International Center for Public Policy
Working Paper 17-01
February 2017

Cross-Country Differences in Corporate Tax Rates, Anti-Tax Avoidance Rules, and Base Erosion Profit Shifting

Giulia Zilio

International Center for Public Policy
Georgia State University
Andrew Young School of Policy Studies

International Center for Public Policy
Working Paper 17-01

Cross-Country Differences in Corporate Tax Rates, Anti-Tax Avoidance Rules, and Base Erosion Profit Shifting

Giulia Zilio

February
2017

International Center for Public Policy
Andrew Young School of Policy Studies
Georgia State University
Atlanta, Georgia 30303
United States of America

Phone: (404) 413-0235
Fax: (404) 651-4449
Email: paulbenson@gsu.edu
Internet: http://icepp.gsu.edu/

International Center for Public Policy
Andrew Young School of Policy Studies

The Andrew Young School of Policy Studies was established at Georgia State University with the objective of promoting excellence in the design, implementation, and evaluation of public policy. In addition to two academic departments (economics and public administration), the Andrew Young School houses seven leading research centers and policy programs, including the International Center for Public Policy.

The mission of the International Center for Public Policy is to provide academic and professional training, applied research, and technical assistance in support of sound public policy and sustainable economic growth in developing and transitional economies.

The International Center for Public Policy at the Andrew Young School of Policy Studies is recognized worldwide for its efforts in support of economic and public policy reforms through technical assistance and training around the world. This reputation has been built serving a diverse client base, including the World Bank, the U.S. Agency for International Development (USAID), the United Nations Development Programme (UNDP), finance ministries, government organizations, legislative bodies and private sector institutions.

The success of the International Center for Public Policy reflects the breadth and depth of the in-house technical expertise that the International Center for Public Policy can draw upon. The Andrew Young School's faculty are leading experts in economics and public policy and have authored books, published in major academic and technical journals, and have extensive experience in designing and implementing technical assistance and training programs. Andrew Young School faculty have been active in policy reform in over 40 countries around the world. Our technical assistance strategy is not to merely provide technical prescriptions for policy reform, but to engage in a collaborative effort with the host government and donor agency to identify and analyze the issues at hand, arrive at policy solutions and implement reforms.

The International Center for Public Policy specializes in four broad policy areas:

- Fiscal policy, including tax reforms, public expenditure reviews, tax administration reform
- Fiscal decentralization, including fiscal decentralization reforms, design of intergovernmental transfer systems, urban government finance
- Budgeting and fiscal management, including local government budgeting, performance-based budgeting, capital budgeting, multi-year budgeting
- Economic analysis and revenue forecasting, including micro-simulation, time series forecasting,

For more information about our technical assistance activities and training programs, please visit our website at https://icepp.gsu.edu or contact us by email at paulbenson@gsu.edu.

Cross-Country Differences in Corporate Tax Rates, Anti-Tax Avoidance Rules, and Base Erosion Profit Shifting

by Giulia Zilio
Department of Economics
Andrew Young School of Policy Studies
Georgia State University
14 Marietta Street, NW
Atlanta, GA 30303
ph: 404-903-2243
email: giuliazilio@gmail.com

Abstract

Cross-country differences in corporate income tax (CIT) rates create incentives for multinational enterprises (MNEs) to manipulate the prices that they use for intracompany transactions (known as transfer prices) to shift profits to countries with more favorable tax treatments. Such behavior reduces the aggregate tax burden of an MNE thus increasing its worldwide after-tax profits, which presumably increases stockholder value. However, this behavior also erodes the CIT bases of countries, like the United States and other OECD countries, with relatively high CIT rates. To mitigate such behavior, governments adopt and enforce anti-tax avoidance rules. In this paper, I seek to gauge the effect on profit shifting of CIT-rate differentials among countries. I improve upon the current practice to estimating this elasticity by constructing a measure of the stringency with which countries enforce their anti-tax avoidance rules and take into account their incentive to enforce them. I report evidence showing that the failure to account for the enforcement of anti-tax avoidance rules and the incentive to enforce them results not only in biased estimates of the semi-elasticity of reported profits with respect to CIT-rate but also results in a misspecified empirical model. I estimate the empirical model of reported profits using detailed annual data on more than 40,000 affiliates located in 28 countries during the period from 2008 to 2014. To illustrate the practical consequences for tax policy analysis of correctly specifying the empirical model, I conduct a policy simulation in which the United States reduces its CIT rate by 20 percent.

Key words: public finance, behavioral effect of taxes, base erosion profit shifting, transfer-pricing, and tax-avoidance

JEL Classification: F23, H25

Draft: January 20, 2017

1. Introduction

Policy-makers and the public alike are paying increasing attention to issues involving international taxation because, among other reasons, multinational enterprises (MNEs) are using increasingly sophisticated tax planning strategies to minimize their worldwide tax liabilities. For example, cross-country differences in corporate income tax (CIT) rates create incentives for MNEs to manipulate the prices that they use for intracompany transactions (known as transfer prices) to shift profits to countries with more favorable tax treatments. Doing so, without detection by the tax authorities, decreases the MNE's aggregate CIT liabilities and increases its worldwide after-tax profits which, presumably, increases shareholder value. However, such behavior by MNEs erodes the tax bases of countries, like the United States and other OECD countries, with relatively high CIT rates. Clausing (2015) estimates that the United States lost $111 billion in federal CIT revenue in 2012 due to the illegal shifting by U.S.-based MNEs of $371 billion of corporate profits to foreign affiliates.

Generally speaking, a country has two policy options at its disposal to deter so-called base erosion profit shifting (BEPS) by MNEs. They can cut the CIT rate and/or adopt and enforce anti-tax avoidance regulations. Cutting the CIT rate to deter BEPS can be likened to international tax competition to attract mobile capital. The he risk of countries cutting CIT rates is that it will lead to a 'race-to-the-bottom' where governments repeatedly cut CIT rates in response to the tax cuts of other countries in a repeated game of 'tit-for-tat'.

The existing literature on BEPS (see, for example, Hines Jr & Rice, 1994; Huizinga & Laeven, 2008; Lohse & Riedel, 2013), henceforth HR, HL, and LR, respectively, generally focuses on estimating the semi-elasticity of reported profits with respect to CIT tax-rate differentials among countries (henceforth referred to simply as the semi-elasticity of reported profits).[1] At this point, the alert reader may very well be puzzled. How does the semi-elasticity of reported profits allow tax policy analyst to conclude anything about the effect of CIT-rate differentials among countries on BEPS? The relationship between reported profits and BEPS is relatively

[1] I estimate a semi-log specification of a model of reported profits. More specifically, the dependent variable in a semi-log specification of the model is the natural logarithm of an affiliate's reported profits and, on the right-hand-side of the regression equation, is the simple difference in the maximum statutory CIT rate of the host country of the affiliate and that of the host country of the MNE's ultimate owner. As a result, the estimated coefficient of the CIT-rate differential is a semi-elasticity rather than an elasticity which is the interpretation given to the estimated coefficient in a double-log specification (see Olsen & Osmundsen, 2003 for further details on these points).

straightforward. In contrast to reported profits which is observable, the true profits and the amount of tax motivated profit shifting by an MNE's affiliate is not observable. However, the reported profit of an MNE's affiliate is equal to its true profit minus the net amount of outbound profit shifting, which may be positive or negative depending on the tax incentives facing the MNE, minus the cost to the affiliate of engaging in intracompany transactions to illegally shift profits to a foreign affiliate. In other words, the reported profit of an MNE's affiliate is a negative function of the net amount of outbound profit shifting in response to cross-country differences in CIT rates. This relationship allows us to infer the effect of CIT-rate differentials on BEPS from the semi-elasticity of reported profits. This explains why the literature has settled upon this approach.

In this paper, I show that the current 'state-of-the-art'- empirical models of reported profits not only result in biased estimates of the semi-elasticities of reported profits but are also seriously misspecified. First, existing studies fail to account for the stringency with which countries enforce their transfer-pricing rules. Yet, countries with relatively high CIT rates are more likely to adopt and more stringently enforce transfer-pricing rules to mitigate BEPS. Therefore, empirical models of reported profits which do not control for the stringency with which countries enforce their anti-tax avoidance rules may result in inconsistent estimates of the semi-elasticity of reported profits due to omitted variable bias. To be fair, existing approaches to estimating the semi-elasticity of reported profits do include controls for the adoption of anti-tax avoidance regulations, particularly transfer-pricing rules, by countries over time. However, adopting transfer-pricing rules is necessary but not sufficient to mitigate BEPS. A country must also enforce its rules and apply penalties for detected violations by domestic affiliates of MNEs to deter BEPS.

The second reason that existing practice may result in biased estimates of the semi-elasticity of reported profits is that the CIT-rate differential is potentially endogenous because of international tax competition among countries aimed at stemming BEPS. Again, there are a few studies that use instrumental variables to estimate their models of reported profits; however, the overwhelming majority of studies do not appear to address this issue in the estimation of their models of reported profits.

Third, and certainly most seriously, researchers have not accounted for the incentives of countries to enforce their transfer-pricing rules in the specification of their empirical models of reported profits. More specifically, a country seeking to mitigate BEPS should only monitor the

transfer-pricing practices of domestic affiliates of MNEs engaged in intracompany transactions involving foreign affiliates located in countries with lower CIT rates than its own. Since a country's tax administration must use scarce resources to enforce transfer-pricing rules, countries should not monitor the transfer pricing practices of domestic affiliates of MNEs engaging in intracompany transactions involving the foreign affiliates located in countries with higher CIT rates than its own. In this case, the domestic affiliate has no incentive to shift profits to the foreign affiliate; to do so would increase the aggregate tax burden of the MNE. More specifically, countries with high CIT rates should use scarce administrative resources to monitor the transfer pricing practices of domestic affiliates of MNEs engaging in intracompany transactions with foreign affiliates located in low CIT-rate countries. And, researchers striving to provide consistent estimates of the semi-elasticity of reported profits should take these incentives into account when specifying and estimating an empirical model of reported profits.

To address these three concerns, I construct a dummy variable for the stringency with which a country enforces its transfer-pricing rules. The enforcement dummy variable reflects both the level of transfer-pricing documentation that a country requires domestic affiliates of MNEs to submit with its annual CIT return, and the frequency with which the host country applies penalties for violations of its transfer-pricing rules. In constructing the enforcement dummy variable for a given country, the specification of the model accounts for whether the incentives facing the domestic affiliate of the MNE and thus whether the host country should monitor the affiliate's transfer-pricing practices. As discussed in greater detail below, I show that the functional form of the empirical model must be sufficiently flexible to allow for the estimation of potentially three distinct semi-elasticities of reported profits.

Following the existing literature, I estimate my model of reported profits using detailed firm-level data for the period 2008 to 2014. In contrast to the sample periods used in previous studies, my sample period spans the Great Recession.[2] The sample, which is constructed from the Orbis database, contains information on 43,103 affiliates located in 28 countries. Since the sample includes affiliates with ultimate owners located in a variety of developing, developed, and tax haven countries, there is considerable heterogeneity in the combinations of CIT-rate differentials and transfer-pricing enforcement regimes in my sample. This variation should be helpful in

[2] Orbis is Bureau van Dijk's flagship database of private and listed company information from around the world that emphases the ownership linkages among firms that belong to the same multinational enterprise.

identifying the parameter estimates of the model. Using this sample, I estimate a firm-level, instrumental variables, fixed-effects, panel-data model of reported profits to gauge the effect of CIT-rate differentials among countries on reported profits of an MNE's affiliate.

I develop a theoretical model of tax motivated profit shifting which also accounts for the incentives of countries to enforce their transfer-pricing rules. The comparative statics of the model show that there are potentially three distinct semi-elasticities of reported profits with respect to CIT-rate differentials among countries. Based on this finding, I specify an empirical model of reported profits which is sufficiently flexible to permit the simultaneous estimation of these three semi-elasticities of reported profits. Specifically, I estimate a semi-elasticity of reported profits when the tax incentives favor outbound (inbound) profit shifting because the host country of the MNE's subsidiary (ultimate owner) has a greater CIT-rate than the host-country of the MNE's ultimate owner (subsidiary). This accounts for two of the three semi-elasticities of reported profits. I estimate a third semi-elasticity of reported profits for the case in which neither country has adopted transfer-pricing rules or fails to enforce them.

My preferred estimate, when countries enforce their transfer-pricing rules, is -3.2 (-1.0) for the semi-elasticity of reported profits when the tax incentives favor outbound (inbound) profit shifting. The estimated semi-elasticity of -3.2 implies that a 10 percent increase in the CIT-rate differential results in a 32 percent decrease in an affiliates' reported profits due to outbound profit shifting. The estimated semi-elasticity of -1.0 implies that a 10 percent decrease in the CIT-rate differential results in a 10 percent increase in an affiliates' reported profits due to inbound profit shifting. My preferred estimate of the semi-elasticity of reported profit when neither country has adopted transfer-pricing rules or fails to enforce them is equal to -3.5, meaning that a ten percent increase in the CIT-rate differential results in a 35 percent decrease in the affiliates' reported profits.

Finally, to illustrate the practical consequences for tax policy analysis of correctly specifying the empirical model of reported profits, I conduct a policy simulation. I assume the United States reduces its CIT rate by 20 percentage points, which results in a proposed-law CIT rate of 15 percent. This is approximately equal to the median CIT rate of OECD countries. I use my preferred estimates of the semi-elasticities of reported profits as well as a single estimate of the semi-elasticity obtained using a state-of-the-art but seriously misspecified model to conduct

the policy simulation. This exercise shows that using consistent estimates of the semi-elasticities obtained from a correctly specified model has a substantial effect on the estimated CIT tax revenue effect of the proposed reform.

The remainder of this paper is organized as follows. Section 2 consists of a brief overview of the literature on estimating the semi-elasticity of reported profits. In particular, I focus on those studies that control for the adoption of transfer-pricing rules by countries over time. Section 3 describes a simple theoretical model of tax motived profit shifting by MNEs and analyzes the comparative statics of the model. Section 4 describes the data and construction of the sample used to estimate the empirical model, the econometric specification of the model of profit shifting, and the construction of the variables. Section 5 discusses the empirical results. I report the results of the policy simulation in the subsequent section, and Section 7 concludes.

2. Literature review

It is beyond the scope of the present study to provide a comprehensive review of the vast literature on BEPS.[3] Therefore, we proceed below by reviewing some of the seminal papers in this literature.

The literature on tax-motivated, international profit shifting focuses on gauging the effect of CIT-rate differentials on the reported profit of the affiliates of MNEs. Due to the large variety of methodologies, data, and sample periods used in this literature, it is difficult to compare estimates. Heckemeyer & Overesh (2013), however, seek to provide a consensus estimate of the semi-elasticity of reported profits by conducting a meta-analysis of the available estimates in the literature while controlling for the diversity of approaches. They report a consensus estimate of -0.8, meaning that a 10 percent increase in the CIT-rate differential among countries causes an 8 percent decrease in the reported profits of an MNE's affiliate.

The literature on BEPS generally follows the practice introduced by HR. They assume that the true profit of an MNE's affiliate is generated by a Cobb-Douglas production function. They further assume that it is a function of capital, labor, and technological change. They use the natural logarithm of these variables as regressors in their empirical model to control for the true profits earned by the MNE's affiliate in a given country. Using aggregate time-series data, HR and Gruber

[3] See Heckemeyer & Overessh (2013) and Dharmapala (2014) for up-to-date and excellent reviews of the literature on BEPS.

& Mutti (1991) report evidence of a decrease in the reported profits of subsidiaries located in countries with high CIT rates. In addition to not accounting for the enforcement of anti-tax avoidance rules, they do not account for the role of CIT rates in other countries in which an MNE has a presence.

To address the latter issue, HL estimate a model of reported profits using a 1999 cross-section of firm-level data for 12 European countries. They use the weighted-average (by the size of the affiliate) CIT rates of countries in which an MNE has a presence to calculate the CIT-rate differential facing an MNE's affiliate. They report an estimated semi-elasticity of reported profits with respect to the weighted-average, CIT-rate differential of -1.3. Dischinger, Knoll, & Riedel (2014) and Lohse & Riedel (2013) also report evidence consistent with BEPS by MNEs. They show that reported profits are greater (less) than predicted for affiliates located in countries with relatively low (high) CIT rates.

To their credit, Dharmapala & Riedel (2013) and LR make an important methodological contribution to specification of models of reported profit by including a control variable for the existence of transfer-pricing rules by country and over time. As previously discussed, however, the mere existence of transfer-pricing rules is necessary but not sufficient to deter BEPS. Countries must also enforce their anti-tax avoidance regulations if they are going to have a deterrent effect on the tax planning strategies of MNEs. Since I contend that the stringency with which a country enforces its transfer-pricing rules plays an important role in correctly specifying a model of reported profits and consistently estimating the semi-elasticity of reported profits, I proceed below by carefully describing the approaches used in the literature to control for transfer-pricing rules by country and over time.

Although Bartelsman & Beetsma (2003) do not focus on the effect of transfer-pricing rules on BEPS, they do introduce a control variable for transfer-pricing rules as a robustness check of their estimate of the semi-elasticity of reported profits. They do so by constructing an index of transfer-pricing rules for each country in their sample based on the following three criteria: (1) a country's adoption of transfer-pricing rules; (2) the country requires domestic affiliates of MNEs to provide transfer-pricing documentation with its annual CIT return; and (3) the country's adoption of penalties for violating transfer-pricing rules. They estimate their model of reported profits using a sample of 16 countries. As expected, they report evidence that the responsiveness

of reported value added to CIT-rate differentials among countries is stronger for observations in countries with less stringent rules than it is for observations located in countries with more stringent rules. The potential limitations of this approach are twofold. First, their estimate may not be identified because of the limited number of countries in their sample which may result in a lack of sufficient variation in the index of transfer-pricing rules. Second, and more importantly, their control variable for the existence of transfer-pricing rules does not account for whether countries are actually assessing penalties on domestic affiliates of MNEs for violations of their transfer-pricing rules.

Lohrse & Riedel (2012, 2013) also include an index for transfer-pricing rules based on a country's documentation requirements. In their specification of the econometric model, they include an interaction term between the index for the existence of transfer-pricing rules and the CIT-rate differential among countries. This allows the estimate of semi-elasticity of reported profits to differ for affiliates of MNEs located in countries with documentation requirements and for those located in countries without such requirements. They conclude that transfer-pricing regulations are an important strategy for governments seeking to deter BEPS. However, they also do not account for whether countries actually enforce for their transfer-pricing rules.

Klessen & Laplante (2012) look deeply into the interaction between the regulatory costs to an MNE's affiliate of the "enforcement" of transfer-pricing rules and a proxy variable for income shifting. They estimate their model using a sample of MNEs located in the United States. Their measure of enforcement is the IRS audit rate for large corporations. This is arguably an imprecise measure of the enforcement of transfer-pricing rules. As a proxy for regulatory costs, they use the weighted average of the existence and enforcement of transfer-pricing rules among the major trading partners of the United States. They conclude that U.S. companies are becoming more active at shifting income out of the United States as the regulatory costs of shifting have changed over time.

Beer & Loeprick (2013) study the effect of the introduction of transfer-pricing rules on the time path of reported profits. They find that within four years of introducing a rule requiring transfer-pricing documentation to be submitted with an MNE's annual CIT return, the reported profits of a subsidiary decreases by approximately 60 percent. Theirs is an innovative way of thinking about the regulator costs of transfer-pricing rules. At the risk of being repetitive, their

econometric specification does not include a control variable for whether a country actually enforces its documentation requirements.

The present research makes the following contributions to the literature on BEPS. First, my econometric specification includes a control variable that accounts for the enforcement of transfer-pricing rules. This variable was painfully constructed using information gleaned from reviewing hundreds of reports issued by KPMG and Ernst & Young. Second, in constructing the enforcement dummy variable, I account for the incentives of the host country to enforce its transfer-pricing rules vis-à-vis a foreign affiliate of the MNE based on the prevailing CIT-rate differential between those the host countries. In constructing the enforcement dummy variable, I use the rules of the ultimate owner's host country when that country's top statutory CIT rate is greater than that of the foreign subsidiary's host country and, vice versa, I use the rules of the foreign subsidiary's host country when that country has a top statutory CIT rate that is greater than that of the ultimate owner's host country. The rationale for constructing the enforcement dummy variable in this manner is straightforward: countries should only monitor the transfer-pricing practices when a domestic affiliate of an MNE is engaging in intracompany transactions with a foreign affiliate located in a country with a lower CIT rate than its own. When a domestic affiliate's host country has a lower CIT rate than that for the foreign affiliate's host country, there is simply no risk of BEPS.

Third, consistent with the theoretical predictions of the theory, the specification of my empirical model is sufficiently flexible to allow for the simultaneous estimation of three separate semi-elasticities of reported profit. Fourth, the sample used to estimate the model includes a larger number of countries, including developing, developed, and tax haven countries, than those used in previous studies. Consequently, there is likely to be greater heterogeneity in the sample in terms of the combinations of CIT-rate differentials among countries and the values of the enforcement dummy variable used in this study. The added variation among the independent variables should be helpful in identifying estimated parameters of the model. Fifth, I estimate an instrument variables model to address the potential endogeneity of the CIT-rate differentials among countries in my sample.

3. A simple model of tax motivated profit shifting by an MNE

In this section, we describe a simple model of tax-motivated, international profit shifting of an MNE and derive the comparative statics of the model. The comparative static results of the model are useful in guiding the specification of the empirical model and also provide an entirely new set of testable hypotheses that are an important focus of the econometric exercise discussed in the subsequent section of this study.

A fundamental concept in this section is the reported profit of an MNE's affiliate, which is defined as follows:

$$\pi_j^R = \pi_j^T - S_j - \frac{\gamma_j}{2}\frac{S_j^2}{\pi_j^T} \quad (1)$$

Where π_j^R is the reported profit of an MNE's affiliate j (= 1,…, n) located in country J (= 1,…, n); t_J is the CIT rate of country J; π_j^T is the true profit earned by the MNE in country J; S_j is the net amount of outbound profit shifting by the MNE's affiliate j; and $\gamma_J S_j^2/2\pi_j^T$ is the total cost to affiliate j of engaging in intracompany transactions to illegally shift profits to a foreign affiliate. These costs are assumed to be increasing in the stringency with which country J enforces its anti-tax avoidance rules, which is denoted by γ_J. This policy parameter is assumed to be greater than or equal to zero. As discussed in greater detail below, I assume that $\gamma_J = 0$, when country J has not incentive to enforce its transfer-pricing rules. In addition, the total costs of engaging in illegal profit shifting to a foreign affiliate is a positive function of the ratio of the square of the net amount of outbound profit shifting and the true profit of the MNE's affiliate j. The quadratic specification of the cost function captures the assumption that the costs to the affiliate increase with the square of the net amount of illegal outbound profit shifting.

Following HR and HL, we assume that an MNE seeks to maximize worldwide after-tax profits subject to the constraint that the sum of net outbound profit-shifting by all n affiliates of the MNE is equal to zero. Furthermore, I assume an affiliate's net outbound profit shifting may be positive or negative depending on the tax incentives facing the MNE in particular countries. The resulting constrained optimization problem can be written as follows:

$$\max V = \sum_{j=1}^{n} \pi_j^R = \sum_{j=1}^{n} (1 - t_J)\left(\pi_j^T - S_j - \frac{\gamma_j}{2}\frac{S_j^2}{\pi_j^T}\right), \quad (2)$$

$$\text{subject to } \sum_{j=1}^{n} S_j = 0.$$

To simplify the model, we assume that the MNE only has two affiliates: a foreign affiliate g located in country G, and an affiliate h located in the MNE's home country H. The Lagrange expression for (2) is given by the following expression:

$$\mathrm{L} = (1 - \mathrm{t_G})\left(\pi_g^T - S_g - \frac{\gamma_G}{2}\frac{S_g^2}{\pi_g^T} \right) + (1 - \mathrm{t_H})\left(\pi_h^T - S_h - \frac{\gamma_H}{2}\frac{S_h^2}{\pi_h^T} \right) - \lambda(S_g + S_h). \qquad (3)$$

Where λ is a Lagrange multiplier for the constraint that the sum of S_j must equal zero; t_J is the CIT rate of country J (= G, H); π_j^T is the true profit of affiliate j (= g or h) earned in country J (= G or H, respectively); and S_j is the net amount of outbound profits being illegally shifted abroad by affiliate j (= g or h).

Without loss of generality, we assume that the CIT rate of country G is greater than that of country H or $t_G - t_H > 0$. Given the tax incentives created by $(t_G - t_H) > 0$, the MNE should seek to shift profits from the foreign affiliate g to the home affiliate h. This action by the MNE will increase country H's CIT base and consequently its CIT revenues. Given these circumstances, country H has no incentive to spend scarce administrative resources monitoring the transfer pricing practices of a domestic affiliate in so far as it is engaging in intracompany transactions with the foreign affiliate g. There is simply no risk that the domestic affiliate h will seek to illegally shift profits to the foreign affiliate by strategically using transfer prices to understate the true profit earned in country H. If, however, affiliate g is engaging in intracompany transactions with affiliate h, country G should monitor affiliate g's transfer-pricing practices to deter BEPS. Therefore, we assume $\gamma_G > 0$ and $\gamma_H < 0$.

The necessary first order conditions for a maximum are given as follows:

$$\frac{\delta L}{\delta S_i} = -(1 - \mathrm{t_I})\left(1 + \frac{\gamma_I S_i}{\pi_i^T}\right) = \lambda. \qquad (4)$$

Where i = g or h, and I = G or H. Solving these two equations simultaneously for affiliate g's optimal level of outbound profit shifting results in the following expression:

$$S_g^* = \frac{t_G - t_H}{\gamma_G}\left(\frac{\pi_g^T}{(1 - t_G)}\right) \qquad (5)$$

The signs of the expressions on the right-hand-side of (5) implies that $S_g^* > 0$, meaning that affiliate g should shift profits to affiliate h. This in turn implies that affiliate g's reported profits will be less

than the true profits earned in country G. Finally, the constraint $S_g + S_h = 0$ implies that $S_h^* = -S_g^* < 0$, meaning that affiliate h is receiving inbound profit shifting, which, in turn, implies its reported profits are greater than the true profits earned in country H. According to (5), affiliate g's optimal level of outbound profit shifting is positively related to $t_G - t_H$, inversely related to γ_G, and independent of γ_H

Differentiating (5) by the policy parameters available to country G to deter BEPS, specifically $t_G - t_H$ and γ_G, results in the following two expressions:

$$\frac{\partial S_g^*}{\partial(t_G - t_H)} = \frac{\pi_g^T}{\gamma_G(1 - t_G)} > 0 \text{ and} \tag{6}$$

$$\frac{\partial S_g^*}{\partial \gamma_G} = -\frac{\pi_g^T(t_G - t_H)}{\gamma_G^2(1 - t_G)} < 0. \tag{7}$$

From (6), there is a positive relationship between the CIT-rate differential $t_G - t_H$ and affiliate g's optimal level of outbound profit shifting, and (6) implies that there is a negative relationship between the stringency with which country G enforces its transfer-pricing rules γ_G and affiliate g's optimal level of outbound profit shifting.

As previously discussed, the amount of illegal profit shifting among affiliates of an MNE is not observable; therefore, (6) and (7) are difficult to test empirically. Since an affiliate's reported profits are observable, we recast the comparative static results derived above in terms of the effect of G's policy parameters on affiliate g's optimal level of reported profits. Substituting (5) into (1) and differentiating the resulting expression by the policy parameters available to G to mitigate BEPS, we obtain the following expressions:[4]

$$\frac{\partial \pi_g^{R^*}}{\partial(t_G - t_H)} = -\left(\frac{\pi_g^T}{\gamma_G} - \frac{\pi_g^T(t_G - t_H)}{\gamma_G(1 - t_G)}\right) < 0, \tag{8}$$

$$\frac{\partial \pi_g^{R^*}}{\partial \gamma_G} = \left(\frac{\pi_g^T(t_G - t_H)^2}{\gamma_G(1 - t_G)} - \frac{\pi_g^T(t_G - t_H)}{\gamma_G}\right) > 0 \text{ , and} \tag{9}$$

$$\frac{\partial^2 \pi_g^{R^*}}{\partial(t_G - t_H)\partial \gamma_G} = \left(\frac{\pi_g^T}{\gamma_G^2} - \frac{\pi_g^T(t_G - t_H)}{\gamma_G^2(1 - t_G)}\right) > 0. \tag{10}$$

[4] Substituting (5) into (1) results in the following expression for affiliate g's optimal level of reported profits: $\pi_g^{R^*} = \pi_g^T\left[1 - \frac{(t_G - t_H)}{\gamma_G} - \frac{(t_G - t_H)^2}{(1 - t_G)}\right]$.

From (8), there is an inverse relationship between affiliate g's optimal level of reported profits and the CIT-rate differential; (9) shows a positive relationship between affiliate g's optimal level of reported profits and the stringency with which country G enforces its transfer-pricing rules. Finally, (10) implies that increasing the stringency with which country G enforces its transfer-pricing rules decreases (in absolute value) the effect of the CIT-rate differential on affiliate g's optimal level of reported profits. In other words, increasing the stringency with which a country enforces its transfer-pricing rules deters BEPS for every positive value of the CIT-rate differential between countries G and H.

A graph illustrating the implications of (8) - (10) for the relationships between affiliate g's optimal level of reported profits and the CIT-rate differential may help in understanding the comparative static results of this model. Figure 1 illustrates the relationships between affiliate g's optimal level of reported profits and the CIT-rate differential. As we will see, the relationships crucially depend on the stringency with which country G (H) enforces its transfer-pricing rules.

The vertical axis of Figure 1 represents affiliate g's reported profit $\pi_g^{R^*}$and the horizontal axis represents the CIT-rate differential between countries G and H, which is denoted by ($t_G - t_H$). The CIT-rate differential can be greater than, less than, or equal to zero. When the CIT-rate differential is equal to zero, there is no incentive for either affiliate to shift profits to the other; therefore, affiliate g's reported profits are equal to its true profits when $t_G = t_H$. This point is labeled T on the vertical axis of Figure 1. Furthermore, if the reported profits of the affiliates are independent of the CIT-rate differential, then affiliate g's reported profits would always be equal to its true profits. Assuming for the sake of simplicity that affiliate g's true profit is exogeneous (i.e., independent of the CIT-rate differential), then affiliate g's reported profit would equal its true profit for every value of ($t_G - t_H$). This case is illustrated by the horizontal line and labeled $\overline{AB}$ and passing through point T. This line provides a useful reference in following discussion.

According to (8) – (10), we must analyze three distinct cases. First, let's suppose neither country adopts transfer-pricing rules in which case $\gamma_G = \gamma_H = 0$. In this case, there is an inverse relationship between affiliate g's optimal level of reported profits and ($t_G - t_H$) This relationship is illustrated in Figure 1 by the negatively sloped line segment labeled $\overline{CD}$. When ($t_G - t_H$) < 0, then affiliate h has an incentive to shift profits to the foreign affiliate g in which case affiliate g's reported profits are greater than its true profits. This is illustrated in Figure 1 by the fact that that

the negatively sloped line segment labeled $\overline{CT}$, which represents affiliate g's reported profits, lies above the line labelled $\overline{AB}$, which represents affiliate g's true profits. The vertical distance between $\overline{CT}$ and $\overline{AB}$ represents affiliate h's optimal level of outbound profit shifting, which is equal to the amount of inbound profit shifting received by to affiliate g, for every value of $(t_G - t_H) < 0$.

Now, let's consider the range of the horizontal axis where $t_G - t_H > 0$. In this situation, affiliate g has an incentive to shift profits to firm h, or $S_g^* > 0$, and, as a result, the reported profits of affiliate g are less than its true profits. This is illustrated in Figure 1 by the fact that the negatively sloped line segment labeled $\overline{TD}$, representing affiliate g's optimal level of reported profits, lies below the horizontal line labelled $\overline{AB}$, representing the true profits of affiliate g, for every value of $t_G - t_H > 0$. The vertical distance between $\overline{TD}$ and $\overline{AB}$ represents affiliate g's optimal level of outbound profit shifting at every value of $(t_G - t_H) > 0$.

For purposes of interpreting the empirical model, it is important to observe that the inverse relationship between affiliate g's reported profits and its optimal level of net outbound profit shifting, which can be positive or negative depending on the tax incentives facing the MNE, is evident in Figure 1, as well. As we move from left to right along the horizontal axis, the CIT-rate differential is increasing; reported profits are decreasing; and affiliate g's optimal amount of net outbound profit shifting is increasing. The negatively sloped line labeled $\overline{CD}$ illustrates (8) after setting $\gamma_G = 0$.

Turning to the second case 2, consider the range of the horizontal axis where $t_G - t_H < 0$. As previously discussed, affiliate h has an incentive to shift profits to the foreign affiliate g. Now, in contrast to the previous case, country H enforces its transfer-pricing rules to prevent BEPS. According to (10), enforcement decreases (in absolute value) outbound profit shifting by affiliate h, and, consequently, we assume $\gamma_H > 0$. The effect of country H enforcing its transfer-pricing rules on the optimal level of inbound profits being received by g with respect to the CIT-rate differential is illustrated in Figure 1 by the negatively sloped line segment labeled $\overline{ET}$. This line segment is not as steeply sloped as the line labeled $\overline{CT}$ because country H is enforcing its transfer-pricing rules. This has a deterrent effect on affiliate h's optimal level of outbound profit shifting thus decreasing the amount of inbound profits received by affiliate g at every value of $t_G - t_H < 0$.

The third case arises when $t_G - t_H > 0$, and country G enforces its transfer pricing rules to deter BEPS, thus $\gamma_G > 0$. Again, according to (10) enforcement decreases (in absolute value)

affiliate g's optimal level of net outbound profit shifting at every value of $t_G - t_H > 0$. This is illustrated in Figure 1 by the negatively sloped line segment labeled $\overline{TF}$. Again, this line segment is not as steeply sloped as the line segment $\overline{TD}$ because of the deterrent effect of country G enforcing its transfer-pricing rules on affiliate g's optimal level of outbound profit shifting.

I conclude this section with a couple of final observations. First, the line segment labeled $\overline{EF}$ may not have a constant slope. Indeed, there should be a kink in $\overline{EF}$ at the point labelled T on the vertical axis of Figure 1 if $\gamma_G \neq \gamma_H$, meaning that one country is enforcing its transfer-pricing rules, when it has the incentive to do so, more stringently than the other country. Consequently, the functional form of the empirical model should be flexible enough to permit the simultaneous estimation of three distinct semi-elasticities of reported profit. Second, for expository reasons, I assume that true profits are exogenous. If, however, a country's CIT rate distorts the real activity of domestic affiliates of MNEs, as seems likely, then this could be illustrated in Figure 1 by rotating the three lines counter-clockwise about the point labeled T on the vertical axis. This also shows the necessity of controlling for true profits in the empirical model.

4. Sample construction, econometric specification, and variable construction

In this section, we describe the data and the construction of the sample used to estimate the empirical model, the econometric specification of the empirical model of reported profits, and the variable construction.

4.1 The data and sample construction

To estimate the model, I use firm-level data. Such data are not readily available. At the moment, there are only three government entities that collect information on MNEs: The Bureau of Economic Analysis's (BEA) Operations and Management Companies Database in the U.S., Deutsche Bundesbank's Microdatabase on Direct Investments (MIDI), and the United Kingdom's Office for National Statistics annual inquiry into Foreign Direct Investment (AFDI). Unfortunately, these databases are not publicly available. Fortunately, some private institutions, such as Capital IQ (COMPUSTAT and Capital IQ Platform) and Bureau Van Dijk-BvD (Orbis and Amadeus), offer various platforms that contain information on company profits, costs, performance, and other indicators. These datasets are frequently used by firms providing accounting services to MNEs and by tax enforcement authorities, such as the IRS to take one

example. These data are often used by scholars interested in corporate finance and international tax issues and are frequently cited in the academic literature.

I construct a sample of affiliates of MNEs from the Orbis (BvD) database which contains information on over 200 million private companies worldwide. One of the limitations of using these data for the task at hand is that ownership information is only available for the most recent year of the data. Indeed, when applying the match of the current year to prior years, it is possible to obtain mismatches between parents and subsidiary firms, particularly when there have been mergers and acquisitions during the intervening years. As noted in previous studies that use these data (Dharmapala & Riedel, 2013; Dischinger et al., 2014; Huizinga & Laeven, 2008), this is an unfortunate but unavoidable limitation of using these data. Since mergers and acquisitions are relatively infrequent events, particularly during the time period spanned by my sample, I believe that any bias resulting from using these data is relatively small.

I construct the sample, which I use to estimate the model, from the Orbis database by excluding firms with the following characteristics: subsidiaries firms, inactive firms, firms with losses, non-industrial firms (banks, hedge funds, foundations, insurance, public authorities, trustees, venture capital, and others), small firms as defined by Orbis and firms with an ultimate owner located in the same country.[5] Ultimate owners are excluded from the sample to prevent perfect multicollinearity due to the adding-up constraint that profit-shifting must sum to zero. Loss-making firms are excluded from the sample because they are subject to specific accounting rules; incorporating these rules into the empirical model is beyond the scope of the current study. After applying these exclusion criteria to the dataset, the resulting sample consists of 48,309 subsidiaries for the period 2008 to 2014. Tables 1 and 2 report the number subsidiaries and ultimate owners in the sample by country, respectively. I augment the firm-level data with country-level data drawn from a variety of sources, as discussed in greater detail below.

4.2 The econometric specification

To test the predictions derived from the theoretical model, I adapt the econometric specification pioneered by HR and HL. More specifically, I estimate the following fixed-effects, instrumental variables, panel data model:

[5] Ultimate owners are excluded from the data set because the same semi-elasticity of BEPS is calculated using the differential between an affiliate of an MNE and its ultimate owner.

$$Log(\pi_{gt}^{r}) = \beta_0 + \beta_1(t_{Gt} - t_{Ht}) + \beta_2(t_{Gt} - t_{Ht})\gamma_{Gt} + \beta_3(t_{Gt} - t_{Ht})\gamma_{Ht} + \beta_4\gamma_{Gt} + \beta_5\gamma_{Ht} + \beta_6 \log(k_{gt}) + \beta_7 \log(l_{gt}) + \beta_8 Log(a_{Gt}) + \beta_9\omega_{Gt} + \sum \sigma_{st} + u_{gt}. \quad (10)$$

The dependent variable is the natural logarithm of affiliate g's reported profits in country G and year t. The CIT-rate differential for countries G and H, respectively, in year t, is denoted by t_{Gt} - t_{Ht}, and, as discussed in greater detail below, γ_{Gt} and γ_{Ht} are dummy variables reflecting the stringency with which countries G and H, respectively, enforce their transfer-pricing rules while also accounting for their incentives to do so. The interaction terms involving the CIT-rate differential and the enforcement dummy variables provide the necessary flexibility to estimate the three distinct semi-elasticities of reported profits predicted by the theory.

The right-hand-side variables k_{gt} and l_{gt}, denote the value of firm g's capital assets and labor costs, respectively. The variable a_{Gt} denotes country G's real GDP per capita, which serves as a proxy variable for the rate of technological change. Following the methodology pioneered by HR, these variables are included in the model to control for the true profit earned by affiliate g in country G. The variable ω_{Gt} is a vector of country and time specific characteristics, namely indexes of trade freedom and political stability; σ_{st} is an industry-year fixed effect; and u_{gt} is a stochastic-error term, which is assumed to be normally distributed with mean zero and constant variance.

The model is estimated using an instrumental variable for the potentially endogenous variables in (10) involving the CIT-rate differential. Following HR and HL, I use the log difference in the populations of the affiliates' and ultimate owner's host countries as an instrument for the potentially endogenous variable. The intuition behind using this instrument is that tax haven countries tend to be sparsely populated island countries, often located in the Caribbean. In contrast, high CIT-rate countries tend to be more populous OECD countries. I conduct Hausman-Wu specification tests for each model. These tests reject the null hypothesis that the variables involving the CIT-rate differential are exogeneous. I also conduct a Wright-Yogo test which rejects the null hypothesis that the log difference in populations is a weak instrument. In short, I believe that the log difference in populations is a valid instrument. It is sufficiently correlated with the potentially endogenous variables. Furthermore, there is no reason to believe that it belongs in the model of reported profits; so the exclusion restriction is valid, as well.

4.3 Construction of the variables

The dependent variable is measured by the natural logarithm of reported earnings before interest and taxes (EBIT). Firm-level information on reported EBIT, the value of fixed assets, and labor costs by year are from the Orbis database. The CIT-rate differential is constructed using the maximum statutory CIT rates of an affiliate's and ultimate owner's host countries. These data come from Bloomberg and various issues of Ernst & Young's Worldwide Corporate Tax Guides, KPMG's Global Corporate Tax Summaries, and Price-Waterhouse-Cooper's Global Corporate Tax Summaries.

The stringency with which a country enforces its transfer-pricing rules is a dummy variable which is built by the product of two constructed variables. One of the constructed variables is a trichotomous variable reflecting the level of documentation that a country requires a domestic affiliate of MNE to submit with its CIT return. The second constructed variable is also a trichotomous variable reflecting the frequency with which a country applies penalties for violating its transfer-pricing documentation requirements. Information used to construct these variables comes from Ernst & Young's Worldwide Transfer Pricing Reference Guide and KPMG's Transfer Pricing Review by country and by year. Table 3 summarizes the criteria used to construct the categorical variables measuring the level of a country's documentation requirements and the frequency with which a country applies penalties for failing to comply with its transfer-pricing documentation requirements.

The product of these two constructed categorical variables results in a variable with the following six values: 1, 2, 3, 4, 6, and 9. For ease of reference, let's refer to this variable as the stringency measure. The enforcement dummy variable in (10) is constructed by setting it equal to one when the stringency measure is greater than or equal to four, and zero otherwise. To test the robustness of the model, as discussed in greater detail below, I also estimate a specification in which the enforcement variable is set equal to one when the stringency measure is greater than or equal to five. This change in the definition of the enforcement dummy variable has no appreciable effect on the estimated coefficients.

Data on GDP per capita and the index of trade freedom by country and year come from the World Bank's Development Indicators (World Bank Group) and the Heritage Foundation's Index of Economic Freedom, respectively. Table 4 reports sample summary statistics.

5. The empirical results

Now, we turn to the discussion of the empirical results. Since the focus of this research is obtaining consistent estimates of the semi-elasticities of reported profits, I report estimates of this parameter for a variety of specifications in Table 5. All specifications include a full set of firm and industry-year fixed effects, and I report robust standard errors clustered at the MNE level.

For the sake of comparison, I estimate a "first-generation model of reported profits," using my sample. This specification does not include a control variable for countries with transfer pricing rules. This estimate of the semi-elasticity of reported profits is reported in the row labelled First-generation model and the second column of Table 5. The estimate is equal to -1.789 and it is distinguishable from zero at conventional levels of statistical significance. This estimate has the expected sign. The full set of estimated coefficients for this specification are reported in the second column of Table 6. For reasons previously discussed, I believe this model is misspecificied and the estimate of the semi-elasticity is inconsistent.

Second-generation models include a variety of ways to control for whether a country has transfer-pricing rules. Accordingly, I estimate two versions of the second-generation model, using my sample. In version of the model that I refer to as the second-generation model A, I follow the practice in the literature of controlling for whether a country has adopted transfer-pricing rules by including a dummy variable equal to one when the subsidiary's host country requires that the affiliates of MNEs submit documentation of their transfer-pricing practices. This generation of models includes an interaction term between the CIT-rate differential and the dummy variable controlling for the adoption of transfer-pricing rules. As a result, there are two distinct estimates of the semi-elasticity of reported profits. There is an estimate for the case in which the host country does not have transfer pricing rules, and there is an estimate for the case in which the host country of the subsidiary requires submission of documentation of the affiliates' transfer pricing practices. The former estimate is reported in the row labelled Second-generation model A and the second column of Table 5. This estimate is equal to -1.589. Consistent with the theory, the estimate is negative and statistically different from zero at conventional levels of significance. The latter estimate is equal to -1.039; however, it is not distinguishable from zero at conventional levels of statistical significance. The estimated coefficients for this specification are reported in the third column of Table 6.

In the specification that I refer to as the second-generation model B, I follow the practice in the literature of controlling for a country's adoption of transfer-pricing rules, which may or may not include documentation of the affiliates' transfer-pricing practices, by including a dummy variable set equal to one when the host country of the subsidiary has adopted transfer-pricing rules of some type and zero otherwise. I also include an interaction term between the CIT-rate differential and the dummy variable controlling for foreign subsidiary's adoption of transfer-pricing rules. The estimates of the semi-elasticity of reported profits are reported in the row labelled second-generation model B of Table 5 and are equal to -9.435 and -1.811, respectively. Consistent with the theory, the estimates are negative and statistically different from zero at conventional levels of significance.

Second-generation models are an improvement over first-generation model because they control for whether countries have adopted transfer-pricing rules. However, for these reasons previously discussed, these models are misspecified and the estimated semi-elasticities are inconsistent. These models do not account for which country – the host country of the subsidiary or of the ultimate owner – has adopted transfer-pricing rules, enforces these rules, and has the incentive to do so.

Now, I estimate (10) in which I include a dummy variable to control for whether a country enforces its transfer-pricing rules and which country – the host of the affiliate or the ultimate owner -- has an incentive to do so. In this specification of the model, there are two interaction terms with the CIT-rate differential. There is an interaction term for the case in which the host country of the affiliate (ultimate owner) has adopted transfer-pricing rules and has the incentive to enforce them. Therefore, this specification results in three potentially distinct values of the semi-elasticity of reported profits.[6] The estimated coefficients of this specification are reported in the fourth column of Table 6.

The estimated semi-elasticity for the case in which neither country enforces its transfer-pricing rules is reported in the row labeled Enforcement model 1 and the second column of Table 5. The estimated semi-elasticity is equal to -3.540 and is distinguishable from zero at conventional

[6] These three semi-elasticities are defined in terms of (10) by the following expressions: $\frac{dE[\ln(\pi_g^R)|t_G-t_H\geq 0,\gamma_G=0\gamma_H,=0]}{d(t_G-t_H)}=\beta_1$; $\frac{dE[\ln(\pi_g^R)|t_G-t_H\geq 0,\gamma_G=1,\gamma_H=0]}{d(t_G-t_H)}=\beta_1+\beta_2$; and $\frac{dE[\ln(\pi_g^R)|t_G-t_H<0,\gamma_G=0,\gamma_H,=1]}{d(t_G-t_H)}=\beta_1+\beta_3$, where the subscripts G and H are for the host country of the affiliate and ultimate owner, resespectively.

levels of statistical significance. This estimate implies a ten-percent increase in the CIT-rate differential results in a 35 percent decrease in reported profits, which is substantial. The estimate reported in the corresponding row and third column of Table 5 is for the case in which the foreign affiliate's host country has adopted, enforces its rules, and has the incentive to do so because $t_G - t_H > 0$. This estimate of the semi-elasticity of reported profits is equal to -3.063, meaning that a ten-percent increase in the CIT-rate differential results in an approximately 30 percent decrease in reported profits. Consistent with the theory, this estimate is negative and statistically distinguishable from zero at the ten-percent level. Furthermore, it is somewhat greater (in absolute value) than the previous estimate when countries do not enforce transfer-pricing rules. As reported in the corresponding row and third column of Table 5, the semi-elasticity of reported profits is equal to -1.286 and is statistically distinguishable from zero at the 5-percent level. This semi-elasticity corresponds to the case in which the ultimate owner's host country has adopted transfer-pricing rules, enforces its rules, and has the incentive to do so because $t_G - t_H < 0$. This estimate implies a ten-percent increase in the CIT-rate differential results in an approximately 13 percent decrease in reported profits. As predicted by the theory, this estimate is smaller (in absolute value) than the estimate when neither country enforces its rules. It is also interesting to note that the estimates for the cases when the subsidiary's and ultimate owner's host countries have the incentive to enforce their rules differ, as well.

Now, I estimate (10) on two subsamples to test the key assumption that accounting for the incentive of a country to enforces its transfer-pricing rules is important for correctly specifying a model of reported profits. In the row labeled Enforcement 2, I report the estimates of the semi-elasticities of reported profits on the subsample in which the CIT-rate differential is positive or $(t_G - t_H) > 0$. In this case, the affiliate's host country G has an incentive to enforce its transfer-pricing rules to mitigate BEPS, but the ultimate owner's host country does not. Consistent with the theory, the semi-elasticity for the case in which the host country of the affiliate has the incentive to enforce its rules is negative and statistically distinguishable from zero at the ten-percent level, but, as predicted by theory, the estimate when the ultimate owner's host country enforces its rules but has no incentive to do so is indistinguishable from zero at conventional levels of statistical significance. I repeat the same exercise on the subsample in which the CIT-rate differential is negative or $(t_G - t_H) < 0$. In this case, the ultimate owner's host country has an incentive to enforce

its rules but the foreign affiliate's host country does not. The estimated semi-elasticities for this subsample are reported in the row labelled Enforcement model 2. Consistent with the theory, the semi-elasticity for the case in which the ultimate owner's host country has the incentive to enforce its rules, which is reported in column 3 of Table 5, is negative and statistically different from zero at conventional levels of significance. And, as predicted by the theory, the estimate for the case in which the foreign affiliate's host country enforces its rules but has no incentive to do so because $(t_G - t_H) < 0$ is indistinguishable from zero at conventional levels of statistical significance. These placebo estimates provide important evidence that is consistent with the theory. In specifying a model of reported profits, the functional form should be sufficiently flexible to permit the estimation of three semi-elasticities of reported profits. Furthermore, the construction of the enforcement dummy variable should account for not only whether the country has adopted rules and enforces them but should also account for whether the country has the incentive to enforce its rules given the tax incentives facing domestic affiliates of MNEs engaging in intracompany transactions with foreign affiliates. The estimated coefficients obtained from these two subsamples are reported in columns 2 and 3, respectively, of Table 7.

To gauge the robustness of the main results to alternative specifications, estimate a specification of the model in which I add a control variable for political stability. The estimated coefficients of this specification are reported in columns 1-3 of Table 8. This model is estimated on the full sample and the two subsamples previously described. The estimated coefficients have the expected signs and statistical significance. Next, I examine the robustness of my main findings to an alternative definition of the stringency with which a country enforces its rules. More specifically, I redefine γ_{Gt} and γ_{Ht} to be equal to one when the constructed categorical variable for the frequency of applying penalties is equal to or greater than six rather than four as in the case of the previous specifications. The estimated coefficients of this specification are reported in columns 4-6 of Table 8. Again, I estimate this specification on the full sample and the two subsamples previously described. The estimated coefficients of this specification have the expected signs and statistical significance.

6. Policy simulation

To illustrate the practical consequences for tax policy analysis of correctly specifying the empirical model of reported profits, I report describe the results of a policy simulation in this section. For

purposes of the simulation, I assume the United States reduces its CIT rate by 20 percent. A 20 percent cut in the top statutory CIT rate of the U.S. would be equivalent to a tax rate of 15 percent, instead of the current-law rate of 35 percent. This proposal is particularly relevant because the United States has one of the highest top statutory CIT rates in the world, and there is an ongoing policy debate about the merits of the United States reducing its top statutory CIT rate to make it more competitive with that of other countries.

For the sake of comparison, I use the estimated semi-elasticities for reported profits obtained from the First–generation model reported and Enforcement model 1, which are reported in the corresponding rows of Table 5, to provide two estimates of the policy simulation. The estimates for the policy simulation based on the First-generation model of the effect of the proposal on the percent change in reported CIT revenue by country and on the percent change in aggregate reported firm EBIT by country are reported in columns two and three, respectively, of Table 9, Similarly, the estimates for the policy simulation based on the Enforcement 1 model are reported in columns four and five, of Table 9.[7]

There are three noteworthy findings in Table 9. First, every country, except the United States, experiences a decrease in aggregate reported firm revenue. In contrast, the U.S. experiences an increase in aggregate reported firm revenue as a result. Second, every country, including the U.S., experiences a decrease in CIT revenue. In the case of the U.S., this finding shows that the increase in the CIT tax base or aggregate reported firm revenue is not large enough to offset the effect of the 20 percent reduction in the U.S. CIT rate. For the other countries, the decrease in CIT revenues is proportional to the decrease in the country's CIT tax base as a result of the proposal because they do not change their current-law CIT rate. Third, and most importantly for the purposes at hand, the estimated effect of the proposed reform on the percent decrease in CIT revenues for the U.S. is 15 percentages points smaller using estimates obtained from the Enforcement 1 model relative to that based on the First-generation model. In sum, this exercise illustrates the practical importance of using a correctly specified model to estimate the effect on reported profits of CIT-rate differentials for tax policy analysis.

[7] The simulation for the first generation model I used column 1 if Table 6. [7] To run the simulation for the enforcement model I used column 4 if Table 6

7. Conclusions

As globalization increases so has international tax competition among countries to attract foreign direct investment. The resulting CIT-rate differentials among countries is leading to BEPS as MNEs shift profits from affiliates located in high CIT-rate countries to affiliates located in low CIT rate countries to minimize their aggregate tax liabilities thus increasing their worldwide after-tax profits.

This paper seeks to gauge the effect of CIT-rate differentials among countries on BEPS. I improve upon the existing literature by accounting for whether countries actually enforce their transfer-pricing rules and when they have the incentive to do so because of the tax incentives facing domestic affiliates of MNEs. I report strong evidence that correctly specifying the model of reported profits in the manner prescribed in this paper has important implications for the correct choice of function form and a substantial effect on the estimated semi-elasticities of reported profits. I also conduct a policy simulation to illustrate the practical importance to tax policy analysis. I use my preferred estimates of the semi-elasticities of reported profits as well as an estimate of this semi-elasticity using a state-of-the-art but misspecified model to conduct the policy simulation. This exercise shows that using estimates of the semi-elasticities from a correctly specified model has a substantial effect on the estimated tax revenue effect of the proposed reform.

References

Alesina, A., Angeloni, I., & Etro, F. (2005). International unions. The American Economic Review, 95(3), 602-615.

Bartelsman, E. J., & Beetsma, R. M. (2003). Why pay more? Corporate tax avoidance through transfer pricing in OECD countries. Journal of Public Economics, 87(9), 2225-2252.

Becker, J., & Fuest, C. (2012). Transfer pricing policy and the intensity of tax rate competition. Economics Letters, 117(1), 146-148.

Beer, S., & Loeprick, J. (2013). Profit shifting: Drivers and potential countermeasures. WU International Taxation Research Paper Series(2013-03).

Blouin, J., Huizinga, H., Laeven, M. L., & Nicodème, G. (2014). Thin capitalization rules and multinational firm capital structure. International Monetary Fund

Clausing, K. A. (2015). The Effect of Profit Shifting on the Corporate Tax Base in the United States and Beyond. Available at SSRN 2685442.

Crivelli, E., De Mooij, R. A., & Keen, M. M. (2015). Base Erosion, Profit Shifting and Developing Countries. International Monetary Fund.

De Mooij, R. A., & Ederveen, S. (2008). Corporate tax elasticities: a reader's guide to empirical findings. Oxford Review of Economic Policy, 24(4), 680-697.

Dharmapala, D. (2014). What Do We Know about Base Erosion and Profit Shifting? A Review of the Empirical Literature. Fiscal Studies, 4(35), 421-448.

Dharmapala, D., & Riedel, N. (2013). Earnings shocks and tax-motivated income-shifting: Evidence from European multinationals. Journal of Public Economics, 97, 95-107.

Dischinger, M., Knoll, B., & Riedel, N. (2014). The role of headquarters in multinational profit shifting strategies. International Tax and Public Finance, 21(2), 248-271.

Fuest, C., & Riedel, N. (2010). Tax evasion and tax avoidance in developing countries: The role of international profit shifting.

Grubert, H., & Mutti, J. (1991). Taxes, tariffs and transfer pricing in multinational corporate decision making. The Review of economics and Statistics, 285-293.

Heckemeyer, J., & Overesch, M. (2013). Multinationals' profit response to tax differentials: Effect size and shifting channels. ZEW-Centre for European Economic Research Discussion Paper(13-045).

Hines, J. R., & Rice, E. M. (1994). Fiscal Paradise: Foreign Tax Havens and American Business. The Quarterly Journal of Economics, 109(1), 149-182.

Huizinga, H., & Laeven, L. (2008). International profit shifting within multinationals: A multi-country perspective. Journal of Public Economics, 92(5), 1164-1182.

Klassen, K. J., & Laplante, S. K. (2012). Are US multinational corporations becoming more aggressive income shifters? Journal of Accounting Research, 50(5), 1245-1285.

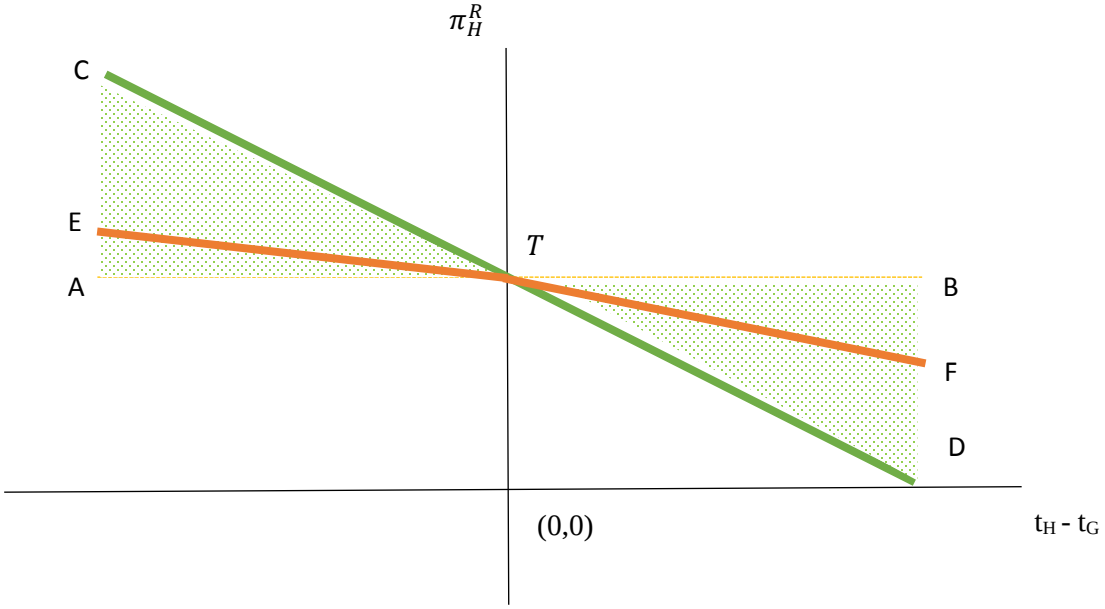
Lohse, T., & Riedel, N. (2012). The impact of transfer pricing regulations on profit shifting within european multinationals.University of Hohenheim, Center for Research on Innovation and Services

Lohse, T., & Riedel, N. (2013). Do transfer pricing laws limit international income shifting? Evidence from European multinationals.

Markle, K. (2015). A Comparison of the Tax-Motivated Income Shifting of Multinationals in Territorial and Worldwide Countries. Contemporary Accounting Research.

OECD. (2013). Actifon plan on base erosion and profit shifting Retrieved from OECD:
Olsen, T. E., & Osmundsen, P. (2003). Spillovers and international competition for investments. Journal of International Economics, 59(1), 211-238.
World Bank Group. (2016)World Development Indicators World Bank Publications.

Figure 1. The Optimal Reported Profits of Affiliate g with Respect to the Corporate Income Tax Rate Differential between Countries G and H



Note: The slope of the line segment labelled $\overline{CD}$ corresponds to β_1 in the econometric specification (10), when $\gamma_G = \gamma_H = 0$. The slope of the line segment labelled $\overline{TF}$ is corresponds to $\beta_1 + \beta_2$ in the econometric specification (10), when $\gamma_G > 0$ and $\gamma_H = 0$. The slope of the line segment labeled $\overline{ET}$ corresponds to $\beta_1 + \beta_3$ in the econometric specification, when $\gamma_G = 0$ and $\gamma_H = 0$.

Table 1. Number of affiliates in the sample by country

Country	Number of affiliates
1. Australia	5
2. Austria	895
3. Belgium	2,959
4. Britain	4,386
5. Cyprus	39
6. Czech	3,108
7. Denmark	1,194
8. Estonia	631
9. Finland	886
10. France	6,161
11. Germany	3,584
12. Hong Kong	5
13. Iceland	14
14. Ireland	743
15. Italy	4,044
16. Japan	156
17. Luxembourg	40
18. Netherlands	779
19. New Zealand	725
20. Norway	1,273
21. Portugal	1,858
22. Slovakia	1,892
23. Slovenia	546
24. South Korea	995
25. Spain	3,838
26. Sweden	2280
27. Switzerland	46
28. United States	21
Total number of affiliates	43,103

Table 2. Host countries of the ultimate owners (in alphabetical order)

Country	Number of firms	Country	Number of firms	Country	Number of firms
Andorra	10	Greece	42	Peru	1
Angola	9	Guinea-Bissau	1	Philippines	3
Argentina	13	Hong Kong	165	Poland	184
Australia	490	Hungary	73	Portugal	255
Austria	1,300	Iceland	52	Romania	26
Bahamas	30	India	291	Russian Federation	102
Bahrain	3	Indonesia	4	Saint Vincent	4
Barbados	2	Ireland	504	Saudi Arabia	24
Belarus	2	Israel	172	Serbia	10
Belgium	1,058	Italy	1,825	Seychelles	21
Bermuda	198	Japan	2,295	Singapore	174
Bosnia	5	Korea, Republic of	231	Slovakia	87
Brazil	60	Kuwait	24	Slovenia	40
Bulgaria	31	Latvia	34	South Africa	50
Canada	450	Lebanon	36	Spain	1,171
Cayman Isl.	196	Liechtenstein	107	Sri Lanka	4
Chile	18	Lithuania	43	Sweden	1,726
China	319	Luxembourg	1626	Switzerland	1,961
Colombia	14	Macedonia	1	Syria	1
Costa Rica	2	Malaysia	58	Taiwan	142
Croatia	47	Malta	104	Thailand	12
Cyprus	287	Marshall Islands	17	Tunisia	10
Czech Rep.	291	Mauritius	21	Turkey	73
Denmark	1,281	Mexico	50	Ukraine	43
Ecuador	1	Monaco	22	UAE	91
Egypt	3	Morocco	8	United Kingdom	2,921
Estonia	18	Namibia	1	United States	7,234
Finland	777	Netherlands	1,992	Uruguay	3
France	2,957	New Zealand	63	Venezuela	8
Georgia	1	Norway	811	Viet Nam	2
Germany	6,107	Panama	67	Total	43,103

Table 3. Coding of the categorical variables according to a country's transfer-pricing documentation requirements and application penalties for violations

Report	Documentation requirements		Penalties applied for violations	
	KPMG's Transfer Pricing Review	EY's Worldwide Transfer Pricing Reference Guide	KPMG's Transfer Pricing Review	EY's Worldwide Transfer Pricing Reference Guide
Information provided in the report	Are transfer-pricing required to be submitted on an annual basis?	Documentation requirements and return disclosures and related-party disclosures	To what extent are transfer pricing penalties enforced?	Audit risk/transfer pricing scrutiny
Coding	Answers to the questions stated above			
0	No	No documentation required.	Never	None
1	No, but documents need to be prepared when requested	Documents are required when a firm is audited and a firm has some time to prepare them.	Not often	Low risk
2	No, but documents need to prepared along with the tax return	Documents need to be ready when requested.	Increasing	Medium risk
3	Yes	Documents need to be summited with the annual CIT return	Often or always	High risk

Table 4. Summary statistics for the full sample (number of observations = 190,862)

Variable	Mean	Standard deviation	Minimum	Maximum	Source
CIT-rate differential ($t_G - t_H$)	-0.022	0.090	-0.425	0.407	Author
Average CIT-rate differential	0.009	0.041	-0.167	0.190	Author
Enforcement regime by the subsidiary's host country	0.259	0.438	0.000	1.000	Author
Enforcement by the ultimate owner's host country	0.656	0.475	0.000	1.000	Author
Transfer-pricing rules in the subsidiary's host country	0.991	0.091	0.000	1.000	Author
Transfer-pricing rules in the ultimate owner's host country	0.909	0.288	0.000	1.000	EY, KPMG
Transfer-pricing documentation required by the subsidiary's host country	0.149	0.357	0.000	1.000	EY, KPMG
Transfer-pricing documentation required by the ultimate owner's host country	0.086	0.280	0.000	1.000	EY, KPMG
Log(subsidiary's reported profits)	6.426	1.836	-11.236	15.614	ORBIS
Log(value of fixed assets)	6.559	2.626	-6.001	17.635	Author
Log(labor costs)	7.610	1.554	-4.977	16.486	Author
Log(GDP per capita)	10.521	0.386	9.592	11.667	ORBIS
Index of trade freedom[c]	68.442	15.544	38.500	96.000	ORBIS
Index of political stability	0.698	0.392	-0.466	1.514	World Bank

Table 5. Instrumental variable estimates of the semi-elasticity of reported profits

Empirical specification	Semi-elasticity of reported profits		
	β_1 (without transfer-pricing rules)	$\beta_1 + \beta_2$ (country H has no incentive to enforce its transfer-pricing rules)	$\beta_1 + \beta_3$ (country G has no incentive to enforce its transfer-pricing rules)
	Models are estimated on the full sample		
First-generation model	-1.789***	-	-
Second-generation model A	-1.589***	-1.039	-
Second-generation model B	-9.435*	-1.811***	-
Enforcement model 1	-3.54***	-3.063*	-1.286**
	Model is estimated on the subsample in which $t_G - t_H > 0$		
Enforcement model 2	-4.741*	-3.225*	-1.648
	Models are estimated on the subsample in which $t_G - t_H < 0$		
Enforcement model 3	-4.438*	-4.040	-1.041*

Note: The dependent variable in these models is the natural logarithm of earnings before interest and taxes (EBIT). The second-generation model A includes a dummy variable = 1 if the subsidiary's host country requires transfer-pricing documentation to be submitted with the affiliate's annual CIT return and zero otherwise. The second-generation model B includes a dummy variable = 1 if the for the subsidiary's host country has adopted transfer-pricing rules and zero otherwise. The enforcement model includes a dummy variable = 1 if the host country of the subsidiary enforces transfer-pricing rules. The instrument for the potentially endogenous variable (CIT-rate differential) is the log of the difference in populations of the two countries.

Table 6. Instrumental variable estimates of alternative models of reported profits

Variable	Empirical specification			
	First generation	Second generation A	Second generation B	Enforcement model
IT-rate differential ($t_G - t_H$)	-1.798*** (0.633)	-1.589*** (0.512)	-9.435* (5.002)	-3.540*** (1.244)
Transfer-pricing documentation required by subsidiary's host country (TPD-SHC)	-	0.050** (0.023)	-	-
TPD-SHC×($t_G - t_H$)	-	0.550 (0.352)	-	-
Existence of transfer-pricing rules in the subsidiary's country (ETPR-SHC)	-	-	1.441* (0.810)	-
ETPR-SHC ×($t_G - t_H$)	-	-	7.624* (4.379)	-
Enforcement by subsidiary's host country (E-SHC)	-	-	-	-0.026 (0.019)
E-SHC ×($t_G - t_H$)	-	-	-	0.477** (0.189)
Enforcement by ultimate owner's host country (E-UHC)	-	-	-	-0.081*** (0.019)
E-OHC ×($t_G - t_H$)	-	-	-	2.254** (0.928)
Log(value of fixed assets)	0.045*** (0.003)	0.045*** (0.003)	0.045*** (0.003)	0.045*** (0.003)
Log(labor costs)	0.447*** (0.006)	0.447*** (0.006)	0.447*** (0.006)	0.448*** (0.006)
Log(GDP per capita)	0.788*** (0.037)	0.795*** (0.037)	0.776*** (0.034)	0.804*** (0.034)
Index of trade freedom	0.012*** (0.002)	0.012*** (0.002)	0.012*** (0.002)	0.014*** (0.002)
Number of observations	190,862	190,862	190,862	190,862
R-squared	0.048	0.048	0.045	0.048
Number of subsidiaries	38,314	38,314	38,314	38,314

Notes: The dependent variable in these models is the natural logarithm of earnings before interest and taxes (EBIT). Heteroscedasticity robust standard errors adjusted for MNE clusters are reported in parentheses. *, **, *** indicates statistical significance at the 10-percent, 5-percent, and 1-percent levels. The unit of observation is active subsidiaries of MNEs by year. All specifications include affiliate-level fixed effects. Each specification also includes 130 industry-year dummy variables (NACE Rev.1 1-digit level).

Table 7. Instrumental variable estimates of the enforcement model of reported profits

Variable	Sample		
	Full	CIT-rate differential is positive $(t_G - t_H) > 0$	CIT-rate differential is negative $(t_G - t_H) < 0$
CIT-rate differential $(t_G - t_H)$	-3.540***	-4.741*	-4.438*
	(1.244)	(1.172)	(1.809)
Existence of transfer-pricing rules in the subsidiary's host country (ETPR-SHC)	-0.001	-0.081***	0.008
	(0.020)	(0.031)	(0.036)
ETPR-SHC×$(t_G - t_H)$	0.477**	1.516*	0.392
	(0.189)	(0.900)	(0.336)
Existence of transfer-pricing rules in the ultimate owner's host country (ETPR-UHC)	-0.026	-0.161	0.092
	(0.019)	(0.214)	(0.078)
ETPR-UHC×$(t_G - t_H)$	2.254**	3.093	3.397**
	(0.928)	(4.311)	(1.600)
Log(value of fixed assets)	0.045***	0.042***	0.044***
	(0.003)	(0.005)	(0.004)
Log(labor costs)	0.448***	0.433***	0.462***
	(0.006)	(0.010)	(0.008)
Log(GDP per capita)	0.804***	0.733***	0.857***
	(0.034)	(0.065)	(0.043)
Index of trade freedom	0.0138***	0.0171***	0.0120***
	(0.002)	(0.003)	(0.003)
Number of observations	190,862	80,702	107,730
R-squared	0.048	0.041	0.053
Number of affiliates	38,314	17,137	22,475

Notes: The dependent variable in these models is the natural logarithm of earnings before interest and taxes (EBIT). Heteroscedasticity robust standard errors adjusted for MNE clusters are reported in parentheses. *, **, *** indicates statistical significance at the 10-percent, 5-percent, and 1-percent levels. The unit of observation is active subsidiaries of MNEs by year. All specifications include affiliate-level fixed effects. Each specification also includes 130 industry-year dummy variables (NACE Rev.1 1-digit level).

Table 8. Robustness of the main results to the inclusion of a political stability index and to an alternative definition of enforcement

Variable	Includes an index of political stability			Alternative definition of enforcement		
	Sample			Sample		
	Full	$(t_G - t_H) > 0$	$(t_G - t_H) < 0$	Full	$(t_G - t_H) > 0$	$(t_G - t_H) < 0$
CIT-rate differential $(t_G - t_H)$	-3.518*** (1.245)	-6.217* (4.920)	-4.049** (1.806)	-2.977*** (1.006)	-2.709 (5.297)	-2.980** (1.260)
Enforcement by subsidiary's host county (E-SHC)	-0.0111 (0.0209)	-0.0921*** (0.0303)	-0.00869 (0.0363)	0.006 (0.023)	-0.043 (0.052)	0.007 (0.035)
E-SHC×$(t_G - t_H)$	0.393** (0.192)	1.637* (0.881)	0.266 (0.337)	0.661*** (0.233)	0.682* (0.253)	0.464 (0.338)
Enforcement by ultimate owner's host county (E-UHC)	-0.0236 (0.0188)	-0.219 (0.205)	0.0818 (0.0782)	0.044** (0.018)	0.113 (0.168)	0.024 (0.064)
E-UHC×$(t_G - t_H)$	2.237** (0.929)	4.290 (4.107)	3.087* (1.596)	1.715** (0.679)	1.853 (2.841)	2.272* (1.214)
Log(value of fixed assets)	0.045*** (0.00301)	0.042*** (0.00499)	0.044*** (0.004)	0.045*** (0.003)	0.044*** (0.005)	0.044*** (0.004)
Log(labor costs)	0.450*** (0.006)	0.433*** (0.010)	0.462*** (0.009)	0.448*** (0.006)	0.428*** (0.011)	0.463*** (0.008)
Log(GDP per capita)	0.447*** (0.00613)	0.433*** (0.00959)	0.844*** (0.0436)	0.794*** (0.035)	0.770*** (0.068)	0.849*** (0.044)
Index of trade freedom	0.013*** (0.002)	0.015*** (0.003)	0.0109*** (0.003)	0.015*** (0.002)	0.01 (0.003)	0.012*** (0.003)
Political stability index	0.0719*** (0.0195)	0.0779** (0.0308)	0.0827*** (0.0263)	-	-	-
Number of observations	190,862	80,702	107,730	190,862	80,702	107,730
R-squared	0.048	0.041	0.053	0.048	0.041	0.053
Number of affiliates	38,314	17,137	22,475	38,314	17,137	22,475

Notes: The dependent variable in these models is the natural logarithm of earnings before interest and taxes (EBIT). The estimates of reported in right-hand-side panel of the table uses an alternative definition the dummy variable for a country's enforcement of transfer-pricing rules. The dummy variable = 1.0 when the constructed categorical variable is greater than or equal to 5 (rather than 4) and zero otherwise. Heteroscedasticity robust standard errors adjusted for MNE clusters are reported in parentheses. *, **, *** indicates statistical significance at the 10-percent, 5-percent, and 1-percent levels. The unit of observation is active subsidiaries of MNEs by year. All specifications include affiliate-level fixed effects. Each specification also includes 130 industry-year dummy variables (NACE Rev.1 1-digit level).

Table 9. Policy simulation of the effect of the United States decreasing its CIT rate by 20 percent

Country	Based on the first-generation model		Based on the enforcement model	
	Percent change in tax revenue by country	Percent change in the sum of affiliate's reported profits by country	Percent change in tax revenue by country	Percent change in the sum of affiliate's reported profits by country
Austria	-4.48	-4.48	-2.53	-2.53
Belgium	-5.79	-5.79	-4.34	-4.34
Britain	-8.33	-8.33	-6.25	-6.25
Czech	-3.22	-3.22	-2.41	-2.41
Denmark	-5.40	-5.40	-2.67	-2.67
Estonia	-1.76	-1.76	-1.32	-1.32
Finland	-5.13	-5.13	-3.85	-3.85
France	-4.88	-4.88	-3.66	-3.66
Germany	-5.29	-5.29	-2.62	-2.62
Iceland	-4.32	-4.32	-3.24	-3.24
Ireland	-9.03	-9.03	-6.78	-6.78
Italy	-5.03	-5.03	-3.77	-3.77
Japan	-6.27	-6.27	-4.71	-4.71
Netherlands	-5.91	-5.91	-4.43	-4.43
New Zealand	-8.91	-8.91	-6.69	-6.69
Norway	-3.22	-3.22	-2.42	-2.42
Portugal	-3.09	-3.09	-1.53	-1.53
Slovakia	-2.31	-2.31	-1.63	-1.64
Slovenia	-2.48	-2.48	-1.86	-1.86
South Korea	-5.56	-5.56	-3.93	-3.93
Spain	-4.65	-4.65	-2.47	-2.47
Sweden	-4.35	-4.35	-3.27	-3.27
United States	**-28.36**	**43.29**	**-35.55**	**28.91**

Note: The percent change in tax revenue is percent difference in proposed-law tax revenue with respect to current-law tax revenue by country. The percent change in affiliate's reported profits is the percent change in the difference in the sum of affiliates' reported profits revenue under proposed law with respect to affiliates' reported profits under current law.