224)\text{NoPriorityofMethods} + (0.251)\text{RelatedParty} + (0.387)\text{SecretComp} \\ & +(0.227)\text{NoPenaltyReduction} + (0.178)\text{TaxFirst} + (0.229)\text{NoSetoffs} \\ & +(0.175)\text{NoCCAs} + (0.326)\text{NoBenchmark} + (2.794)\text{TPAudit} \end{aligned}$$

Arguably, the coefficients obtained from the regression can be used to generate a value for the level of transfer-pricing risk for both years and countries outside of the sample. Since the transfer-pricing enforcement measure obtained from the experts is not available for other years, transfer-pricing audit risk, which is available from Ernst & Young's annual transfer pricing guide is used in its place. That data needed to calculate this measure for the period

[29] For years 2010 and earlier, this publication was called the Strategy Matrix for Global Transfer Pricing. From 2011 on, it is referred to as the Global Transfer Pricing Desktop Reference.

between 2006 and 2011 are collected. Depending on the year, the number of countries for which the necessary information is available varies, so the set of countries ranges from 37 countries in 2006 to 53 countries in 2011. Countries that are known to have no transfer-pricing regulations a *tprisk* score of 1.03.[30]

From the initial survey, the practitioners believed that priority of methods, related-party disclosure requirements, transfer-pricing documentation requirements, contemporaneous documentation requirements, the use of secret comparables, not having transfer-pricing penalty reductions, having to pay tax first, not having related-party setoffs, not having cost contributions agreements, not having commissionaire arrangements and not allowing for the use of foreign comparables would all increase transfer-pricing risk. They believed that allowing for advanced pricing agreements, allowing for self-initiated adjustments and having benchmark data available should decrease transfer-pricing risk. The above results then, are roughly in line with the perceptions of the transfer-pricing experts. Table A.2 summarizes the measure *tprisk* for each country for the years between 2006 and 2011.

Since the weights given to various aspects of a country's transfer pricing system (such as documentation requirements, the ability to use foreign comparables, if a country uses secret comparables, if advanced pricing agreements are available, and a variety of other factors) are determined based on practitioners' perceptions of risk, the *tprisk* measure should do a reasonable job of capturing the variation in transfer-pricing regulation that exists. One drawback to this measure is that it is constructed using a rather limited sample of countries, so it is not clear if the weights assigned to the different kinds of transfer pricing regulation would be expected to carry over to a broader sample of countries. To control for the fact that the coefficients found by Mescall may not be generalizable across countries or across years, an alternative measure of enforcement, *tpcost*, is also considered. The variable *tpcost* simply measures how many of the seven characteristics that are statistically significant and were expected by practitioners to increase risk ($RelatedParty$, $SecrectComp$, $NoPenaltyReduction$, $TaxFirst$, $NoSetoffs$, $NoCCAs$ and $NoBenchmark$) are present in a given country in a given year. The $TPAudit$ variable, which is based on an individual's perception, is omitted from this measure so that it is fully based on observable characteristics. This measure is summarized in Table A.3. On first glance, neither measure seems to match up particularly well with popular perceptions of the ability to detect profit shifting across countries. The United States, for example, on the seven point cost index only gets a score of one. The training and the ability of the IRS to target audits is not something that can be picked up by this measure. That might suggest that this measure is going to do a better

[30]Table A.4 summarize the periods for which various countries are assumed to have had no transfer-pricing regulations in existence.

job of capturing variation in pure compliance costs than it does capturing variation in the ability to deter profit shifting. This also speaks in favor of using *tprisk* which does at least include the audit risk term.

Both measures suffer from the problem that they cannot fully capture differences across countries in the resources that are available to the tax enforcement agency, and so they will struggle to capture variation in the risk of audit or variation in the quality of the training of those who will perform the audit. While the measure of audit risk may, in part, capture the availability of resources for a given tax agency, it is unlikely to capture variation in expertise. A recent paper, Klassen, Lisowsky, and Mescall (2013) also uses a survey to rank countries by the experience and expertise of their transfer pricing authorities. In future work, a measure of this nature could also be interesting to analyze. For now, however, this paper will use *tprisk* as the preferred measure of transfer-pricing enforcement.

Table A.1: Transfer-Pricing Policy Characteristics

| Characteristic | Description of Variable |
|---|---|
| Priority of Method | NoPriorityofMethods=1 if a country does not identify a priority of transfer-pricing methods to use |
| Transfer-Pricing Documentation Requirement | DocReq=1 if a country has legislation requiring transfer-pricing documentation |
| Contemporaneous Documentation Requirement | ContempDoc=1 if a country has a requirement that documentation be prepared at the time of transactions |
| Related-Party Disclosure | RelatedParty=1 if a country has a tax return that requires disclosure of related-party transactions |
| Availability of Benchmark Data | NoBenchmark=1 if benchmark data on prices is not available to taxpayer |
| Use of Foreign Comparables | NoForeignComp=1 if the government does not allow the use of foreign comparables for transfer pricing transactions |
| Use of Secret Comparables | SecretComp=1 if the government uses secret comparables in the calculation of "correct" transfer prices |
| Transfer-Pricing Penalty Reduction | NoPenaltyReduction=1 if the government does not allow for reductions in transfer-pricing penalties |
| Pay Tax First | TaxFirst=1 if the taxpayer is required to pay tax assessment before going to competent authority |
| Availability of Cost-Contribution Agreements | NoCCAs=1 if the government does not allow cost-contribution agreements |
| Availability of Commissionaire Arrangements | NoCommissionaire=1 if the government does not allow commissionaire arrangements |
| Related-Party Setoffs | NoSetoffs=1 if no bundling of transactions is allowed |
| Self-Initiated Adjustments | Adjust=1 if self-initiated adjustments are allowed |
| Availability of Advance Pricing Agreements | APA=1 if advanced pricing agreements are allowed |
| Audit Risk | TPAudit: ranges between .2 if audit risk is low and 1 if audit risk is high |

Table A.2: Transfer-Pricing Risk Measure by Country

| Country | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|
| Argentina | 3.5302 | 3.1775 | 3.7363 | 3.7363 | 4.8539 | 3.7363 |
| Australia | 4.2352 | 2.7303 | 3.2891 | 3.2891 | 3.2891 | 3.8479 |
| Austria | 4.2133 | 3.6525 | 3.0937 | 3.0937 | 4.2113 | 4.2113 |
| Belgium | 3.0385 | 3.0385 | 3.0385 | 3.2891 | 3.2891 | 3.2891 |
| Brazil | 5.1895 | 4.2434 | 4.2434 | 4.2434 | 4.2434 | 3.6846 |
| Canada | 4.4643 | 4.4643 | 4.4643 | 4.4643 | 4.4643 | 4.4643 |
| Chile | 2.5431 | | | | 1.7606 | 4.9419 |
| China | 4.2526 | | 4.3069 | 4.3069 | 4.8657 | 4.8657 |
| Colombia | 3.5096 | 2.9508 | 3.5096 | 3.5096 | 4.6272 | 4.6272 |
| Czech Republic | 3.4226 | 3.0961 | 3.0961 | 3.0961 | 4.2137 | 4.2137 |
| Denmark | 2.7303 | 3.8479 | 3.8479 | 3.8479 | 3.8479 | 3.8479 |
| Ecuador | | 4.1463 | 3.914 | 3.6903 | 4.8079 | 5.1952 |
| Egypt | | | | | 2.0112 | 4.8052 |
| Finland | 3.8957 | 4.2278 | 4.2547 | 4.2547 | 4.4784 | 4.4784 |
| France | 4.435 | 4.2113 | 4.2113 | 4.2113 | 4.2113 | 4.2113 |
| Germany | 3.9846 | 3.9846 | 3.9846 | 4.3111 | 4.3111 | 4.3111 |
| Greece | | | | | | 4.4643 |
| Hong Kong | | | | | | 2.9053 |
| Hungary | 3.6634 | 3.6634 | 3.1592 | 3.1592 | 3.4098 | 4.5274 |
| India | 3.8969 | 3.8969 | 3.8969 | 3.8969 | 3.8969 | 5.0145 |
| Indonesia | | | | | 3.8999 | 5.0175 |
| Ireland | 2.3681 | | | | 1.3565 | 1.9153 |
| Israel | | 3.5126 | 3.5126 | 3.5126 | 3.5126 | 4.6302 |
| Italy | 4.4035 | 4.4035 | 4.4035 | 4.4035 | 4.4035 | 4.4035 |
| Japan | 4.0808 | 4.0808 | 3.9031 | 3.9031 | 3.9031 | 3.9031 |
| Kenya | | | | | | 3.1105 |
| Korea | 3.8479 | | 3.8479 | 3.8479 | 3.8479 | 4.0716 |
| Luxembourg | | | | | 3.1592 | 4.2768 |
| Malaysia | 4.7908 | 4.7908 | 4.7908 | 4.7908 | 4.7908 | 4.7908 |
| Mexico | 4.0746 | 3.6218 | 3.6218 | 3.6218 | 4.7394 | 4.7394 |

Table A.2: Transfer-Pricing Risk Measure by Country

| Country | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|
| Netherlands | 4.4643 | 4.688 | 4.688 | 4.688 | 4.688 | 4.688 |
| New Zealand | 4.3111 | 4.5348 | 4.3111 | 4.3111 | 4.3111 | 4.3111 |
| Norway | 4.2308 | 4.6181 | 4.8687 | 4.8687 | 4.8687 | 4.8687 |
| Peru | 3.2805 | 3.2805 | 3.2805 | 3.2805 | 3.6678 | 3.6678 |
| Philippines | 3.4857 | | | | 4.2081 | 4.2081 |
| Poland | 4.4011 | | 4.6369 | 4.6369 | 4.6369 | 4.0781 |
| Portugal | 4.077 | 3.3467 | 3.3467 | 3.3467 | 3.3467 | 3.3467 |
| Romania | | | | | 3.2162 | 3.775 |
| Russia | 3.437 | 2.3194 | 2.3194 | 2.3194 | 3.8243 | 4.9419 |
| Singapore | 3.7242 | 3.3369 | 3.3369 | 3.3369 | 3.3369 | 3.3369 |
| Slovak Republic | | | | | 3.3467 | 3.3467 |
| South Africa | 4.8049 | 4.8049 | 4.8049 | 4.8049 | 4.5758 | 4.5758 |
| Spain | 3.1132 | 2.8865 | 2.3277 | 4.2547 | 4.2547 | 4.2547 |
| Sweden | 3.2652 | 4.435 | 4.2113 | 4.2113 | 4.2113 | 4.2113 |
| Switzerland | | 2.9355 | 2.9355 | 2.9355 | 2.9355 | 4.2768 |
| Taiwan | 3.9748 | 3.9748 | 5.0924 | 5.0924 | 4.7051 | 4.7051 |
| Thailand | 3.8326 | 4.0563 | 4.0832 | 4.0832 | 4.0832 | 4.642 |
| Turkey | | 4.9906 | 5.0145 | 5.0145 | 4.7908 | 4.7908 |
| UK | 4.1623 | 4.1623 | 4.1623 | 4.1623 | 4.1623 | 3.8272 |
| Uruguay | | | | | 2.2349 | 5.0289 |
| US | 4.0716 | 4.0716 | 4.0716 | 4.0716 | 4.0716 | 4.0716 |
| Venezuela | 3.2859 | 4.4035 | 4.4035 | 4.4035 | 4.4035 | 4.4035 |
| Vietnam | | 5.4162 | 4.8574 | 5.4162 | 5.4162 | 4.8574 |

Table A.3: Number of Transfer-Pricing Characteristics by Country

| Country | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|
| Argentina | 6 | 4 | 4 | 4 | 4 | 4 |
| Australia | 2 | 1 | 1 | 1 | 1 | 1 |
| Austria | 2 | 2 | 2 | 2 | 2 | 2 |
| Belgium | 0 | 0 | 0 | 1 | 1 | 1 |
| Brazil | 5 | 4 | 4 | 4 | 4 | 4 |
| Canada | 3 | 3 | 3 | 3 | 3 | 3 |
| Chile | 2 | 4 | 4 | 4 | 4 | 5 |
| China | 7 | 7 | 4 | 4 | 4 | 4 |
| Colombia | 3 | 3 | 3 | 3 | 3 | 3 |
| Czech Republic | 3 | 2 | 2 | 2 | 2 | 2 |
| Denmark | 1 | 1 | 1 | 1 | 1 | 1 |
| Ecuador | | 4 | 5 | 5 | 5 | 6 |
| Egypt | | 5 | | | 5 | 5 |
| Finland | 3 | 2 | 3 | 3 | 3 | 3 |
| France | 2 | 2 | 2 | 2 | 2 | 2 |
| Germany | 1 | 1 | 1 | 2 | 2 | 2 |
| Greece | | | | | | 3 |
| Hong Kong | | | | | 2 | 2 |
| Hungary | 4 | 4 | 2 | 2 | 3 | 3 |
| India | | | | 5 | 5 | 6 |
| Indonesia | 4 | 4 | 4 | 4 | 4 | 4 |
| Ireland | 3 | 2 | 2 | 2 | 2 | 2 |
| Israel | | 4 | 4 | 4 | 4 | 4 |
| Italy | 3 | 3 | 3 | 3 | 3 | 3 |
| Japan | 4 | 4 | 3 | 3 | 3 | 3 |
| Kenya | | | | | | 3 |
| Korea | 1 | 1 | 1 | 1 | 1 | 1 |
| Luxembourg | | | | 2 | 2 | 2 |
| Malaysia | 4 | 4 | 4 | 4 | 4 | 4 |
| Mexico | 5 | 4 | 4 | 4 | 4 | 4 |
| Netherlands | 3 | 3 | 3 | 3 | 3 | 3 |

Table A.3: Number of Transfer-Pricing Characteristics by Country

| Country | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|
| New Zealand | 2 | 2 | 2 | 2 | 2 | 2 |
| Norway | 3 | 4 | 5 | 5 | 5 | 5 |
| Peru | 2 | 2 | 2 | 2 | 3 | 3 |
| Philippines | 3 | 3 | 4 | 4 | 4 | 4 |
| Poland | 3 | 3 | 4 | 4 | 4 | 4 |
| Portugal | 2 | 3 | 3 | 3 | 3 | 3 |
| Romania | | | | | 1 | 1 |
| Russia | 4 | 4 | 4 | 4 | 5 | 5 |
| Singapore | 4 | 3 | 3 | 3 | 3 | 3 |
| Slovak Republic | | | | | 3 | 3 |
| South Africa | 4 | 4 | 4 | 4 | 3 | 3 |
| Spain | 3 | 2 | 3 | 3 | 3 | 3 |
| Sweden | 1 | 2 | 2 | 2 | 2 | 2 |
| Switzerland | | 2 | 2 | 2 | 2 | 2 |
| Taiwan | 5 | 5 | 5 | 5 | 4 | 4 |
| Thailand | 3 | 3 | 4 | 4 | 4 | 4 |
| Turkey | | 4 | 4 | 4 | 4 | 4 |
| UK | 2 | 2 | 2 | 2 | 2 | 2 |
| Uruguay | | | | | 5 | 5 |
| US | 1 | 1 | 1 | 1 | 1 | 1 |
| Venezuela | 3 | 3 | 3 | 3 | 3 | 3 |
| Vietnam | | 6 | 6 | 6 | 6 | 6 |

Table A.4: Existence of Transfer-Pricing Regulation

| Country | No TP Regulation | Country | No TP Regulation |
|---|---|---|---|
| Algeria | 2003-2010 | Liberia | 2003-2011 |
| Andorra | 2003-2011 | Libya | 2003-2011 |
| Anguilla | 2003-2011 | Macau | 2003-2011 |
| Armenia | 2003-2011 | Macedonia | 2003-2007 |
| Angola | 2003-2010 | Malawi | 2003-2007 |
| Aruba | 2003-2007 | Mali | 2003-2011 |
| Bahamas | 2003-2011 | Mauritania | 2003-2011 |
| Bangladesh | 2003-2011 | Mongolia | 2003-2011 |
| Belarus | 2003-2011 | Morocco | 2003-2008 |
| Bolivia | 2003-2011 | Mozambique | 2003-2009 |
| Bosnia and Herzegovina | 2003-2006 | Namibia | 2003-2005 |
| Botswana | 2003-2011 | Netherland Antilles | 2003-2009 |
| Brunei | 2003-2011 | Nicaragua | 2003-2011 |
| Burkina Faso | 2003-2011 | Nigeria | 2003-2011 |
| Cambodia | 2003-2011 | Oman | 2003-2009 |
| Cameroon | 2003-2010 | Pakistan | 2003-2011 |
| Cayman Islands | 2003-2011 | Panama | 2003-2010 |
| Costa Rica | 2003-2011 | Papua New Guinea | 2003-2011 |
| Cote d'Ivoire | 2003-2011 | Paraguay | 2003-2011 |
| Cyprus | 2003-2011 | Puerto Rico | 2003-2010 |
| Dominican Republic | 2003-2010 | Qatar | 2003-2011 |
| Ecuador | 2003-2004 | Senegal | 2003-2011 |
| Egypt | 2003-2004 | Sierra Leone | 2003-2011 |
| Ethiopia | 2003-2011 | Sri Lanka | 2003-2009 |
| Gambia | 2003-2011 | Swaziland | 2003-2011 |
| Georgia | 2003-2010 | Syria | 2003-2011 |
| Ghana | 2003-2010 | Trinidad and Tobago | 2003-2011 |
| Honduras | 2003-2011 | Tunisia | 2003-2011 |
| Iraq | 2003-2011 | Turkey | 2003-2006 |
| Jamaica | 2003-2011 | Uganda | 2003-2010 |
| Kuwait | 2003-2011 | United Arab Emirates | 2003-2011 |
| Lesotho | 2003-2011 | Zimbabwe | 2003-2011 |

# B Alternative Measure of Enforcement

Since it is the most readily available measure and also the most used in previous papers, in this appendix a measure of documentation that expands on a measure created in Lohse, Riedel, and Spengel (2012) is also considered. In their paper, they create a measure that places a country in a category between 0 and 5, depending on the strictness of its transfer-pricing documentation requirements. Countries in category 0 have no transfer pricing regulations. Countries in category 1 have regulation that introduces the arm's length principle but have no documentation requirements. Countries in category 2 do not have legislation on documentation requirements, but documentation is required to exist in practice. Countries in category 3 have documentation requirements introduced in national law, but the submission of documentation is only required on request. Countries in categories 4 and 5 require automatic disclosure of documentation, with category 4 countries requiring a short form and category 5 countries requiring a long form. In this section, the measure is extended to include years between 2003 and 2012. The information is obtained from a combination of Ernst & Young Transfer Pricing Global Reference Guides, Deloitte Transfer Pricing Country Guides, KPMG Global Transfer Pricing Reviews and PwC International Transfer Pricing publications. [31] For the period from 2003 to 2012, Table B.1 summarizes the minimum enforcement level observed and the maximum enforcement level observed for each country. The distribution of the firms in the sample (described in Section 4.3) across the different documentation categories is detailed in table B.2. The large decrease in category zero firms from 2003 to 2004 is caused by Belgium implementing transfer pricing legislation in 2004. The increase in category 4 firms in 2008 is largely due to Norway moving up to category 4 in 2008. Overall, there is a clear trend towards having statutory documentation requirements (categories 3 and above) over the time period being considered. As can be seen from Table B.1, many countries change categories between 2003 and 2011, so it seems like there is the potential for enough within-country variation to identify the effect of changes in enforcement in the firm fixed-effects framework.

Recognizing both that difference across these categories might be small in practice and that few firms are located in category 0 or category 5 countries, the measure used in the regressions that follow places countries into three different categories, where a country is classified as category 0 if there is no documentation requirement at all (categories 0 or 1 of the original index), category 1 if there is no statutory documentation requirement but there is a documentation requirement in practice (category 2 of the original index) and category

[31] For earlier years, the Deloitte publication is referred to as the Strategy Matrix for Global Transfer Pricing.

Table B.1: Documentation Requirement Measure by Country

| Country | Min. Enforce | Max. Enforce | Country | Min. Enforce | Max. Enforce |
|---|---|---|---|---|---|
| Argentina | 5 | 5 | Lithuania | 3 | 3 |
| Australia | 4 | 4 | Luxembourg | 2 | 2 |
| Austria | 2 | 2 | Malaysia | 4 | 4 |
| Azerbaijan | 2 | 2 | Mexico | 5 | 5 |
| Belgium | 0 | 2 | Moldova | 2 | 2 |
| Brazil | 5 | 5 | Montenegro | 2 | 2 |
| Bulgaria | 1 | 2 | Namibia | 2 | 2 |
| Canada | 4 | 4 | Netherlands | 4 | 4 |
| Chile | 1 | 1 | New Zealand | 2 | 2 |
| China | 4 | 5 | Norway | 3 | 4 |
| Columbia | 2 | 5 | Panama | 1 | 3 |
| Croatia | 1 | 3 | Peru | 2 | 5 |
| Czech Republic | 2 | 2 | Philippines | 1 | 2 |
| Denmark | 4 | 4 | Poland | 4 | 4 |
| Dominican Republic | 0 | 3 | Portugal | 4 | 4 |
| Ecuador | 0 | 5 | Qatar | 2 | 2 |
| Egypt | 0 | 3 | Romania | 2 | 3 |
| El Salvador | 0 | 2 | Russia | 2 | 3 |
| Estonia | 0 | 4 | Saudi Arabia | 2 | 2 |
| Finland | 2 | 3 | Serbia | 2 | 2 |
| France | 2 | 3 | Singapore | 2 | 2 |
| Georgia | 1 | 1 | Slovak Republic | 2 | 3 |
| Germany | 3 | 3 | Slovenia | 4 | 4 |
| Greece | 1 | 4 | South Africa | 2 | 3 |
| Hong Kong | 1 | 3 | Spain | 2 | 3 |
| Hungary | 3 | 4 | Sweden | 2 | 3 |
| Iceland | 1 | 1 | Taiwan | 4 | 4 |
| India | 4 | 4 | Tanzania | 2 | 2 |
| Indonesia | 4 | 5 | Thailand | 2 | 2 |
| Ireland | 1 | 3 | Turkey | 4 | 4 |
| Israel | 1 | 4 | Ukraine | 1 | 1 |
| Italy | 4 | 4 | United Kingdom | 3 | 3 |
| Japan | 4 | 4 | US | 4 | 4 |
| Kazakhstan | 2 | 3 | Uzbekistan | 0 | 1 |
| Kenya | 1 | 2 | Uruguay | 1 | 3 |
| Korea | 3 | 4 | Venezuela | 4 | 4 |
| Latvia | 1 | 2 | Vietnam | 2 | 3 |
| Lebanon | 1 | 1 | Zambia | 2 | 2 |

Table B.2: Summary of documentation requirement measure for sample used

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 12.38 % | 1.37% | 1.01% | 1.22% | 0.01% | 0.01% | 0.00% | 0.00% | 0.00% |
| 1 | 1.25% | 1.30% | 0.38% | 0.67% | 0.95% | 0.58% | 0.54% | 0.61% | 0.07% |
| 2 | 49.44% | 57.71% | 57.94% | 56.66% | 31.56% | 29.24% | 26.65% | 13.99% | 14.25% |
| 3 | 14.75% | 15.51% | 18.60% | 19.21% | 43.70% | 37.50% | 40.05% | 52.26% | 52.19% |
| 4 | 21.67% | 23.42% | 22.07% | 22.23% | 23.46% | 32.35% | 32.40% | 32.83% | 33.49% |
| 5 | 0.00% | 0.00% | 0.01% | 0.00% | 0.00% | 0.01% | 0.02% | 0.02% | 0.02% |
| Missing | 0.52% | 0.69% | 0.00% | 0.01% | 0.32% | 0.31% | 0.34% | 0.30% | 0.28% |

Note: The countries with at least one year of missing information on enforcement are Bosnia and Herzegovina, Liechtenstein, Malta, Morocco and Slovakia.

2 if there is a statutory documentation requirement (categories 3, 4 and 5 of the original index). If there is evidence that a country has no transfer-pricing regulation in place, then, for this three category classification, the country is assigned to category 0. A summary of the countries that this rule is applied for is in Table A.4. The only exception to this rule is Switzerland, which, although it has no official transfer-pricing regulation, follows OECD guidelines and so receives a documentation requirement score of 2 for all years between 2003 and 2012.

Replicating the baseline results obtained using the transfer-pricing risk index in Table 5.1, Table B.3 indicates that increases in documentation requirements have also been associated with a reduction in reported profits. Column (1) of Table B.4 indicates that the effect of increased enforcement is again less negative for higher-tax rate countries, which is consistent with documentation requirements reducing outflows. The limited variation in transfer-pricing documentation requirements over time, however, means that it is not possible to identify a heterogenous response by the distribution of a firm's affiliates. Column (2) suggests that having more lower-tax affiliates makes the response to increased documentation less negative, but it is very small and statistically insignificant.

Table B.3: Baseline Regressions-Documentation Measure

| | (1) | (2) | (3) |
|---|---|---|---|
| | Log EBIT | Log EBIT | Log EBIT |
| Doc Req=1 | 0.0295*** | -0.0309*** | -0.0312*** |
| | (0.00986) | (0.0112) | (0.0113) |
| Doc Req=2 | 0.0364 | -0.0660** | -0.0678** |
| | (0.0255) | (0.0279) | (0.0283) |
| Tax Rate | | | 0.0671 |
| | | | (0.167) |
| Log Assets | 0.107*** | 0.0932*** | 0.0933*** |
| | (0.00502) | (0.00514) | (0.00514) |
| Log Labor | 0.473*** | 0.432*** | 0.432*** |
| | (0.00886) | (0.00928) | (0.00928) |
| Log GDP | | -0.773** | -0.756** |
| | | (0.374) | (0.375) |
| Log GDP$^2$ | | 0.202*** | 0.199*** |
| | | (0.0556) | (0.0557) |
| Deficit | | -0.000153 | -4.97e-05 |
| | | (0.00187) | (0.00190) |
| | | | |
| Observations | 196,350 | 194,433 | 194,433 |
| Within R-squared | 0.103 | 0.118 | 0.118 |
| Number of Firms | 36,760 | 36,444 | 36,444 |
| | | | |
| Industry-Year F.E. | | ✓ | ✓ |

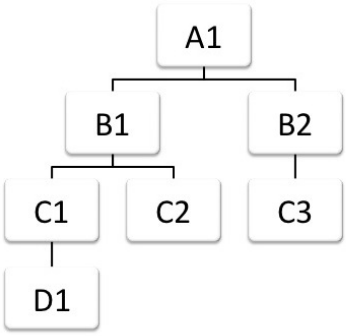
**Notes**: Firm fixed-effects regression. Standard errors clustered at the firm level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The dependent variable in all columns is the log of reported profit before interest and taxes. Doc Req=1 indicates the firm's home country is in category 2 of the documentation requirement measure that is discussed in this appendix, Doc Req=2 indicates the firm's home country is in category 3, 4 or 5. Tax Rate=corporate tax rate in the firm's home country. Log Assets=log(fixed tangible assets). Log Labor=log(employee compensation). Log GDP=log(per capita GDP). Log GDP$^2$=log(per capita GDP)$^2$. Deficit=government deficit/surplus as a percentage of GDP.

Table B.4: Heterogeneous Response-Documentation Measure

| | (1) | (2) |
|---|---|---|
| | Log EBIT | Log EBIT |
| Doc Req=1 | 0.00822 | -0.000237 |
| | (0.0619) | (0.0628) |
| Doc Req=2 | -0.393*** | -0.393*** |
| | (0.0860) | (0.0881) |
| Tax Rate | -0.219 | -0.242 |
| | (0.222) | (0.228) |
| Doc Req=1*Tax Rate | -0.151 | -0.141 |
| | (0.197) | (0.200) |
| Doc Req=2*Tax Rate | 1.252*** | 1.171*** |
| | (0.289) | (0.292) |
| Doc Req=1*NumLo | | 0.000298 |
| | | (0.00146) |
| Doc Req=2*NumLo | | 0.00706 |
| | | (0.00537) |
| Doc Req=1*NumHi | | 0.00556 |
| | | (0.00594) |
| Doc Req=2*NumHi | | -0.00321 |
| | | (0.00961) |
| Log Assets | 0.0938*** | 0.0937*** |
| | (0.00514) | (0.00514) |
| Log Labor | 0.433*** | 0.433*** |
| | (0.00928) | (0.00928) |
| Log GDP | -0.587 | -0.565 |
| | (0.374) | (0.376) |
| Log GDP$^2$ | 0.147*** | 0.143** |
| | (0.0560) | (0.0561) |
| Deficit | 0.00247 | 0.00245 |
| | (0.00193) | (0.00193) |
| | | |
| Observations | 194,433 | 194,433 |
| Within R-squared | 0.119 | 0.119 |
| Number of Firms | 36,444 | 36,444 |
| | | |
| Industry-Year F.E. | ✓ | ✓ |

**Notes**: Firm fixed-effects regression. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. The dependent variable in all columns is the log of reported profit before interest and taxes. Doc Req=1 indicates the firm's home country is in category 2 of the documentation requirement measure, Doc Req=2 indicates it is in category 3, 4 or 5. Tax Rate=corporate tax rate in firm's home country. NumLo=number of lower-tax affiliates the firm has. NumHi=number of higher-tax affiliates the firm has. Log Assets=log(fixed tangible assets). Log Labor=log(employee compensation). Log GDP=log(per capita GDP). Log GDP$^2$=log(per capita GDP)$^2$. Deficit= government deficit or surplus as a percentage of GDP.

Figure C.1: Structure of a Hypothetical Multinational Corporation




# C Details on Corporate Group Membership

Figure C.1 shows the structure of a hypothetical multinational firm. Assume, for now, that each firm is located in a different country and that it is fully owned by the firm above it. In that case, the sample could include any of the firms outside of $C2$, $C3$ and $D1$. By pulling information on all foreign subsidiaries and foreign shareholders, all shifting opportunities are captured for affiliate $A1$. For other affiliates, however, the opportunities for shift across the different branches of the multinational are not captured. For affiliate $B1$, for example, only the opportunities to shift profits to or from affiliates $A1$, $C1$, $C2$ and $D1$ are captured, potential shifting with $B2$ or $C3$ will not be captured. In terms of how they would appear in the data, firm $A1$ is different from the other firms in the group in that it would be listed as its own global ultimate owner (GUO). The current dataset will fully capture shifting opportunities for GUOs, but may miss some affiliate links for Non-GUOs. Approximately 35% of the firms in the sample are GUOs.

The information from ORBIS on ownership links is static. Although information is available on what year the information on the subsidiary or shareholder was obtained, there is no way of knowing if a firm is linked to its subsidiaries and shareholders in all years that it appears in the sample. The model suggests that the number of higher-tax affiliates a firm has and the number of lower-tax affiliates a firm has are important in determining the response of reported profits to a change in own-country enforcement. For these purposes, it is assumed that set of subsidiaries and shareholders remains constant for all years between 2006 and 2011. While this may not perfectly reflect the composition of the multinational over time, it should do a reasonable job. Even holding constant the firm's set of shareholders and subsidiaries, the number of higher-tax affiliates and the number of lower-tax affiliates a firm has will vary because of changes in corporate tax rates. When including information on the level of transfer-pricing enforcement in the countries where affiliates are located, it

is again assumed that the firm is linked to all of its affiliates for all years in which data is available. In the future work, it might be possible to use archival data from ORBIS to better capture ownership links over time.

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