Shifty profits in shifty places

A study of the sensitivity of profit shifting to changes in the corporate tax rate by looking at FDI income inside and outside of tax havens in a gravity model.

A seminar paper in *Public Economics* at Copenhagen University in May 2017 by

R. Bjørn

Abstract.

This paper studies whether the presence of *profit shifting* can be expected to intensify or dampen *international tax competition.* The analysis is based on a yearly panel dataset of OECD countries, who report the net income generated on their foreign direct investments in individual partner countries. I find evidence for the main premise of tax competition using OLS on a gravity model, as profits realized abroad decrease as the corporate tax rate falls at home, indicating countries may attract investment by lowering rates. I then argue that we may compare the responsiveness of real and shifted profits by comparing tax havens and non-havens, because profits in the former will to a large degree be shifted profits, which the evidence supports. I find that profits in havens are less sensitive to tax rates, and might not respond to altered tax rates at all. However, the results are uncertain. I provide a number of robustness checks for my findings. I use PPML estimation and IHS transformation to include zeroes and negatives, and i expand the models with data on partner tax rates, haven size, types of income and CFC legislation. Even so, the validity of the analysis remains threatened by endogeneity, and could be followed by IV estimation. In the study at hand, the evidence suggests shifted profits are insensitive to corporate tax rates and thus should not affect international tax competition.

Contents

1. Introduction: Do shifted profits respond to corporate tax rates?

This paper will seek to convince you of two things, one of them perhaps new. First, the race to the bottom of corporate income taxes rates in recent years is driven by real economic forces, where firms move capital around in response to tax rates. Second, the fact that firms also use *profit shifting* to avoid taxes do not necessarily intensify these competition effects, as shifted profits in tax havens may be insensitive to changes in tax rates.

These are questions relevant to the real world. President Trump has suggested slashing the US corporate income tax (CIT) rate from 35% to 15% (The Atlantic 2017). Our results suggest he may bring real investment back home, but will not dissuade the use of tax havens. The considered change is massive, but I expect results will still hold as rates remain above havens.

The paper analyses a panel of OECD countries, who report the net income of their *foreign direct investments* (FDI) in partner countries. I argue that excess profits located in tax havens which cannot be accounted for by basic economic forces are likely shifted profits. I then compare the sensitivity of profits to tax rates in havens and non-havens respectively using a gravity model. The research question and design are described in section 2, resulting in four hypotheses.

The analysis estimates seven regression models. Section 3 estimates the basic gravity-based model. This is based on a log-transformation of profits, so one could fear that the exclusion of non-positive profits invalidates results. However, robustness checks using Poisson PML and inverse hyperbolic sine transformation do not suggest this is the case.

The second analytical section therefore continue to use the log-based model. I find further support for my research design, as even accounting for the tax rates of partner countries, profits in tax havens remain well above what is expected based on economic forces. Finally, I find that isolation of shifted profits may be done even more precisely if one accounts for the size of havens, CFC rules and possibly the type of FDI income, but that results continue to hold.

Section 5 lists a few of the identification concerns one could raise. Mainly, we might have endogeneity because of causality loops, measurement error or omitted variables, where the study only really tries to answer the last one. There are also some issues regarding the reliability of data, and why some observations are missing, which are not reassuring.

Finally, the conclusion provides a nice table which summarizes all seven regressions, and whether they support each individual hypothesis. Thus, you need not take notes (unless you'd like to factcheck the table). I argue that evidence is all in all supportive of the statements I began this section with, although there is uncertainty. Let's see if you agree.

2. Set-up: Honestly, we know where to find shifty firms.

This section describes the research design. First, I motivate the research question, and then translate this into a proper design (hopefully). Finally, I (briefly) describe the data used.

2.1. Question: Does profit shifting affect tax competition?

Source-based corporate income taxes (CIT) are challenged by at least two aspects of international taxation. First, by the very nature of being *source*-based, they drive international tax competition, where countries compete for mobile capital, driving down tax rates. Theoretical models support that this results in rates below optimal levels[1], because coordination on higher tax rates could achieve similar investment rates, since capital cannot flee the entire world.

The second challenge to source-based taxation is the quite challenging definition of where profits are generated. Theoretically, this is solved by *arm's length pricing* where all national entities computes profits separately, pricing internal flows at market prices. However, two issues arise. First, bilateral tax treaties have created quite a few loopholes for diligent multinational companies. Second, it is often difficult to determine the proper prices of goods and particularly services, and firms may simply (and illegally) misstate transfer prices (Zucman 2014).

$$\Pi_i^{\text{Reported}} = \Pi_i^{\text{Real}} + \Pi_i^{\text{Shifted}} \tag{1}$$

The second challenge in short is the presence of incentives and possibilities for *profit shifting*, shown in equation 1. Countries tax reported profits, but firms may shuffle some of these from high tax jurisdictions to low. Simple models of tax competition assume the second term to be zero, so countries face a clear trade-off: Lowering CIT rates mechanically lowers revenue, but may attract capital and increase the tax base. Equilibrium occurs where the effects balance out, so no country has an incentive to lower rates further (Keen and Konrad 2013, p. 267)

How does profit shifting affect this competition? I first propose one key prediction: Shifting implies *tax havens*. Consider yourself a small country, possibly an island. For millennia, you have been taxing your meagre industry in isolation. Now, you discover a vast number of foreign firms eager to shift profits into low-tax domains. Given that your domestic tax base is small enough that you may earn *more* revenue this way, shifting interferes with the trade-off above.

However, this need not be the case for countries with larger real economies. They will likely earn greater revenue by taxing that economy at a higher rate than they could attract by matching the haven rate, which will be much lower (as havens also compete with each other). Thus, the game of competition can be divided into two sections: Havens and 'real' economies.

How is competition between the 'real' economies affected by the presence of havens and shifted profits? That depends on how shifted profits respond to changes in the tax rates at their disposal. If, for instance, shifting was costless but capped at some level, it would not affect competition at all. Realistically, shifting carries cost. If these are variable, shifted profits should respond to small tax changes. However, if they are (partly) fixed, small changes will not necessarily affect whether shifting is optimal (Johannesen, Tørsløv, and Wier 2016). All in all, the semi-elasticity between shifted profits and the tax rate should be of interest.

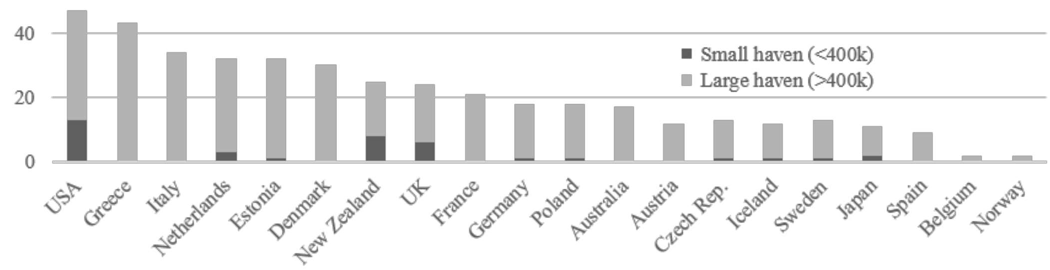
2.2. Design: Foreign direct investment income in a gravity model

How do we estimate this semi-elasticity?[2] I propose leveraging the haven prediction above. The basic reason for becoming a tax haven is to attract large shifted profits to be taxed/fined at a low rate, and the main incentive for doing so is because your own corporate tax base is small. Figure 2.1 provides some evidence of this. The average country included there realizes 20.5% of the income of their foreign direct investments in tax havens. Comparably, haven share of world GDP was 2.7%. This supports that shifted profits form a larger share of tax havens.

[1] See, e.g., the simple ZMW framework summarized in Keen and Konrad (2013).

[2] For an excellent, if slightly older, review of the empirical literature on this, see Devereux and Maffini (2007).

Figure 2.1: *Share of FDI income realized in tax havens in 2015.*



Notes: This figure excludes Ireland (90 pct. in havens) and Hungary (77 pct.) as outliers, Korea (150 pct.) due to errors in the total, Latvia (-64) and Slovenia (- 38) as negatives and Canada (0 pct.) as missing allocation. They are featured in the analysis.

This leads us to my particular design. I compare the sensitivity of profits to corporate tax rates, based on whether profits are located in havens or non-havens. One could discuss whether we can ascribe the entire difference to shifted profits, but if there are clear differences, I argue this is suggestive of the nature of shifted profits.

Havens do not typically report profits with the country of origin nicely marked. However, other countries are more transparent. Official statistics tracks the affiliates multinational companies work through as *foreign direct investment* (FDI), where resident entities in economy i establish a lasting interest in enterprises located in economy j (OECD 2008, p. 22). Since there are few havens among the reporting countries we must work with *outwards* FDI, where a country tracks the investments of nationally based companies. Select OECD countries provide the *income* generated from FDI allocated to the (first non-SPE) partner country (ibid., p. 31). Profits shifted from the reporting country to another should show up in this flow.

This flow also tracks profits from real investments in other countries. There is evidence that tax havens also produce actual services (e.g. Hebous and Johannesen (2016)) which could attract investment. Thus, we cannot simply assume that all FDI activity in havens is related to shifting, but need to account for the expected economic activity. I use the simple but successful gravity model in (2). This model mimics Newton's law of gravity, letting economic flows be proportional to the economic 'mass' (GDP) of countries, and inversely proportional to the distance between them, and has long been a workhorse model of international trade (Shepherd 2012). It has also been used for portfolio holdings (Zucman 2013) and indeed FDI flows (Blonigen 2005). Therefore, it should account well for observed (real) profits.

$$\begin{aligned} \ln \mathrm{FDIInc}_{ijt} &= \alpha_0 + \alpha_1 \ln \mathrm{GDP}_{it} + \alpha_2 \ln \mathrm{GDP}_{jt} + \alpha_3 \ln \mathrm{Distance}_{ij} + \beta D_{ij} \\ &+ \gamma_1 \mathrm{CIT_{it}} + \gamma_2 \mathrm{Haven}_j + \gamma_3 \mathrm{Haven}_j \cdot \mathrm{CIT_{it}} + \epsilon_{ijt} \end{aligned} \tag{2}$$

The basic gravity model is featured in the first line in (2). Our dependent variable is the profits realized by firms resident in reporting country i in affiliated enterprises in the partner country j in the year t. One would expect this to increase in both GDP terms, and to decrease in the two later terms, which serve as proxies for the costs of investment. Distance[3] the is the most notable proxy, but D_{ij} contains other pairwise cost specifications. I include four dummies here as specified in table 2.1, a somewhat basic set-up (Shepherd 2012, p. 16).

That concludes the basic set-up. The remainder of this section translates this into specific

[3]I use weighted distances from the CEPII GeoDist, as specified in Mayer and Zignago (2011).

expectations on the model. The first variable of real interest is γ_1, which specifies how profit in (non-haven) j by reporting country i changes when corporate tax rates in i change[4]. For non-havens, I expect the predictions of tax competition to hold. That is, I assume that if domestic investments become relatively more attractive ($CIT_{it} \downarrow$), then domestic firms should invest more at home, and thus realize fewer profits abroad.

$$\textbf{Hypothesis I}: \qquad H_0 : \gamma_1 \leq 0, \qquad H_A : \gamma_1 > 0$$

Had there been no profit shifting, the model would be complete then. Remaining parameters thus relate to shifting. First, I argue that havens have a larger share of shifted profits. This is decently easy to test, since the model predicts an expected level of profits based on economic forces. I check whether a level effect exists, increasing profits for havens.

$$\textbf{Hypothesis II}: \qquad H_0 : \gamma_2 \leq 0, \qquad H_A : \gamma_2 > 0$$

We arrive then at the parameter of main interest. If the sensitivity of real and shifted profits are different, then the sensitivity of profits in havens to CIT_{it} will be different. This is accounted for by γ_3, which is attached to an interaction term modifying the effect of CIT_{it} for havens. I expect a lower sensitivity for shifted profits.

$$\textbf{Hypothesis III}: \qquad H_0 : \gamma_3 \geq 0, \qquad H_3 : \gamma_3 < 0$$

One may take this even further. It may be that shifted profits are completely impervious to changes in the tax rate (e.g. if costs of shifting are fixed amd already paid for most firms). I may therefore test whether, considering only havens, there is evidence of a relationship at all.

$$\textbf{Hypothesis IV}: \qquad H_0 : \gamma_1 + \gamma_3 = 0, \qquad H_3 : \gamma_1 + \gamma_3 \neq 0$$

2.3. Data: 27×212 country pairs per year (ideally)

Don't skip ahead! I promise to move swiftly through the mandatorily boring data section, and handle most data concerns as they become relevant for the analysis. For now, I just want to arm you with enough information to read the first analytical part. The paper analyses data reported by 27 (of 35) OECD countries on up to 212 (of 235) partner countries (see table 8.1 for which countries leave the dataset and why). Of these 212 countries, I have identified 48 tax havens by combining lists compiled by previous authors (see table 8.2).

Data is naturally a panel, since we observe country statistics reported yearly. It is unfortunately not the longest panel and quite unbalanced. Most countries report FDI income only for 2013-2015, although a few report for longer periods (see table 8.3 for individual lengths). This adds uncertainty to my results, and it would be interesting to repeat the analysis in a few years.

The FDI data is enriched with eight other datasets providing necessary variables for the various models estimated. Data sources are nicely summarized in appendix 8.1, including a lovely figure showing all the featured datasets. Appendix 8.2 and 8.3 further expands on the

[4] You may squint at this formula, and look critically for a tax rate for j. Indeed, firms are interested in tax differentials. However, data on tax rates for partner countries is sketchy at best, especially for havens. I discuss this and include them as a robustness check in section 4.1.

Table 2.1: *Codebook*

Gravity variables			Other variables		
Variable	**Description**	**Values**	**Variable**	**Description**	**Values**
GDP_{it}	Reporting country	Current USD (mio.)	Haven	Partner is a haven	Dummy
GDP_{jt}	Partner country	Current USD (mio.)	CIT_{it}	Statutory tax rate	$\{13, 38\}$
Distance (weighted)	Between countries	Kilometers.	Small Haven	Population < 0.4m	Dummy
Common border	Share land border	Dummy	Large Haven	Population > 0.4m	Dummy
Common language	Share language	Dummy	DCIT_{ijt}	$\text{CIT}_{it} - \text{CIT}_{jt}$	$\{-43, 38\}$
Colony	Former colony	Dummy	CFC_i	Has CFC legislation	Dummy
Common colony	Colonized by same	Dummy			

data process, and all datasets and code appendices are provided via GitHub.

The final dataset has 23.778 pairwise, yearly observations and 54 variables. However, this includes missing values, zeroes and negative profits, as will be discussed intermittently (see section 3.2, 3.3 and 5). Table 2.1 provides a list of the used variables. Descriptive statistics can be seen in table 8.5, if the reader should start to worry on the data. If not, let's analyse!

3. Analysis I: Wait, what happens in tax havens?

The first analytical section estimates equation (2) directly. The first subsection estimates it by OLS (and FE). The next two incorporate zeroes and negative values into the estimation.

3.1. Estimation: A first shot from the hips

Let's get right down to it - Model (1) in table 3.1 estimates equation 2 by (pooled) OLS[5]. Identification rests on the assumption that the error term is uncorrelated with the regressors. There are three main reasons to fear that this might fail. Endogeneity from measurement error or simultaneous causality are discussed in section 5, but not explicitly handled. The third cause is that omitted (relevant) variables may be correlated with the regressors, which is quite likely.

I use the fact that data is structured in a panel, rather than search for all such control values. Panel data allows us to hold dimensions of data fixed, and thus consider subsets of variation at a time. If the source of the bias is fixed across the same dimension, the bias evaporates. Consider, as an example, that Danes might have a preference for higher tax rates, and for investing mainly at home. This preference could cause endogeneity. Yet if we add a dummy ζ_i allowing a level difference for each reporting country, that should account for this effect.

The next four models adds an increasing number of dummies, limiting the variation we consider. First we add a time dummy δ_t[6], which accounts for overall economic conditions although this does not alter estimates or R^2 much, possibly because 2013-2015 saw little economic change. Next, we add the aforementioned reporter-specific dummy ζ_i, which implies we only consider variation across time and partner countries.Although R^2 increases, we see few changes in parameters. The next model restricts this model further by adding a partner dummy η_j. Although we control for level effects of either country, we still compare parameters across pairs of countries.

Fixed effects. The final model shuts this down, shifting into fixed effects estimation (FE) by replacing ζ_i and η_j with country-specific dummies θ_{ij} (Wooldridge 2009, p. 479)[7]. This

[5] I observe 5.930 positive profit values - see table 8.1 for why a few of these drop out

[6] One might allow time effects for individual countries (or pairs), but this would not just vastly increase the number of parameters to be estimated, but indeed be quite hard to isolate from the effects of changes to tax rates.

[7] R^2 appears very high, but this is a given for FE estimation (Wooldridge 2009, p. 471). Just adding θ_{ij} and

Table 3.1: *Main regression*

	(1) Eq. (2)	(2) $+\delta_t$	(3) $+\zeta_i$	(4) $+\eta_j$	(5) $+\theta_{ij}$ (FE)
$\ln \text{GDP}_{it}$	0.976***	0.955***	1.435**	1.409***	0.567**
	(0.020)	(0.021)	(0.561)	(0.493)	(0.243)
$\ln \text{GDP}_{jt}$	0.837***	0.837***	0.820***	0.315*	0.180
	(0.014)	(0.014)	(0.014)	(0.166)	(0.156)
ln Distance (w)	-0.792***	-0.782***	-0.840***	-1.091***	
	(0.031)	(0.031)	(0.028)	(0.051)	
Haven (γ_2)	2.598***	2.601***	2.568***		
	(0.327)	(0.327)	(0.316)		
CIT_{it} (γ_1)	0.033***	0.035***	0.060***	0.043***	0.023***
	(0.004)	(0.004)	(0.014)	(0.012)	(0.008)
Haven$\times\text{CIT}_{it}$ (γ_3)	-0.030**	-0.030**	-0.029**	-0.014	-0.022
	(0.012)	(0.012)	(0.012)	(0.011)	(0.019)
Common border	0.212*	0.183	0.377***	0.176	
	(0.110)	(0.111)	(0.110)	(0.111)	
Common language	0.789***	0.806***	0.671***	0.587***	
	(0.100)	(0.100)	(0.100)	(0.098)	
Colony	1.236***	1.248***	0.968***	1.006***	
	(0.113)	(0.113)	(0.099)	(0.105)	
Common colony	2.587***	2.557***	3.157***	3.529***	
	(0.319)	(0.317)	(0.385)	(0.406)	
Constant	-14.666***	-14.559***	-21.183***	-12.463	-6.993*
	(0.366)	(0.371)	(7.866)	(7.653)	(3.735)
Observations	5,850	5,850	5,850	5,850	5,850
R^2	0.540	0.542	0.638	0.735	0.949
$\gamma_1 + \gamma_3 = 0$ (p-value)	0.797	0.689	0.0810	0.0558	0.955

Dummies are added as specified above. FE drops $\zeta_i + \eta_j$. Robust standard errors in parantheses.
*** p<0.01, ** p<0.05, * p<0.1

implies we only use time variation *within* each country pair to estimate parameters. Whilst this accounts for any bias caused by time-constant effects for a given pair, it also massively restricts the variation considered by the model. Variation within pairs is theoretically appealing (we are interested in the effects of changes to tax rates), but it is unclear it leaves enough variation to precisely estimate parameters, due to limited amount of changes to the tax rates which have occurred in the panel period. Thus, we continue to also consider the models exploiting cross-sectional variation.

There is ample evidence that profits realized in tax havens exceed what we would expect based solely on the economic forces modelled in the gravity equation ($\hat{\gamma}_2 > 0$). Indeed, by the usual approximation, we expect profits to be 257 pct. higher in havens than in non-havens[8].

The expectations of tax competition also seem to hold, at least for non-havens ($\hat{\gamma}_1 > 0$), indicating that as taxes fall at home, firms tend to realize fewer profits abroad. However, as expected, this effect is lower for havens in all models, although insignificantly so when we control for partner country. Even so, in no model can we reject that there is no effect for havens on a 5 pct. level[9]! Whilst the insignificance for FE shows uncertainty, the results are consistent with a lower sensitivity for shifted profits, if these indeed form the preponderance of haven profits.

no other variables yield $R^2 = 0.948$.

[8]The exact percentage difference between predictions over Haven is $100(\exp(\hat{\gamma}_2) - 1)$ and indicates profits are *twelve times higher* in havens. However, this is sensitive to choice of reference group (Wooldridge 2009, p. 225)

[9]The bottom tests this through an F-test implemented on the hypothesis $\gamma_1 + \gamma_3 = 0$.

Clustered standard errors. The above models use robust standard errors for testing, valid in the presence of arbitrary heteroscedasticity. An added measure would be to use clustered standard errors, allowing for correlation of error terms within country pairs (Angrist and Pischke 2009, p. 312). This is often used in the gravity literature by distance, which identifies country-pairs from either side (Shepherd 2012). Table 3.1 is repeated in table 8.6 with clustered standard errors. This causes the interaction term to become insignificant in all models, which further shows the uncertainty of $\hat{\gamma}_3$. However, the F test for an effect for havens remains insignificant.

3.2. Robustness: Poisson estimation (PPML) – From hero to zero

Our model encounters a classical gravity nemesis: zeroes in the dataset. The problem is actually exacerbated compared to trade since we also observe negative profits! The horror! Because the gravity model is log-based these observations drop out of the estimation. The tragedy! I observe 11.961 zeroes of the FDI income variable and 1.361 negative values. The inhumanity!

Missing values. The acute reader may have noticed that the provided numbers do not add up - indeed, we also observe 4.526 missing values. Some of these are excluded due to confidentiality concerns, and may therefore be close to zero, and could be replaced as such.

However, a simple check suggest this is not so wise. Countries routinely report a large share of FDI income as 'unallocated' (Canada, for instance, never allocates more than 52 pct). Furthermore, even when countries do not report profits as unallocated, a discrepancy between their reported overall FDI income and the income they assign to individual countries can sometimes be observed (table 8.3 report both these shares for each country in each year). This suggest that, for some countries, statistics do not cover all partners, and 'zeroes' need not be actual zeroes. Even though many countries provide the full allocation, we do not reassign missing values.

Returning to the task at hand, Poisson pseudo-maximum likelihood estimation (PPML) was suggested as an alternative allowing zeroes by Silva and Tenreyro (2006). The formal requirement for consistency is $E[y_i|x] = \exp(x_i\beta)$, which does not imply that data need be Poisson distributed, or even integers (it is usually used for count models). The assumption actually just implies that the gravity model include the correct set of explanatory variables effects (Shepherd 2012, p. 52). The model allows fixed effects (apparently an oddity in non-linear models), and parameters are interpreted as (semi)elasticities, just as in OLS.

Table 3.2 estimates the model by PPML[10] for both the same sample as before, and extended with zeroes. At first glance, the new estimates do not spell well for my hypotheses. The haven and CIT effects are both much lower, and becomes insignificant as dummies are added. The interaction effect is significant, but has the wrong sign sign[11].

Despite this, there is not necessarily reason to panic. R^2 is far lower in this new estimation, where we might actually expect it to increase if PPML captured significant features of the data (ibid., p. 53). Furthermore, the number of observations increase by less than a thousand for fixed effects, suggesting that most zeroes remain zeroes in all periods (and thus do not seem to matter for (observed) profit shifting). Finally, Poisson estimates are quite similar in both samples, which suggest differences occur because of the estimation technique, not because we incorporate zeroes. Let's continue looking for a solution, shall we?

[10] I use the package *ppml* developed by Silva and Tenreyro (2011). Fixed effects is implemented by *xtpoisson*

[11] Replacing the missing values with zeroes does not change the picture substantially.

Table 3.2: *Poisson pseudo-maximum likelihood estimator*

	OLS			Poisson PML, FDI Income > 0			Poisson PML, FDI Incomen ≥ 0		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Eq. (2)	$+\delta_t + \zeta_i$	FE	Eq. (2)	$+\delta_t + \zeta_i$	FE	Eq. (2)	$+\delta_t + \zeta_i$	FE
$\ln \mathrm{GDP}_{it}$	0.976***	1.435**	0.567**	0.860***	0.581	0.443*	0.933***	0.538	0.444*
	(0.020)	(0.561)	(0.243)	(0.041)	(0.853)	(0.235)	(0.039)	(0.855)	(0.235)
$\ln \mathrm{GDP}_{jt}$	0.837***	0.820***	0.180	0.617***	0.629***	0.923***	0.685***	0.687***	0.924***
	(0.014)	(0.014)	(0.156)	(0.023)	(0.022)	(0.163)	(0.021)	(0.020)	(0.163)
ln Distance (w)	-0.792***	-0.840***		-0.536***	-0.567***		-0.608***	-0.609***	
	(0.031)	(0.028)		(0.043)	(0.041)		(0.042)	(0.042)	
Haven (γ_2)	2.598***	2.568***		0.551*	0.395		0.602*	0.416	
	(0.327)	(0.316)		(0.328)	(0.333)		(0.334)	(0.340)	
CIT_{it} (γ_1)	0.033***	0.060***	0.023***	0.010**	-0.009	0.001	0.008*	-0.008	0.001
	(0.004)	(0.014)	(0.008)	(0.005)	(0.018)	(0.010)	(0.005)	(0.018)	(0.010)
Haven×CIT_{it} (γ_3)	-0.030**	-0.029**	-0.022	0.032***	0.038***	0.004	0.033***	0.040***	0.004
	(0.012)	(0.012)	(0.019)	(0.012)	(0.012)	(0.011)	(0.012)	(0.012)	(0.011)
Observations	5,850	5,850	5,850	5,850	5,850	5,475	15,764	15,764	6,327
R^2	0.540	0.638	0.949	0.314	0.393		0.335	0.412	

All models include D_{ij} and a constant term. Dummies are added as specified above. Robust standard errors in parantheses.
*** p<0.01, ** p<0.05, * p<0.1, + p<0.15

3.3. Robustness: Inverse hyperbolic sine transformation – Its fine to be define(d).

There is an alternative: *inverse hyperbolic sine* (IHS) transformation. This also allows negative profits, which may by itself be enough to make it more fitting than PPML. It is however less common in the gravity literature, even though it has apparently been around since 1949 (Burbidge, Magee, and Robb 1988).The transformation[12] yields $\sinh^{-1}(y_i) = \ln(y_i + (y_i^2 + 1)^{\frac{1}{2}})$, which is zero at zero. This is approximately equal to $\ln(2) + \ln(y_i)$ except for very small values of y_i, so we may interpret as in the logged models. That's just easy. Table 3.3 estimates.

Notice first that the IHS transformations performs quite similar to the log when used on the same sample. Coefficients are generally somewhat lower, both on the gravity variables, haven and CIT, but far from enough to alter significance. Indeed, all parameters remain significant. Furthermore, R^2 is hardly altered, indicating a similar fit. This implies that this transformation fits my analysis better than PPML did.

This finally allows us to consider the effects of expanding the sample, which we almost triple (by adding mainly zeroes, but also 1.344 negative profits). In an odd twist, the effect of GDP_{it} is negative under FE. Consider this a fluke. Of more interest is the fact that $\hat{\gamma}_1$ and $\hat{\gamma}_3$ falter in the fixed effects estimation, yielding the opposite signs of what we expect. This implies that profits in havens are sensitive to tax changes, but those outside are not. These results are however not significant, and we still cannot reject that there is no effect in havens[13].

Incorporating zeroes affects (only) coefficients in the FE estimation, indicating that OLS does seem to capture mainly the same features. The FE estimation appears to have some issues, as there is also a negative effect of GDP_{it}. It could be that the model is simply not well suited for explaining zeroes in profits (R^2 is markedly lower than for OLS), or that the problems of

[12] I use the simplest case of IHS. For more parameters in the transformation, see Burbidge, Magee, and Robb (1988) and MacKinnon and Magee (1990).

[13] Replacing missing values with zeroes further complicates the picture as $\hat{\gamma}_1$ becomes negative in all three models, with an insignificant (but negative) difference for havens). However, R^2 falls even further for all models.

Table 3.3: *Inverse hyperbolic sine transformation*

	Log			IHS, FDI Income > 0			IHS, FDI Income $\in \mathbb{R}$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Eq. (2)	$+\delta_t + \zeta_i$	FE	Eq. (2)	$+\delta_t + \zeta_i$	FE	Eq. (2)	$+\delta_t + \zeta_i$	FE
$\ln \mathrm{GDP}_{it}$	0.976***	1.435**	0.567**	0.878***	1.019**	0.354*	0.496***	-0.680**	-0.259+
	(0.020)	(0.561)	(0.243)	(0.017)	(0.519)	(0.205)	(0.012)	(0.290)	(0.169)
$\ln \mathrm{GDP}_{jt}$	0.837***	0.820***	0.180	0.776***	0.759***	0.335**	0.462***	0.452***	0.437***
	(0.014)	(0.014)	(0.156)	(0.012)	(0.012)	(0.132)	(0.009)	(0.009)	(0.151)
ln Distance (w)	-0.792***	-0.840***		-0.700***	-0.737***		-0.343***	-0.285***	
	(0.031)	(0.028)		(0.027)	(0.025)		(0.030)	(0.029)	
Haven (γ_2)	2.598***	2.568***		2.363***	2.343***		1.473***	1.452***	
	(0.327)	(0.316)		(0.293)	(0.284)		(0.176)	(0.177)	
CIT_{it} (γ_1)	0.033***	0.060***	0.023***	0.030***	0.043***	0.019**	0.019***	0.105***	-0.004
	(0.004)	(0.014)	(0.008)	(0.004)	(0.013)	(0.008)	(0.004)	(0.016)	(0.011)
Haven$\times\mathrm{CIT}_{it}$ (γ_3)	-0.030**	-0.029**	-0.022	-0.024**	-0.024**	-0.026+	-0.027***	-0.028***	0.022
	(0.012)	(0.012)	(0.019)	(0.011)	(0.011)	(0.017)	(0.008)	(0.008)	(0.021)
Observations	5,850	5,850	5,850	5,850	5,850	5,850	17,108	17,108	17,108
R^2	0.540	0.638	0.949	0.568	0.656	0.958	0.345	0.401	0.822
$\gamma_1 + \gamma_3 = 0$ (p-value)	0.797	0.0810	0.955	0.623	0.259	0.683	0.311	6.72e-06	0.377

All models include D_{ij} and a constant term. Dummies are added as specified above. Robust standard errors in parantheses.
*** p<0.01, ** p<0.05, * p<0.1, + p<0.15

zeroes outline above interfere. Given this, there are no large gains from incorporating zeroes, and we expand on the log-based model in the following section.

4. Analysis II: What else might we plausibly account for?

This section estimates alterations of equation 2. First, we perform another robustness check, but next we seek to highlight new features of the relationship between havens and tax rates.

4.1. Robustness: Putting the *j* back in tax rates

I mentioned earlier that what companies are really interested in when shifting profits is the difference in tax rates, $DCIT_{ijt} = CIT_{it} - CIT_{jt}$. If shifting was costless, this is income they would earn by the mere act of shifting. This section incorporates this into the model, simply replacing CIT_{it} with $DCIT_{ijt}$.

So, why didn't we do this at first? There are two main reasons. First, trustworthy data. CIT_{it} is provided by OECD – CIT_{jt} is provided by a private auditing firm. Coverage is also far from complete: Tax rates lack for 9.856 observations (in 101 partner territories).

Second, statutory tax rates are imprecise measure of the marginal taxes firms actually face. This problem is also present for CIT_{it}, but the rates in tax havens are particularly untrustworthy. The tax rate for Luxembourg for instance is 29.22%, but foreign profits are taxed at a far lower rate. However, the statutory rate for a number of tax havens is zero, so the data may be of use.

Table 4.1 estimates. I only lose 732 observations, indicating that most the partners with missing tax rates observe non-positive profits, or are missing on other parameters as well. It makes sense that some countries are systematically missing from international considerations, and that these tend to be places with little economic activity. This means the estimation may actually be quite good.

Table 4.1: *Tax differences*

	(1)	(2) $+\delta_t + \zeta_i$	(3) $+\theta_{ij}$
$\ln \text{GDP}_{it}$	1.059***	1.169**	0.429*
	(0.020)	(0.570)	(0.247)
$\ln \text{GDP}_{jt}$	0.841***	0.832***	0.385**
	(0.017)	(0.017)	(0.151)
$\ln$ Distance (w)	-0.745***	-0.807***	
	(0.033)	(0.030)	
Haven (γ_2)	1.833***	1.857***	
	(0.114)	(0.107)	
DCIT_{ijt} (γ_1)	0.012***	0.008**	0.009*
	(0.003)	(0.004)	(0.005)
Haven$\times\text{DCIT}_{ijt}$ (γ_3)	-0.011	-0.010	-0.022
	(0.008)	(0.007)	(0.016)
Observations	5,118	5,118	5,118
R^2	0.537	0.635	0.951
$\gamma_1 + \gamma_3 = 0$ (p)	0.859	0.830	0.398

All models include D_{ij} and intercept. FE drops ζ_i.
Robust standard errors in parantheses. *** p<0.01, ** p<0.05, * p<0.1

Parameters maintain signs, but their magnitude changes somewhat. The level effect of havens is lower, because we now account for the effect through their lower tax rate. Theoretically, it is unclear that there should even be a level effect when we directly account for the tax difference.

The effect of DCIT follows expectations. Similarly, $\hat{\gamma}_3$ has the expected negative sign, although it is insignificant. Notice that the expected effect of DCIT actually becomes negative for havens. Although the interaction term is insignificant, so is the F-test. Thus, results are hardly rosy for people who expect lower rates to bring shifted profits home.

4.2. Extension: Are all havens created equally?

Do we observe the same effect in all havens? Recall that identification of shifted profits rests on the assumption that they dwarf the real economy in the haven. Yet, some havens boost significant business of their own. The GDP of Ireland, a haven, was \$287bn in 2015, far higher than Iceland's \$16bn for instance. Clearly, Ireland also sports a large real economy. One caveat is that profits were mainly realized in the larger havens, as seen in figure 2.1.

I assume population reflect the size of the real economies (based on the seemingly reasonable assumption that economies are run by people), and divide havens into two groups: Large havens with more than 400 thousand people, and smaller havens with fewer. There are 34 smaller havens, and 14 larger ones (cf. table 8.2). These havens can be quite small: Guernsey hosts less than 70k people, but OECD countries realized an FDI income there of \$760m in 2015.

$$\begin{aligned} \ln \text{FDIInc}_{ijt} = \alpha_0 &+ \alpha_1 \ln \text{GDP}_{it} + \alpha_2 \ln \text{GDP}_{jt} + \alpha_3 \ln \text{Distance}_{ij} + \beta D_{ij} \\ &+ \gamma_1 \text{CIT}_{\text{it}} + \gamma_2^S \text{Haven}_j^{\text{Small}} + \gamma_2^L \text{Haven}_j^{\text{Large}} \\ &+ \gamma_3^S \text{Haven}_j^{\text{Small}} \cdot \text{CIT}_{\text{it}} + \gamma_3^L \text{Haven}_j^{\text{Large}} \cdot \text{CIT}_{\text{it}} + \epsilon_{ijt} \end{aligned} \tag{3}$$

Equation (3) replaces haven with new dummies, and is estimated in table 4.2. The size of havens clearly has an effect, since the models adds 330 pct. to the profits of small havens, and only 200 pct. to larger havens. This indicates a larger share of profits in larger havens are from real

Table 4.2: *Size of havens*

	(1) Eq. (3)	(2) $+\delta_t + \zeta_i$	(3) $+\theta_{ij}$ (FE)
Small Haven	3.754***	3.361***	
	(0.553)	(0.538)	
Large Haven	1.905***	2.066***	
	(0.387)	(0.382)	
CIT_{it} (γ_1)	0.033***	0.059***	0.023***
	(0.004)	(0.014)	(0.008)
Small Haven×CIT_{it}	-0.062***	-0.043*	-0.054
	(0.023)	(0.022)	(0.037)
Large Haven×CIT_{it}	-0.009	-0.017	-0.002
	(0.014)	(0.014)	(0.019)
$\gamma_1 + \gamma_3^S = 0$ (p-value)	0.196	0.519	0.391
$\gamma_1 + \gamma_3^L = 0$ (p-value)	0.0828	0.0258	0.254

All models include gravity variables and intercept. FE drops ζ_i
Robust standard errors in parantheses. *** p<0.01, ** p<0.05, * p<0.1

activities, and thus accounted for by the model.

Consider then our theoretical expectations here: We expect that shifted profits are less sensitive to tax rates, and that these form a larger share of the response in smaller havens. This is exactly what we observe: There is a large correction of the effect of CIT_{it} for smaller havens. There is hardly any effect for larger havens, which is not exactly what we would expect, but still fits the narrative somewhat (although it might fit other narratives as well).

4.3. Extension: Are all types of income created equally?

Until now we have considered total income generated on foreign assets. Such income may be of several types, and it turns out OECD actually distinguishes between these in their statistics. This allows us to divide income into three categories: Dividends, reinvested earnings and debt income. The first two collectively form income on equity, which tends to be the lion's share of FDI income. Table 4.3 estimates the original gravity equation separately for each type of income. Observations drop quite heavily, as not all countries report the subcategories.

A first observation might be that all types of income are realized in havens. Indeed, the level effect of haven is highly significant in all models. All profits welcome beneath sunny skies!

The effect of tax rates at home are especially strong for dividends. This could make theoretical sense, as dividends brought home from tax havens might be subject to some taxation (not necessarily the CIT). It could also be that tax reductions are expected by firms, so they withhold profits until taxes are lowered, and then pay them out as dividends. The effects of CIT_{it} also appear for the two other types of income, although uncertainly for reinvested earnings.

When interpreting γ_3, it pays to look at the test in the bottom. For dividends, even though $\hat{\gamma}_3$ is hardly changed, the increase in $\hat{\gamma}_2$ means we can now reject that there is no effect of CIT in tax havens on a 5 pct. level. This indicates that, for dividends at least, the flow of shifted profits is sensitive to changes in the tax rate. However, this is not the picture we see for reinvested earnings. Here, the effect for havens is significantly low, and indeed low enough that it becomes negative. This certainly does not indicate profits could be brought home by lowering taxes. This could indicate that when modelling profit shifting, one should consider the type of profits.

Table 4.3: *Types of FDI income*

	Dividends			Reinvested earnings			Debt income		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Eq. (2)	$+\delta_t+\zeta_i$	$+\theta_{ij}$	Eq. (2)	$+\delta_t+\zeta_i$	$+\theta_{ij}$	Eq. (2)	$+\delta_t+\zeta_i$	$+\theta_{ij}$
$\ln \text{GDP}_{it}$	1.024***	0.594	1.567***	0.981***	0.389	0.259	0.846***	2.688**	2.261***
	(0.027)	(0.919)	(0.546)	(0.025)	(0.710)	(0.397)	(0.033)	(1.246)	(0.673)
$\ln \text{GDP}_{jt}$	0.807***	0.756***	-0.071	0.711***	0.661***	0.419**	0.816***	0.683***	0.386**
	(0.020)	(0.019)	(0.205)	(0.019)	(0.018)	(0.191)	(0.025)	(0.024)	(0.194)
ln Distance (w)	-0.699***	-0.727***		-0.659***	-0.718***		-0.856***	-0.777***	
	(0.040)	(0.034)		(0.037)	(0.035)		(0.046)	(0.039)	
Haven (γ_2)	2.366***	2.421***		2.666***	2.629***		2.280***	1.275***	
	(0.378)	(0.369)		(0.393)	(0.361)		(0.524)	(0.474)	
CIT_{it} (γ_1)	0.056***	0.078***	0.058***	0.045***	0.007	-0.015	0.047***	0.125	0.094*
	(0.005)	(0.014)	(0.009)	(0.005)	(0.015)	(0.014)	(0.007)	(0.097)	(0.056)
Haven$\times\text{CIT}_{it}$ (γ_3)	-0.026*	-0.027*	-0.009	-0.038**	-0.038***	-0.055***	-0.034*	0.002	0.074
	(0.015)	(0.014)	(0.023)	(0.015)	(0.014)	(0.019)	(0.021)	(0.019)	(0.055)
Observations	3,652	3,652	3,652	3,444	3,444	3,444	2,785	2,785	2,785
R^2	0.492	0.626	0.913	0.562	0.625	0.938	0.421	0.592	0.940
$\gamma_1+\gamma_3=0$ (p)	0.0405	0.00983	0.0301	0.621	0.147	0.00152	0.529	0.195	0.0260

All models include D_{ij} and a constant term. Dummies are added as specified above. FE drops ζ_i
Robust standard errors in parantheses. *** p<0.01, ** p<0.05, * p<0.1, + p<0.15

4.4. Extension: Havens vs. CFC rules – The final showdown

The final expansion of the paper will consider legislation on *controlled foreign corporations* (CFCs). This is used by some countries to 'counter abusive deferral or profit-shifting by multinational groups' (Voget 2011, p. 1067), which is exactly what we study. The intent is that profits diverted to a CFC are still taxed at the CIT rate in the reporting country, effectively eliminating the incentive for profit shifting. I do not discuss how CFC rules work in practice or in particular countries, but simply check whether their inclusion affects the model. Table 8.4 provides a list of the 14 of our 27 reporting countries which had CFC rules in place in 2008. I interact haven and CIT in equation (2) with a dummy for this.

$$\begin{aligned}\ln \text{FDIInc}_{ijt} &= \alpha_0 + \alpha_1 \ln \text{GDP}_{it} + \alpha_2 \ln \text{GDP}_{jt} + \alpha_3 \ln \text{Distance}_{ij} + \beta D_{ij} \\ &\quad + \gamma_1 \text{CIT}_{\text{it}} + \gamma_2 \text{Haven}_j + \iota_1 \cdot \text{CFC}_i + \iota_2 \cdot \text{CFC}_i \times \text{Haven}_j \\ &\quad + \gamma_3 \text{Haven}_j \cdot \text{CIT}_{\text{it}} + \iota_3 \text{CFC}_i \cdot \text{CIT}_{\text{it}} + \iota_4 \text{CFC}_i \cdot \text{Haven}_j \cdot \text{CIT}_{\text{it}} + \epsilon_{ijt}\end{aligned} \tag{4}$$

As a way to get a grasp on this equation, consider what the effect of altering CIT_{it} is for various groups. γ_1 now captures the effect for non-havens without CFC rules. The third line provides interaction terms on this. $\gamma_1 + \iota_3$ is the effect for non-havens with CFC rules. $\gamma_1 + \gamma_3$ provides the effect for havens without CFC rules, and $\gamma_1 + \gamma_3 + \iota_3 + \iota_4$ captures havens with CFC rules. The second line allows level effects for the groups. Thus, the interesting parameters are allowed to vary across all combinations of CFC and haven. This is estimated in table 4.

CFC is quite obviously relevant. Consider that for reporting countries without CFC rules, we expect profits in havens to be 500% higher (γ_2), whilst for CFC reporters, we only expect an increase of 150 pct. ($\gamma_2 + \iota_2$). This suggest that CFC rules are indeed successful in preventing profits from flowing to tax havens, but not completely so.

Profits in tax havens for reporters without CFC rules exhibit the same picture as before:

Table 4.4: *Controlled foreign corporation (CFC) legislation.*

	(1) Eq. (4)	(2) $+\delta_t + \zeta_i$	(3) $+\theta_{ij}$
$\text{CFC}_i(\iota_1)$	3.024***		
	(0.310)		
Haven (γ_2)	5.059***	5.127***	
	(0.877)	(0.793)	
$\text{CFC}_i \times \text{Haven}_j(\iota_2)$	-3.553***	-3.714***	
	(0.934)	(0.857)	
CIT_{it} (γ_1)	0.140***	0.111	-0.029
	(0.012)	(0.127)	(0.075)
$\text{CFC}_i \times \text{CIT}_{it}(\iota_3)$	-0.129***	-0.060	0.054
	(0.012)	(0.129)	(0.076)
$\text{Haven}\times\text{CIT}_{it}$ (γ_3)	-0.115***	-0.119***	-0.013
	(0.036)	(0.033)	(0.105)
$\text{CFC}_i \times \text{Haven}_j \times \text{CIT}_{it}(\iota_4)$	0.119***	0.125***	-0.009
	(0.038)	(0.035)	(0.106)
$\gamma_1 + \gamma_3 = 0$ (p)	0.480	0.956	0.589
$\gamma_1 + \gamma_3 + \iota_3 + \iota_4 = 0$ (p)	0.223	0.00103	0.892

All models include gravity variables and intercept. FE drops ζ_i.
Robust standard errors in parantheses. *** p<0.01, ** p<0.05, * p<0.1

Sensitivity to tax changes is lower, indicating that shifted profits do not respond to marginal tax changes. I cannot reject that there is no effect on haven profits in any model. Similarly, for tax havens with CFC rules, we cannot reject that there is no effect of changes to CIT. In (2) where we actually reject the hypothesis of no effect of CIT on profits between CFC-countries and havens, the full estimate $\hat{\gamma}_1 + \hat{\gamma}_3 + \hat{\iota}_3 + \hat{\iota}_4 = -0.023$ is negative, reflecting the opposite sign of what competition should imply! Again there is little evidence that shifted profits are sensitive to changes in the tax rate, and CFC apparently does not influence this much.

5. Discussion: Identification concerns

It is understandable if you've lost track of what each model said about our hypotheses. I will summarize neatly in just a moment (honestly), but first we may confuse you somewhat further. As is always the case in econometrics, it is wise to be somewhat sceptical of whether we have indeed identified parameters. I have performed a number of robustness checks, but have not answered some more serious concerns.

Endogeneity. The ever-present spectre of endogeneity also looms large over the study. In short, if there is correlation between the error term and the regressors, OLS is inconsistent. This could occur in my study if some of the omitted (relevant) variables are correlated with the regressors, which is hardly impossible. It could also occur if the regressors are in part determined by the dependent variable. This is especially problematic in gravity models where policy variables (like CIT_{it}) are included (Shepherd 2012, p. 41). As I discussed earlier, competition implies that tax rates are set partly to attract investment (and thus profits), indicating a causality loop in my panel. Even the long-term decision to be a haven is affected by whether it attracts profits. Thus, there is good reason to fear endogeneity. It would be relevant to continue this study with an IV based estimation, checking whether the results still hold.

Reliability of data. Official statistics must generally be assumed to be quite reliable.

However, there are also clear problems. As shown in table 8.3, many countries do not report the full allocation of their FDI income, meaning a number of missing values (or zeroes) are erroneous. Even worse, for a number of countries the sum of their profits allocated to countries do not sum to the share of profits they claim to report (for instance, New Zealand reported total profits in 2015 as \$492m with \$4m unallocated, but the sum of their profits on partner countries was \$534m), clearly revealing error in their data. I also discussed that statutory rates need not accurately reflect actual marginal rates. Finally, there is even disagreement over which countries are tax havens. Recall that measurement error does not necessarily bias estimates (Wooldridge 2009, pp. 307-313). As long as measurement is random, error in the dependent variable does not violate consistency, but measurement error in regressors does. This is certainly a concern.

Nonrandom sample. However, it is not even clear that measurement error can be considered random. Particularly for the missing values, there is ample reason to think that poorer, smaller countries are the ones for whom data tends to be missing or erroneous. As an added caveat, these are likely candidates for tax havens, an entity which might even enjoy a little secrecy. Tt be noted that sample selection on regressors does not cause bias. However, if observations are cut off based on the dependent variable (e.g. countries with very low profits), this does bias estimates (ibid., p. 315). Again, this study seems a likely candidate. Error in the data is worrisome, but there is little we can do about this. In the end, we must trust that statistical agencies provide decent data (or at least random error).

Other issues could also be considered (probably), but an intermediate conclusion seems clear. I have decent confidence that my models capture some aspects of reality, but cases can easily be thought of which would bias estimates. Therefore we should not be too certain of the results without comparing to other research designs looking at the same hypotheses. This is further cemented by the fact that standard errors for several of the estimates are high enough to interfere with significance, indicating uncertain results.

6. Conclusion: Shifted profits appears not to respond much to altered taxes

Table 6.1 neatly summarizes all the estimated models. I will go through each hypothesis in turn, first arguing technically whether data seems consistent with the hypothesis, and then summarizing intuitively what this means for the world at large. I will generally ignore the PPML model, which does not appear to be a good fit for data (make of that what you will). Finally, we will consider what the supplementary models allows us to infer about these relationships.

Table 6.1: *Model estimation summary*

		Hypothesis I CIT_{it} $H_A : \gamma_1 > 0$	**Hypothesis II** Haven_j $H_A : \gamma_2 > 0$	**Hypothesis II** $\text{Haven}_j \cdot \text{CIT}_{it}$ $H_A : \gamma_3 < 0$	**Hypothesis IV** $H_0 : \gamma_1 + \gamma_3 = 0$
Basic gravity	3.1	Significant support	Sign. supp.	Sign. supp. until η_j	Cannot reject
Poisson PML	3.2	Insign., wrong sign.	Insign. supp.	Wrong sign	–
IHS	3.3	Sign. supp. until FE	Sign. supp.	Sign. supp. until FE	Cannot reject
Tax differences	4.1	Sign. supp. (weaker)	Sign. supp. (weaker)	Insign. supp.	Cannot reject
Haven size	4.2	Sign. supp.	Especially small	Sign. supp. for small	Reject for large until FE
Type of income	4.3	Especially dividends	Sign. supp. (all)	Especially reinv. earn.	Cannot reject or negative
CFC legislation	4.4	Insign. after ζ_i	Especially non-CFC	Sign. supp. until FE (both)	Cannot reject (both)

Corporate tax rates. The first hypothesis is supported by most of my estimations. The FE estimation cannot always recreate this, but this may be because of the limited variation available to it. Since this is the effect we are most certain of a priori, it is the best for judging whether the FE approach is viable. All in all there is decent evidence for the relationship, which suggest the forces underlying international tax competition are real. When countries lower their corporate tax rate, they should expect domestic profits (through investment) to increase relatively to FDI. This yields the competitive incentive to do so, driving down tax rates.

Haven. All models support a level effect for havens. This implies that far more profits are realized in havens than accounted for by the basic economic forces we model. I interpret this as evidence for profit shifting, rather than their economies being uniquely productive. This finding thus validates my research design, as it suggests we may compare real and shifted profits by comparing havens and non-havens.

Differences for havens. The parameters of main interest are unfortunately also the most uncertain ones. $\hat{\gamma}_3$ is generally negative as expected, and is often strong enough that we do not expect any effect of tax rates on profits in tax havens ($\hat{\gamma}_1 + \hat{\gamma}_3 \approx 0$). This may be seen by the fact that we can almost never reject hypothesis IV. However, the significance of $\hat{\gamma}_3$ often falters in FE estimations. It is impossible to say whether this is because FE has limited variation, because there is no true effect, or possibly because the effect is only present for some havens, unaccounted for by my model (yielding large standard errors). I suggest the following interpretation: The evidence is consistent with the notion that (shifted) profits in havens are insensitive to small changes in the tax rate. However, we cannot conclusively reject the opposite, and it may be that the effect only holds for some havens, or is affected by other factors. The latter could imply that we have not completely isolated shifted profits in my set-up. Even so, it would be wrong to claim that results does not point towards insensitive shifted profits.

Extensions. The extended models attempt to account for such factors, and provide evidence that one may isolate shifted profits further. First, haven effects are stronger for small havens, which is consistent with shifted profits being a larger part of their economy. Second, haven effects appear different for various types of income. Havens especially seem to hold reinvested earnings, while competition effects particularly affect dividends. Note however that returns on equity may start out as reinvested earnings, and later be paid out as dividends, so these are two sides of the same coin. Finally, we saw evidence that the relationship might be affected by whether countries have CFC rules, which could allow us to isolate shifted profits even further. All extensions continue to show that haven profits respond more weakly, possibly not at all.

Overall. In short, there is good evidence that allocation of investment and real profits between countries is affected by corporate tax rates. Data is also consistent with the notion that havens possess a large share of shifted profits. Finally, data is consistent, although not conclusively so, with the notion that these shifted profits respond weakly to small changes in corporate tax rates. They may not even respond at all. The last conclusion should be regarded carefully until recreated with more data or new designs, but is quite interesting even so. It would seem to suggest that countries should disregard shifted profits when competing over tax rates, which could slow the race toward the bottom if realized by world leaders. Possibly.

Perhaps someone should tell Mr. Trump, before he initiates the next sprint.

7. References

Angrist, Joshua David and Jörn-Steffen Pischke (2009). *Mostly Harmless Econometrics: An Empiricist's Companion*. OCLC: ocn231586808. Princeton: Princeton University Press. 373 pp.

Blonigen, Bruce A. (2005). "A Review of the Empirical Literature on FDI Determinants". In: *Atlantic Economic Journal* 33.4, pp. 383–403.

Burbidge, John B., Lonnie Magee, and A. Leslie Robb (1988). "Alternative Transformations to Handle Extreme Values of the Dependent Variable". In: *Journal of the American Statistical Association* 83.401, p. 123.

Devereux, Michael and Giorgia Maffini (2007). "The Impact of Taxation on the Location of Captial, Firms and Profit: A Survey of Empirical Evidence". In:

Dharmapala, Dhammika (2008). "What Problems and Opportunities Are Created by Tax Havens?" In: *Oxford review of economic policy* 24.4, pp. 661–679.

Dharmapala, Dhammika and James R. Hines (2006). *Which Countries Become Tax Havens?* NBER Working Paper #12802.

Gravelle, Jane G. (2015). *Tax Havens: International Tax Avoidance and Evasion*. CRS Report. Congressional Research Service.

Hebous, Shafik and Niels Johannesen (2016). *At Your Service! The Role of Tax Havens in International Trade with Services*. Working Paper. CESifo.

Johannesen, Niels, Thomas Tørsløv, and Ludvig Wier (2016). *Are Less Developed Countries More Exposed to Multinational Tax Avoidance? Method and Evidence from Micro-Data*. OCLC: 946039321. Helsinki, Finland: United Nations University World Institute for Development Economics Research.

Keen, Michael and Kai A. Konrad (2013). "The Theory of International Tax Competition and Coordination". In: *Handbook of Public Economics*. Vol. 5. Elsevier, pp. 257–328.

MacKinnon, James G. and Lonnie Magee (1990). "Transforming the Dependent Variable in Regression Models". In: *International Economic Review* 31.2, p. 315. JSTOR: `2526842?origin=crossref`.

Mayer, Thierry and Soledad Zignago (2011). "Notes on CEPII's Distances Measures: The GeoDist Database". In:

Nielsen, Mette Uhre (2016). *Preventing Tax Evasion - Are Bilateral Tax Information Exchange Agreements Effective?* Bachelor's Thesis. University of Copenhagen.

OECD (2000). *Towards Global Tax Cooperation: Progress in Identifying and Eliminating Harmful Tax Practices*. Paris: OECD.

— ed. (2008). *OECD Benchmark Definition of Foreign Direct Investment*. 4. ed. Paris: Organisation for Economic Co-operation and Development. 250 pp.

Shepherd, Ben (2012). *The Gravity Model of International Trade: A User Guide*. United Nations ESCAP.

Silva, JMCS and Silvana Tenreyro (2006). "The Log of Gravity". In: *The Review of Economics and statistics* 88.4, pp. 641–658.

— (2011). "Poisson: Some Convergence Issues". In: *Stata journal* 11.2, pp. 207–212.

The Atlantic (2017). "A Comprehensive Guide to Donald Trump's Tax Proposal". In: *The Atlantic*.

Voget, Johannes (2011). "Relocation of Headquarters and International Taxation". In: *Journal of Public Economics* 95 (9-10), pp. 1067–1081.

Wooldridge, Jeffrey M. (2009). *Introductory Econometrics: A Modern Approach*. 4th ed. Mason, OH: South Western, Cengage Learning. 865 pp.

Zoromé, Ahmed (2007). *Concept of Offshore Financial Centers: In Search of an Operational Definition*. Working Paper. IMF.

Zucman, Gabriel (2013). "The Missing Wealth of Nations: Are Europe and the U.S. Net Debtors or Net Creditors?*". In: *The Quarterly Journal of Economics* 128.3, pp. 1321–1364.

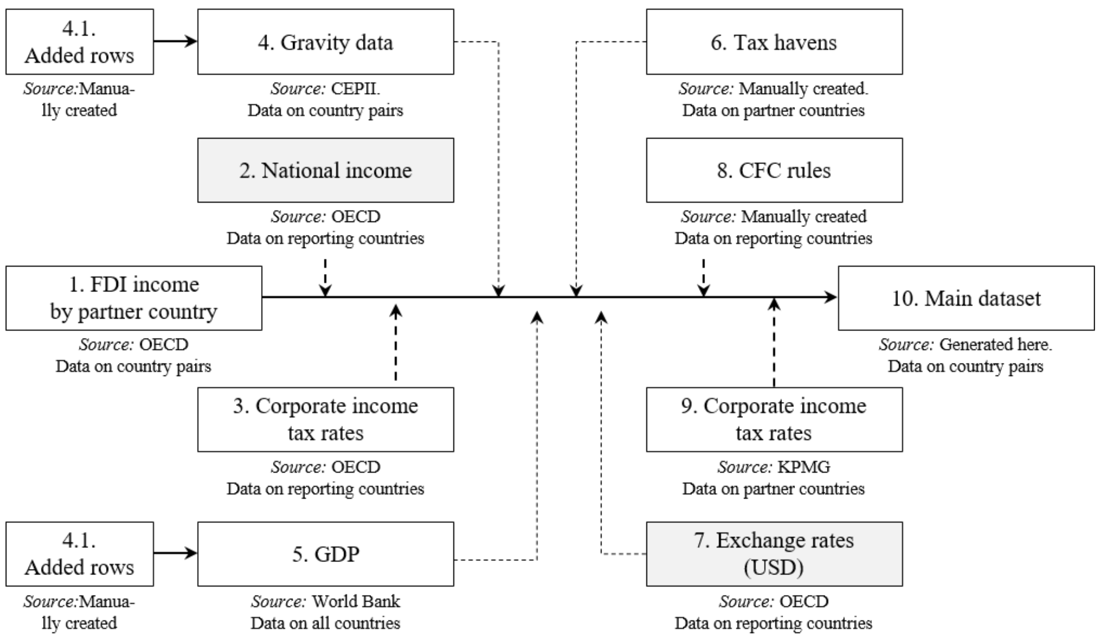
— (2014). "Taxing across Borders: Tracking Personal Wealth and Corporate Profits". In: *Journal of Economic Perspectives* 28.4, pp. 121–148.

8. Appendices

8.1. Data sources

The analysis features FDI income reported by 27 OECD countries on 212 partner countries (see 8.1). This dataset is enriched with a number of other data sets, as shown in figure 8.1. Below you will find sources and a short description of what each brings to the table. All used datasets are available at `https://github.com/rbjoern/Public_Economics/tree/master/Data`.

Figure 8.1: *Data process*



Notes: Dotted lines indicate data is (inner) joined on the country-level there is data on. Full lines indicate data is appended to the dataset. Grey datasets do not contain variables used in the final regressions.

1. OECD countries provides both outwards and inwards FDI income against partner countries. *Source:* `https://stats.oecd.org/Index.aspx?DataSetCode=FDI_INC_CTRY`.

2. Data on GNI and GDP for each reporting country. I wound up using World Bank data for them as well. *Source:* `https://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE2.`.

3. *Source:* `https://stats.oecd.org/Index.aspx?DataSetCode=TABLE_II1`.

4. Dyadic dataset based on the GeoDist database from CEPII, which includes standard gravity variables. *Source:* `http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8`.

5. GDP data from the World Bank WDI data tables. *Source:* `http://databank.worldbank.org/data/reports.aspx?source=2&series=NY.GDP.MKTP.CD`

6. The list of tax havens featured in table 8.2. Sources are listed there.

7. Insignificant. *Source:* `https://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE4`.

8. The list of CFC-rules featured in 8.4. Sources are listed there.

9. CIT rates in 137 countries. *Source:* `https://home.kpmg.com/xx/en/home/services/tax/tax-tools-and-resources/tax-rates-online/corporate-tax-rates-table.html`.

10. The final dataset contains the data pairs from the OECD data, enriched with the listed information. Table 8.1 specifies for which pairs data was available.

8.2. Code appendices

All code used for the paper is available at GitHub: `https://github.com/rbjoern/Public_economics/tree/master/Code`. A short description of each is provided here, but the ones of most interest are likely two and four. The used software is marked in parentheses.

Code Appendix 1 ***(R, 120 lines):*** **Load external data sources**. The code automatically downloads new versions of datasets 1,2,3 5 and 7 from the OECD and World Bank databases. It uses the SDMX framework. Code is saved as CSV files, which are loaded in the next appendix.

Code Appendix 2 ***(R, 760 lines):*** **Format dataset**. This code provides all formatting and changes and outputs the main dataset. Data is loaded from CSV files, and joined to the main dataset on FDI income. All actual changes to the data (rather than mere formatting) is clearly marked by '#DATA FIX.' Each section loads a new dataset, performs formatting and data manipulation, and then joins it to the main dataset, which is finally saved in CSV and DTA formats.

Code Appendix 3 ***(R, 220 lines):*** **Descriptive analysis**. This code generates data for tables and figures, and performs various checks. It is not required for the 4th appendix.

Code Appendix 4 ***(Stata, 620 lines):*** **Statistical Analysis**. The statistical analysis is performed in Stata. All the regression tables are generated in this appendix.

All code should run if working directories are updated, and mentioned packages installed.

8.3. Major data changes

All changes to the data is done in code appendix 2, and clearly marked with the label #DATA FIX. Here, we provide a list of the changes to the data which implied larger assumptions.

- Some countries report FDI Income only for resident operating units (Non-SPEs) and no totals (since SPEs are confidential). Here, we simply set totals equal to non-SPEs.
- GDP is often missing for partner countries in some years. I replaced these with GDP from earlier/later years as possible (i.e. assumed zero growth from year to year).
- GDP was manually added for some countries as specified in table 8.1. Some were missing completely (see appended file), others only had missing values (see code appendix 2).
- Gravity data s manually added for some countries as specified in table 8.1. Manually added distances (see table 8.1) are simple distances, rather than weighted.
- Tax rates for partner countries are only reported for 2006-2015. I assume no change from 2005 to 2006.

8.4. Supplementary tables

Supplementary tables, as referenced in the text, are provided below.

Table 8.1: *Covered countries*

Reporting countries	Partner countries
27 of the 35 OECD members report useful FDI income data, and are featured in the analysis.	The OECD collects data on 237 countries and territories. I have data on 212, excluding 25.
Featured OECD-countries	**Excluded, missing from CEPII data.**
Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Latvia, Netherlands, New Zealand, Norway, Poland, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, United States	Antarctica, Bouvet Island, British Indian Ocean Territory, French Southern Territories, Guam, Heard islands and Mc Donald Islands, Montenegro, Palestinian Territory, Serbia and Montenegro, South Georgia & South Sandwich Islands, South Sudan, U.S. Virgin Islands , Vatican,American Samoa
Excluded, they only provide aggregates (or not even that)	**Included, missing from CEPII data (added manually)**
Finland, Luxembourg, Mexico, Portugal, Switzerland, Turkey	Bonaire, Saint Eustatius and Saba, Curacao, Isle of Man, Guernsey, Jersey, Liechtenstein, Sint Maarten
Excluded, they do not report the statistic.	**Excluded, missing from WB GDP data**
Chile, Israel	Christmas islands, French Polynesia, New Caledonia, Norfolk Island, North Korea, Pitcairn, Saint Helena, Tokelau, US Minor Outlying islands, Wallis and Futuna,Cocos islands
	Included, added manually to GDP data
	Anguilla, Bonaire, Saint Eustatius and Saba, Cook Islands, Guernsey, Jersey, Montserrat, Netherlands Antilles, Niue
	Included, missing GDP replaced
	British Virgin Islands, Curacao, Sint Maarten, Turks and Caicos Islands, Gibraltar
	Included, but no non-zeroes reported.
	Montserrat, Niue, Somalia, Tonga,Grenada
	Included, but no positive values reported.
	Sao Tome and Principe, Tajikistan, Tuvalu

Notes: Countries missing from both CEPII and GDP are listed only under CEPII.

Other partner countries exist with few positive values, but like the ones above, this is likely realistic.

Some reporting countries do not report all FDI income, as indicated in table 8.3

Table 8.2: *List of tax havens*

Country or territory	**ISO**	Tax Haven (D&H 2006)	Tax Haven (OECD 2000)	Tax Haven (Nielsen 2016)	Tax Haven (Gravelle 2015)	OFC (IMF 2007)	Share	**Included?** (3 or more)	Small	Large
Andorra	AND	1	1	1	1	1	5 of 5	1	1	0
Anguilla	AIA	1	1	1	1	1	5 of 5	1	1	0
Antigua and Barbuda	ATG	1	1	1	1	1	5 of 5	1	1	0
Aruba	ABW	0	1	1	1	1	4 of 5	1	1	0
Bahamas	BHS	1	1	0	1	1	4 of 5	1	1	0
Bahrain	BHR	1	1	0	1	1	4 of 5	1	0	1
Barbados	BRB	1	1	1	1	1	5 of 5	1	1	0
Belize	BLZ	1	1	1	1	1	5 of 5	1	1	0
Bermuda	BMU	1	1	1	1	1	5 of 5	1	1	0
Cayman Islands	CYM	1	1	1	1	1	5 of 5	1	1	0
Cook Islands	COK	1	1	0	1	1	4 of 5	1	1	0
Costa Rica	CRI	0	0	1	1	1	3 of 5	1	0	1
Cyprus	CYP	1	1	1	1	1	5 of 5	1	0	1
Dominica	DMA	1	1	1	1	1	5 of 5	1	1	0
Gibraltar	GIB	1	1	1	1	1	5 of 5	1	1	0
Grenada	GRD	1	1	1	1	1	5 of 5	1	1	0
Guernsey	GGY	1	1	1	1	1	5 of 5	1	1	0
Hong Kong	HKG	1	0	1	1	1	4 of 5	1	0	1
Ireland	IRL	1	0	0	1	1	3 of 5	1	0	1
Isle of Man	IMN	1	1	1	1	1	5 of 5	1	1	0
Jersey	JEY	1	1	1	1	1	5 of 5	1	1	0
Jordan	JOR	1	0	0	1	0	2 of 5	0		
Lebanon	LBN	1	0	1	1	1	4 of 5	1	0	1
Liberia	LBR	1	1	1	1	0	4 of 5	1	0	1
Liechtenstein	LIE	1	1	1	1	1	5 of 5	1	1	0
Luxembourg	LUX	1	0	0	1	1	3 of 5	1	0	1
Macao	MAC	1	0	1	1	1	4 of 5	1	0	1
Malaysia (Labuan)	MYS	0	0	0	0	1	1 of 5	0		
Maldives	MDV	1	1	1	1	0	4 of 5	1	1	0
Malta	MLT	1	1	1	1	1	5 of 5	1	0	1
Marshall Islands	MHL	1	1	1	1	1	5 of 5	1	1	0
Mauritius	MUS	0	1	1	1	1	4 of 5	1	0	1
Monaco	MCO	1	1	1	1	1	5 of 5	1		
Montserrat	MSR	1	1	1	1	1	5 of 5	1	1	0
Nauru	NRU	0	1	0	1	1	3 of 5	1	1	0
Netherlands Antilles	ANT	1	1	1	1	1	5 of 5	1	1	0
Niue	NIU	0	1	0	1	1	3 of 5	1	1	0
Palau	PLW	0	0	0	0	1	1 of 5	0		
Panama	PAN	1	1	1	1	1	5 of 5	1	0	1
Saint Kitts and Nevis	KNA	1	1	1	1	1	5 of 5	1	1	0
Saint Lucia	LCA	1	1	1	1	1	5 of 5	1	1	0
Saint Vincent and the Grenadines	VCT	1	1	1	1	1	5 of 5	1	1	0
Samoa	WSM	0	1	0	1	1	3 of 5	1	1	0
San Marino	SMR	0	1	0	1	0	2 of 5	0		
Seychelles	SYC	0	1	0	1	1	3 of 5	1	1	0
Singapore	SGP	1	0	1	1	1	4 of 5	1	0	1
Switzerland	CHE	1	0	1	1	1	4 of 5	1	0	1
Tonga	TON	0	1	0	1	0	2 of 5	0		
Turks and Caicos Islands	TCA	1	1	1	1	1	5 of 5	1	1	0
Uruguay	URY	0	0	1	0	0	1 of 5	0		
Vanuatu	VUT	1	1	1	1	1	5 of 5	1	1	0
Virgin Islands, British	VGB	1	1	1	1	1	5 of 5	1	1	0
Virgin Islands, U.S.	VIR	0	1	0	1	0	2 of 5	0		
States created when the Netherlands Antilles dissolved in 2010.										
Bonaire, Saint Eustatius and Saba	BES							1	1	0
Curacao	CUW							1	1	0
Sint Maarten	SXM							1	1	0
Totals (of 56):								49	34	14

Notes: Countries are coded as havens in this study if they are included in three or more of the featured lists.
Included havens are coded as large if their average population from 2005-2015 exceeded 400 thousand. If not, they are coded as small.
Monaco is not featured by itself in the OECD dataset, and thus is not a part of the analysis.
Sources: The lists from Dharmapala and Hines (2006) and OECD (2000) were taken from Dharmapala (2008).
The IMF list of offshore financial centers (OFC) was provided by Zoromé (2007). The rest were taken from the texts specified.

Table 8.3: *Panel length & share of FDI income which is observed in partner countries.*

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Australia					58 (NaN)	55 (55)	39 (39)	60 (60)	54 (54)	73 (73)	61 (61)
Austria								89 (NaN)	86 (100)	50 (100)	79 (100)
Belgium									94 (100)	94 (100)	81 (100)
Canada							46 (48)	40 (40)	49 (49)	44 (44)	52 (52)
Czech Republic									89 (NaN)	99 (NaN)	100 (NaN)
Denmark									98 (100)	90 (100)	97 (100)
Estonia						102 (100)	100 (NaN)	100 (100)	100 (100)	101 (100)	100 (100)
France	86 (NaN)	86 (NaN)	87 (NaN)	80 (NaN)	85 (NaN)	85 (NaN)	82 (NaN)	82 (NaN)	81 (NaN)	83 (NaN)	79 (NaN)
Germany	97 (100)	98 (100)	98 (100)	96 (100)	98 (100)	98 (100)	98 (100)	100 (100)	100 (100)	100 (100)	100 (100)
Greece									100 (100)	100 (100)	100 (100)
Hungary							100 (100)	100 (100)	94 (100)	99 (100)	99 (100)
Iceland									100 (100)	100 (100)	100 (100)
Ireland								43 (99)	55 (101)	69 (102)	103 (140)
Italy									100 (100)	100 (100)	100 (100)
Japan										92 (100)	96 (100)
Korea									100 (100)	101 (100)	-262 (100)
Latvia									89 (82)	102 (97)	34 (NaN)
Netherlands									100 (100)	100 (100)	100 (100)
New Zealand									94 (100)	98 (100)	109 (99)
Norway									100 (100)	100 (100)	100 (100)
Poland									100 (100)	100 (100)	100 (100)
Slovak Republic										100 (95)	
Slovenia					102 (100)	100 (100)	95 (100)	101 (100)	99 (100)	100 (100)	77 (100)
Spain									39 (NaN)	15 (NaN)	15 (NaN)
Sweden									100 (100)	100 (100)	100 (100)
United Kingdom									94 (100)	92 (100)	99 (100)
United States							99 (99)	99 (100)	99 (99)	99 (99)	98 (100)

Notes: The table compares how much FDI income we observe on individual partner countries, to what the reporting country claim to allocate.
The first number is the sum of observed FDI income in partner countries, as a share of FDI income reported on '*W0: World*'.
The parentheses reports the share of '*W0: World*' which is not '*C_W190: WORLD unallocated and confidential*' (i.e. $(W0 - C\_W190)/W0$)
This share is negative if unallocated profits are negative, which implies income on partner countries must be above world profits.
NaN implies the country has either not reported '*W0*', or more likely not reported '*C_W190*'.

Table 8.4: *CFC Rules*

Featured countries

Country	**ISO**	**CFC-rules**	Introduced
Australia	AUS	1	1990
Austria	AUT	0	
Belgium	BEL	0	
Canada	CAN	1	1976
Czech Republic	CZE	0	
Denmark	DNK	1	1995
Estonia	EST	0	
France	FRA	1	1980
Germany	DEU	1	1972
Greece	GRC	0	
Hungary	HUN	0	
Iceland	ISL	0	
Ireland	IRL	0	
Italy	ITA	1	2002
Japan	JPN	1	1978
Korea, Republic of	KOR	1	1997
Latvia	LVA	0	
Netherlands	NLD	0	
New Zealand	NZL	1	1988
Norway	NOR	1	1992
Poland	POL	0	
Slovakia	SVK	0	
Slovenia	SVN	0	
Spain	ESP	1	1995
Sweden	SWE	1	2004
United kingdom	GBR	1	1984
United States	USA	1	1962

Non-featured countries

Country	**ISO**	**CFC-rules**	Introduced
Argentina	ARG	1	1999
Finland	FIN	1	1995
Indonesia	IDN	1	1995
Israel	ISR	1	2002
Lithuania	LTU	1	2002
Mexico	MEX	1	1997
Portugal	PRT	1	1995
South Africa	ZAF	1	1997

Notes: All CFC rules were implemented prior to our panel's start in 2005. The table is from 2008, so later CFC rules are not covered.
Source: Table 4 in Voget (2011, p. 1072).

Table 8.5: *Descriptive statistics*

	(1) N	(2) mean	(3) p50	(4) sd	(5) p1	(6) p99
Dependent variables						
FDI income - Total	19,252.0	279.3	0.0	2,141.5	-90.3	6,410.1
FDI income - Dividends	16,580.0	133.9	0.0	938.4	0.0	3,540.1
FDI income - Reinv. earnings	16,111.0	123.1	0.0	1,652.9	-569.5	2,575.0
FDI income - Debt income	15,172.0	7.6	0.0	248.0	-16.9	203.1
Dependent variables (transformations)						
ln FDI income - Total	5,930.0	3.5	3.7	3.1	-4.2	9.7
IHS FDI income - Total	19,252.0	1.2	0.0	2.8	-5.2	9.5
ln FDI income - Dividends	3,689.0	3.4	3.4	3.0	-3.4	9.1
ln FDI income - Reinv. earnings	3,461.0	3.5	3.6	2.9	-3.8	9.6
ln FDI income - Debt income	2,816.0	1.0	1.2	2.9	-6.2	7.6
Independent variables						
CIT_{it} (γ_1)	23,778.0	24.2	22.0	6.8	12.5	38.0
CIT_{jt}	13,922.0	21.6	24.2	10.8	0.0	40.7
DCIT_{ijt} (γ_1)	13,922.0	2.7	1.1	12.8	-22.5	34.9
Haven (γ_2)	23,778.0	0.2	0.0	0.4	0.0	1.0
Small_Haven	23,778.0	0.1	0.0	0.3	0.0	1.0
Large_Haven	23,778.0	0.1	0.0	0.2	0.0	1.0
$\text{CFC}_i(\iota_1)$	23,778.0	0.5	1.0	0.5	0.0	1.0
Gravity variables						
GDP	23,778.0	1,875,825.1	545,159.0	3,431,822.1	16,779.6	17,393,103.0
GDP_j	21,996.0	353,148.3	20,265.6	1,451,567.6	49.2	6,100,620.4
distw	22,386.0	7,241.1	7,139.3	4,484.8	442.9	17,337.2
Gravity variables (transformations)						
$\ln \text{GDP}_{it}$	23,778.0	13.2	13.2	1.8	9.7	16.7
$\ln \text{GDP}_{jt}$	21,996.0	10.0	9.9	2.6	3.9	15.6
ln Distance (w)	22,386.0	8.6	8.9	0.9	6.1	9.8
Gravity dummies D_{ij}						
Common border	22,386.0	0.0	0.0	0.1	0.0	1.0
Common language	22,386.0	0.1	0.0	0.3	0.0	1.0
Colony	22,386.0	0.0	0.0	0.2	0.0	1.0
Common colony	22,386.0	0.0	0.0	0.1	0.0	0.0

Table 8.6: *Main regression (Standard errors clustered by distw)*

	(1) Eq. (2)	(2) $+\delta_t$	(3) $+\zeta_i$	(4) $+\eta_j$	(5) $+\theta_{ij}$ (FE)
$\ln \text{GDP}_{it}$	0.976***	0.955***	1.435***	1.409***	0.567*
	(0.036)	(0.037)	(0.408)	(0.373)	(0.310)
$\ln \text{GDP}_{jt}$	0.837***	0.837***	0.820***	0.315	0.180
	(0.024)	(0.024)	(0.024)	(0.212)	(0.258)
ln Distance (w)	-0.792***	-0.782***	-0.840***	-1.091***	
	(0.054)	(0.054)	(0.050)	(0.085)	
Haven (γ_2)	2.598***	2.601***	2.568***		
	(0.619)	(0.619)	(0.609)		
CIT_{it} (γ_1)	0.033***	0.035***	0.060***	0.043***	0.023*
	(0.008)	(0.008)	(0.013)	(0.013)	(0.013)
$\text{Haven}\times\text{CIT}_{it}$ (γ_3)	-0.030	-0.030	-0.029	-0.014	-0.022
	(0.024)	(0.024)	(0.024)	(0.019)	(0.028)
Common border	0.212	0.183	0.377*	0.176	
	(0.202)	(0.203)	(0.201)	(0.191)	
Common language	0.789***	0.806***	0.671***	0.587***	
	(0.193)	(0.192)	(0.191)	(0.177)	
Colony	1.236***	1.248***	0.968***	1.006***	
	(0.199)	(0.201)	(0.171)	(0.177)	
Common colony	2.587***	2.557***	3.157***	3.529***	
	(0.626)	(0.619)	(0.754)	(0.752)	
Constant	-14.666***	-14.559***	-21.183***	-12.463**	-6.993
	(0.667)	(0.666)	(5.773)	(5.960)	(4.959)
Observations	5,850	5,850	5,850	5,850	5,850
R^2	0.540	0.542	0.638	0.735	0.949
$\gamma_1 + \gamma_3 = 0$ (p-value)	0.893	0.834	0.193	0.150	0.970

Dummies are added as specified above. FE drops $\zeta_i + \eta_j$. Robust standard errors in parantheses.
*** p<0.01, ** p<0.05, * p<0.1