European Banks and Tax Havens *

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Abstract: In 2016, the Panama papers exposed a pervasive light on global banks' presence in tax havens. Using individual country-by-country reportings from the largest banks in the European Union, this paper provides a quantitative assessment of the weight of tax havens in international banking activity. Our empirical estimates based on gravity equations uncover several new findings: 1) Ignoring tax havens implies misspecification in a standard gravity model explaining the commercial presence of banks subsidiaries abroad; tax havens attract large extra banking activity beyond the standard gravity factors; 2) Luxembourg, Isle of Man and Guernsey rank at the top of the foreign affiliates presence not explained by standard factors; the presence of foreign banks subsidiaries in Luxembourg is 8.5 times higher than predictions based on a standard gravity model; 3) Combining low tax rates and high governance quality is not sufficient to explain extra banking activity in tax havens.

Keywords: Tax evasion; International banking; Tax havens; Country-by-country reporting.
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1 Introduction

In 2016, the Panama papers exposed a pervasive light on global banks' presence in tax havens.[1] The leaks documented a large activity of global banks in tax havens and specifically their intermediation role in setting up shell companies, foundations and trusts to ease tax avoidance for their clients.[2] However, part of the banks' activity in these jurisdictions might be related to the fact that they are important offshore financial hubs. For example, Luxembourg, which is included in most tax havens lists, ranks first in GDP per capita, twelfth in terms of financial center and is located in the core of the European Union. In sum, attributing the whole presence of banks in Luxembourg to tax havens related motives could be misleading. In order to gauge the importance of banks in facilitating tax and transparency avoidance, we need to quantify the part of offshore banking activity merely due to tax havens attributes. This is the main objective of this paper. At stake is whether a more stringent regulation of banks' activity in tax havens can reduce tax evasion and money laundering, or if it risks the seizure of international financial transactions.

So far, measuring the size of offshore banking in tax havens was impeded by a lack of information exchange by several low-tax jurisdictions. The attention of G-20 leaders in 2012 and the OECD ongoing efforts have successfully reversed the trend and pushed the transparency agenda: since 1 January 2015, all European banks that can be regarded as global systemically important institutions are required to publicly share country-by-country data, as stipulated by Capital Requirements Directive IV of the EU. This paper precisely exploits newly published individual data to provide the first quantitative assessment of the weight of tax havens in international banking activity.

[1] Dharmapala and Hines (2009) propose the following definition: "The tax havens are locations with very low tax rates and other tax attributes designed to appeal to foreign investors." The OECD adds the lack of transparency and of exchange of information as a common feature of tax havens.

[2] The leaked documents revealed that more than 500 banks, their subsidiaries and branches registered nearly 15,600 shell companies with Mossack Fonseca, according to ICIJ's analysis.

We combine two different strands of the international finance literature. First to isolate the specific weight of tax havens, we need to control for structural factors of international bank activity. To do so, we draw from the gravity literature applied to financial transactions. This literature emphasizes the influence of bilateral differences of information and bilateral institutional linkages on international banking activity Portes et al. (2001), Portes and Rey (2005), Martin and Rey (2004) and Okawa and van Wincoop (2012). We use the well-documented result that bilateral transactions rise proportionately with the economic size of both countries ("mass") and are negatively correlated with frictions ("resistance") to quantify the amount of foreign affiliates activity predicted by standard factors. Second, we draw from the literature on tax-motivated activity within MNC to include tax havens in the analysis of offshore banking. Which countries are tax havens? What is the most appropriate measure of tax rate faced by MNC? Are investors sensible to other legal, economic and political conditions beyond tax differences across jurisdictions? The seminal works of Hines and Rice (1994) and more recent works by Bartelsman and Beetsma (2003) and Dharmapala and Hines (2009) among others guide our empirical investigation.

We extend a private database initially collected by the Dutch Center for Research on Multinational Corporations from financial statements in annual reports. Our data include the reported information for the 36 largest EU banks (in terms of total assets) including 13 Global systemically international institutions (SII) and 23 domestic SIIs.[3] Information disclosed are: turnover, employees, profit or loss before tax, tax on profit or loss, and public subsidies received. In this paper we focus on activity through the *turnover*. The data set is cross-sectional and concerns year 2015. Banks headquarters are located in 10 EU countries; their foreign affiliates have activity in 138 countries in total, including 29 tax havens jurisdictions.

[3]We are grateful to Oxfam staff who kindly shared the database with us. We extend their data from the 20 to 35 largest banks in terms of assets (source: Relbanks). A meticulous look at the data indicated that missing information in the original annual report had been misreported as *zero* so we have corrected the misreportings.

The absence of activity in a country/ jurisdiction is an insightful information that we want to account for. Therefore we extend the total sample to 228 countries, the maximum of countries for which controls data are available; however the presence of *zeros* in the vector of the dependent variable poses a methodological challenge. To address it and estimate a gravity model, we use the Poisson pseudo maximum likelihood (PPML) which has the advantage to avoid a log transformation of the specification. It allows us to properly account for zeros in the endogenous variable; the second advantage is that coefficients are unbiased (Silva and Tenreyro (2006)). We estimate the model within the alternative Negative Binomial Quasi-Generalised Pseudo-Maximum Likelihood estimator (NB QGPML) and OLS estimator for robustness check. An important methodological challenge is to keep a stable size of the sample while we add the different measures of tax haven attributes. In fact, while a dummy controlling for whether a jurisdiction is a tax haven or not can be created for the whole sample, data availability can drastically decrease when it comes to effective tax rates or institutions governance quality. Yet keeping a stable size sample is necessary to make sure that our results are robust and not driven by a sample bias. We propose different strategies to run our estimate on a minimum of 138 countries and obtain results consistent across the different specifications.

Our empirical estimation uncover new findings: 1) Ignoring tax havens implies misspecification in a standard gravity model explaining the commercial presence of banks affiliates abroad; tax havens attract extra banking activity beyond the standard gravity factors; 2) Luxembourg, Isle of Man and Guernsey rank at the top of the foreign affiliates presence not explained by standard factors; the presence of foreign banks affiliates in Luxembourg is 8.5 times higher than predictions based on a standard gravity model; 3) Combining low tax rates and high governance quality is not sufficient to explain extra banking activity in tax havens;

Section 2 presents an overview of the current knowledge on tax havens; first we review the

academic literature and then we describe the activity of banks affiliates specific to tax havens. Section 3 presents our database and some descriptive statistics. Section 4 describes the different specifications and the PML estimator. Section 5 presents the estimate results.

2 What do we know about banks in tax havens?

2.1 Tax havens: which data, which studies?

There is very little academic research on tax havens: the specific topic accounts for less than 0.4% of the academic literature on taxation (see more details in Table A in Appendix). Most of the academic articles about tax haven are published in Accounting (21%), and Public economics/Political economy (18%). Surprisingly, few articles have been published in International economics (8%), Development economics (6%) or Financial economics (7%) (Table B). The reason is probably related to the scarcity of data due to the lack of transparency in tax havens. A related and somehow more documented topic is international tax competition and profit shifting by multinational enterprises (MNEs).[4] In the following, we review empirical studies along a data criterion where we distinguish empirical study based on country-level and firm-level data. In addition, we point to whether the study considers non-financial sectors or includes on financial activities.

2.1.1 Country-level data on tax havens and offshore financial centers

A first part of the literature is based on macroeconomic (aggregated) data and examines the characteristics of the countries or jurisdictions considered as tax havens. Some works on offshore financial centers (OFCs) address, somewhat independently, similar issues.

[4] Comprehensive and stimulating academic surveys on international tax competition, profit shifting by multinational enterprises (MNEs), and tax havens are provided by Devereux (2007), Hines (1999), Hines (2007), Hines (2010), Dharmapala (2008), Dharmapala (2014), and Zucman (2015).

In their seminal paper, Hines and Rice (1994) are among the first to document the importance of tax havens.[5] They identify a list of 41 tax havens and they estimate that US multinational firms reported nearly a third of their foreign profits in such countries in the early 1980s. Zucman (2014) evaluates that about 20% of all US corporate profits are held in the main tax havens in 2013, which is a tenfold increase since the 1980s.[6]

Dharmapala and Hines (2009) examine the features of tax havens and find that better-governed countries (measured by the World Bank's indicators for voice and accountability, political stability, government effectiveness, rule of law, and control of corruption) are much more likely than others to become tax havens. Masciandaro (2006) who examined OFC, rather than specifically tax haven, similarly highlights the importance of a high political stability, a low crime level, and a Common Law juridical system, combined with a low resources endowment. Hines (2005) indicates that between 1982 and 1999, the annual per capita real economic growth was 3.3% in average for tax haven, compared to 1.4% for the rest of the world. More recently the growth discrepancy seems to have narrowed as Hines (2010) shows that, from 1992 to 2006, this growth was 2.85% for tax havens, compared to 2.26% for OECD countries. Hampton and Christensen (2002) confirm that offshore financial activities have been very profitable for hosting countries in terms of employment, growth and government revenues.[7]

Rose and Spiegel (2007) discuss the causes and consequences of OFCs. In particular, they argue that while they may increase tax evasion, OFCs may also have unintended positive consequences,

[5] To our knowledge, Johns (1983) produced the earliest academic study on the economics of tax havens.

[6] The list of tax havens considered in Zucman (2014) is restricted to Netherlands, Ireland, Switzerland, Singapore, Luxembourg, Bermuda, and other Caribbean havens.

[7] In Jersey for instance, 90% of the government revenues come from offshore activities, which directly employs up to 20% of the local labor force Hampton and Christensen (2002).

such as providing competition for the domestic banking sector.[8]

2.1.2 Country-level data with a focus on financial positions

A second stream of papers relies on aggregated data with a focus on cross-border deposits and capital flows.

On the one hand, some works attempt to quantify financial positions in tax haven and/ or OFC. Lane and Milesi-Ferretti (2011) collect data from various sources to provide rough estimates of the foreign asset and liability positions in OFCs. They consider a group of 32 small OFCs and purposely exclude important financial centers such as Hong Kong, Ireland, Luxembourg, and Singapore. While these countries represent a very small part of the world population and GDP, they account for 8.5% of the world cross-border investment positions − larger than France, Germany, or Japan. Zucman (2013) uses a restricted dataset on cross-border banking from the BIS, combined with a public survey from the Swiss National Bank, and documents that 10% of the financial wealth of European households is held offshore, which represents a tax revenue loss of $75 billion. According to various source of data gathered by Hampton and Christensen (2002), the total amount of bank deposits in OFCs was estimated to $11 billion in 1968, $385 billion in 1978, $1,000 billion in the early 1990s, and $6,000 billion in the late 1990s (from 0.5% of world GDP in 1968, to 5% in the 1980s, and 20% in the 1990s). Last, Zucman (2015) estimate that the global financial wealth of households held in tax havens in 2013 is about $7.6 trillion.[9]

On the other hand, some works explore the drivers of financial positions in tax haven and/

[8] For a theoretical approach, see Desai et al. (2006b), Slemrod and Wilson (2006), Johannesen (2010). Overall, these models suggest that tax havens may have an ambiguous impact on welfare.

[9] Henry (2012), on behalf of the NGO "Tax Justice Network", reports that between $21 and $32 trillion of unreported financial assets was owned via tax havens in 2010, which represents more than 30% of the world GDP.

or OFC. Grilli (1989) provides preliminary evidence showing that bank secrecy influence location choices of cross-border deposits. Alworth and Andresen (1992) estimate a gravity model and find that tax differential between countries are a key determinant of bilateral deposit flows. Huizinga and Nicodème (2004) also suggest that the location of deposits is likely to be driven by tax evasion concerns and find that information exchange agreements do not foster cross-border deposits. Using the restricted dataset on cross-border banking from the BIS mentioned above, Johannesen (2014) take advantage of the enforcement of European Savings Directive in 2005 to assess to which extent cross-border deposits are motivated by tax evasion. He finds that deposits owned by EU residents in Swiss banks dropped by 30-40% when the new rule was introduced. Andersen et al. (2016) use the same data and show that an increase in the petroleum rents cause a significant increase in deposits in tax haven held by petroleum-rich countries with very weak political institutions ("autocratic rulers").

Masciandaro (2005) and Masciandaro et al. (2016) examine, both theoretically and empirically, the impact for a country or a territory of being blacklisted as a non-cooperative jurisdiction. Contrary to the "name and shame" intended effect, blacklisting attracts international banking activities. Similarly, Johannesen (2014) examine how bilateral treaties for exchange of bank information impact the amount of bank deposits. They find that when some tax havens commit to exchange information, this does not materialize in a repatriation of deposits; instead, the deposits shift to other tax havens not covered by a treaty.

2.1.3 MNE-level data

There is a sizable literature on international profit shifting using firm level data.[10] Papers specifically on tax havens show that low tax rates in such jurisdictions are associated with larger foreign investment and income shifting (Harris et al. (1993); Hines (1997); Grubert and Slemrod (1998) and Grubert and Slemrod (1998).[11] Dyreng et al. (2013) focus on the Delaware as a domestic tax haven. They find that US firms with subsidiaries in Delaware reduce their tax burden by between 15% and 24%. Desai et al. (2006a) adopt a broader approach and examine which firms do establish tax haven operations. Especially, it appears that among firms, the larger, the more productive ones and the ones with sizable foreign operations and a high R&D intensity are the most prone to have tax haven affiliates. Hebous and Lipatov (2014) show, additionally, that firms' investment in corrupt countries is positively related to having affiliates in tax havens.[12]

Demirgc-Kunt and Huizinga (2001) specifically examine the banking sector without, however, focusing on tax havens. Using bank level data for the period 1988-1995, they examine the taxation of domestic and foreign-owned banks in 80 countries, including several notorious tax havens (Hong Kong, Luxembourg, Panama, etc.). Most of all, they find evidence that foreign banks are engaged in extensive profit shifting.

In total, while there are more and more cross-country studies on tax havens and also some papers on tax evasion by MNEs, there is no paper which focuses on financial or banking sector at the microeconomic level, using individual data. Our present paper attempts to fill this gap.

[10] See, for instance, Clausing (2003) and Huizinga and Laeven (2008). For European evidence, see also Dischinger and Riedel (2011) and Vicard (2015).

[11] Differences in international corporate taxation do not impact only the location of foreign direct investment, but also transfer pricing, capital structure, dividend and royalty payments, or R&D.

[12] Other empirical works on MNEs and tax haven based on firm-level data include Gumpert et al. (2016), Johannesen et al. (2016) and Johannesen and Larsen (2016).

2.2 What do banks do in tax havens?

In this Section, we briefly document the activity of foreign banks in tax havens based on "grey literature" by the main intergovernmental organizations (OECD, IMF, BIS, FSB, FATF, etc.), NGOs (Tax Justice Network, Oxfam, etc.) and media. Our objective is to : 1) illustrate some components of their turnover, our dependent variable in the empirical part; 2) identify motivations for European banks to open foreign affiliates in these jurisdictions that we can empirically test; 3) describe the activity that our data do not capture.

Foreign banks open affiliates in tax havens to offer banking services to individuals and companies located in these jurisdictions. Opening a banking account offshore and associate it a with credit or debit card is legal. Residents use offshore accounts to hold income earned overseas that may have been taxed in the country of origin. In 2015, the year covered by our dataset, only the US had enforced the requirement for its residents to report their non-US financial accounts. For European countries, the automatic exchange of information allowing signatory countries to request financial account information on their residents for tax purposes started being enforced only in 2017 (OECD, 2014).[13] In sum, in 2015 European residents could hold funds offshore without reporting it to the domestic authorities.

The Panama Papers shed light on the widespread banking service offered in tax havens consisting in intermediating law firms and their clients to set up shell companies. These companies can take the legal status of International Business Corporation (IBC) which are limited liability companies set up in tax havens as subsidiaries of onshore companies or as independant companies to shift the profitable portion of a business to a low-tax jurdiction (Palan et al. 2014). Accord-

[13]The Foreign Account Tax Compliance Act (FATCA) was passed as part of the HIRE Act in 2010. Foreign financial institutions are encouraged to either directly register with the IRS to comply with the FATCA regulations or comply with the FATCA Intergovernmental Agreements (IGA) treated as in effect in their jurisdictions.

ing to the International Consortium of Investigative Journalists (ICIJ) working on the leaks of the Panamanian law firm Mossack Fonseca, in 2005, banks helped create 1,814 shell companies with the Panama-based firm, up from 543 two years earlier. The number of bank-created shell companies stayed high over the next few years.[14] In total the ICIJ investigation reports the creation of more than 15,000 shell companies by banks for their clients.

Another widespread practice consists in arranging special purpose vehicules (SPV); the offfshore affiliates act as brokers and arrangers by intermediating debt through SPV for their clients. For example, Bandaru (2014) describes the case of Vodaphone who purchased shares of special purpose vehicules (SPV) incorporated in the Cayman Islands that held the majority of stakes of an Indian Telecom company. As a result, capital gains accrued to the SPV. In this example, the offshore bank affiliate earns broking and arrangeing fees which adds to the turnover. Very often, the bank will also sell financial products and offer services to accompany their clients.[15] Ireland, the Netherlands and Luxembourg are preferred jurisdictions for non-resident securitization vehicles, a fact most probably due to the agglomeration effects of the specialized service providers located in these places (Aubry and Dauphin (2017)). A recent evolution in international financial flows is informative: SPV are recorded as FDI in the balance of payments; Lane and Milesi-Ferreti (2017) documented that the expansion of FDI between 2007 and 2015 was primarly explained by large gross positions in financial centers, among which positions are largely due to SPV.

The fact that off shore financial centers with lax regulation are home to SIV, conduits and other off-balance sheet vehicles has generated numerous questions about their role in the practice of regulatory arbitrage. Palan et al. (2013) argue that tax havens allow to escape supervision and

[14] "Banks hatched shell companies with Panama law firm", Financial Times, April, 5, 2016

[15] Online prospectus indicate that the financial services offered by offshore affiliates located in tax havens include all local administrative tasks and responsibilities that are necessary for a domicile, including providing directors, and the listing of the notes on the exchanges (Aubry and Dauphin (2017)).

regulation and as such represent a hole in the international regulatory architecture. Now it is important to point that our data allow us to track only a part of the financial avoidance practice. On the one hand, loans and deposits booked in tax havens are well captured in our data as they generate a revenue recorded in the turnover, our dependent variable. On the other hand, our income statement data do not capture the proprietary securitization used to transfer onshore assets offshore. One may argue that financial regulation avoidance is permitted by the off-balance sheet status of SIV, not their offshore location. Anyhow, it is important to bear in mind that our data are probably not sufficient to appropriately track these practices.

Last but not least, an allegedly defining characteristics of tax haven is secrecy. Beyond banks secrecy laws which make it illegal to report financial information, a lot of tax haven jurisdictions offer a lenient regulation environment allowing individuals or corporate to escape the laws, rules and regulations of home jurisdictions.[16] As a serious implication of secrecy is to facilitate laundering criminal proceeds, governments, mechanisms of automatic exchange of financial information are progressively implemented under the OECD's leadership.[17]

In total an accumulation of qualitative evidence suggest that tax and financial regulation avoidance schemes as well as secrecy are important drivers of foreign banks commercial presence in tax havens. The county-by-country data give us the opportunity to empirically test these different channels. In the following we present our database and some descriptive statistics.

[16] "A high level of bank secrecy is almost invariably used as a selling point by OFCs some of which have been (and are) exploited also for activities related to money laundering?" (Errico and Borrero (1999), p.10).

[17] A major step has been the country-by-country Reporting implying ax authorities will automatically exchange key indicators (such as profits, taxes paid, employees and assets of each entity) of Multinational Enterprise Groups with each other

3 Data

The Capital Requirements Directive IV of the EU imposed that from 1 January 2015, all European banking groups with a consolidated turnover above Eur 750 million are required to publicly share the activity of all their affiliates (subsidiaries and branches). More precisely, the public CBCR imposes banks to disclose information on a country-by-country basis together with their financial statements on the following items: turnover, employees, profit or loss before tax, tax on profit or loss, and public subsidies received.

In order to put together our dataset, we have extended a private database initially collected by CRMC on behalf of Oxfam from the financial statements of 20 banks in their annual reports. Our dataset extends it to the 36 largest EU banks in terms of assets.[18] The dataset is therefore cross-sectional and concerns year 2015. The 36 banks are located in 10 EU countries : Austria (1), Belgium (1), Denmark (1) France (5), Germany (7), Italy (3), Netherlands (3), Spain (4), and Sweden (4), United Kindom (6).

3.1 Descriptive statistics

The 36 banks employ 2.3 million people in 137 partner countries and record a total turnover of EUR 575 billion. Figure 6 plots the turnover disclosed by banks, broken down by location (foreign versus domestic). HSBC records the largest turnover of the sample (EUR 58 billion) and Helaba the smallest (EUR 2 billion). Table 1 displays descriptive statistics at the bank level: Banks have foreign affiliates in 1 to 68 countries. For instance, Lloyds declares activity in 7 partner countries while Société Générale declares activity in 68 different partner countries. On average, each bank

[18] ABN Amro, Banca Monte Dei Paschi di Siena, Banque Postale, Bayern LB BBVA, BFA, BNPP, BPCE, Crédit Agricole, Commerzbank, Crédit Mutuel, Deutsche Bank, Danske Group, DZ Bank, Este Group, Handelsbanken, Helaba, HSBC, ING, Intesa Saopaolo, KBC, La Caixa, LBBW, Lloyds, Nationwide, Nordea, Nordlb, Rabobank, RBS, Santander, Seb, SG, Standard Chartered, Swedbank, Unicredit.

reports activity in **35** partner countries with a large heterogeneity: some banks operate more abroad than in their own countries ((e.g., BBVA in Mexico, Santander in Brazil).

Table 1: Descriptive statistics at the bank level

Bank	**HQ location**	**Nb of countries**	**Foreign turnover**		**Domestic turnover**	**Foreign employees**		**Domestic employees**
			Mean	Max		Mean	Max	
ABN AMRO	NLD	15	108	332	6896	268	966	18112
BBVA	ESP	21	788	6983	6785	4926	38499	32903
BFA	ESP	2	64	128	5155	n.a.	n.a.	13558
BNPP	FRA	63	454	4950	14305	1977	17973	56981
BPCE	FRA	55	86	2548	19118	209	2796	91232
Banka Montei	ITA	6	20	53	4974	85	302	25201
Banque Postale	FRA	1	1	1	5744	n.a.	n.a.	4321
Barclays	GBR	37	520	8488	21090	2181	31221	48622
Bayern LB	DEU	4	55	128	2050	54	89	6223
CA	FRA	41	212	2790	9021	891	10348	37559
Caixa Bank	ESP	2	8	9	12666	14	17	29854
Commerzbank	DEU	10	298	1086	8082	938	6251	33925
Crédit Mutuel	FRA	14	198	1203	13535	926	7071	65828
DZ Bank	DEU	19	91	791	5738	227	1153	25123
Danske Bank	DNK	13	260	1007	7404	639	2021	10098
Deutsche Bank	DEU	52	349	6307	10510	1064	11368	45757
ERSTE Group	AUT	6	612	1409	2838	n.a.	n.a.	n.a.
Handelsbanken	SWE	16	101	577	2779	407	1904	7263
HSBC	GBR	57	782	14079	13602	3760	33062	44559
Helaba	DEU	4	59	109	1879	65	103	5460
ING	NLD	32	364	3123	5185	1229	9645	14586
Intesa Sao	ITA	29	149	780	19323	969	5035	61243
KBC	BEL	16	178	1197	3286	1024	7556	10646
LBBW	DEU	7	26	91	2636	36	71	9748
Lloyds	GBR	7	85	128	21780	157	316	87652
Nationwide	GBR	2	15	36	4226	41	60	16117
Nord LB	DEU	5	77	110	2491	88	208	5580
Nordea	SWE	16	495	2605	2893	1420	8288	6957
RBS	GBR	43	61	763	15161	681	14567	64567
Rabobank	NLD	36	115	1461	8873	330	3989	35041
SEB	SWE	20	172	604	4838	n.a.	n.a.	n.a.
SG	FRA	68	199	1710	12097	1232	16005	51612
Santander	ESP	35	1152	11720	5551	4676	44957	29838
Standard Chartered	GBR	56	238	2774	2736	1642	19731	1853
Swedbank	SWE	5	196	353	3107	1197	2303	7789
Unicredit	ITA	24	503	3452	9252	3833	17653	47865

In total, 175 foreign affiliates are located in 29 tax havens, i.e. the EU banks in our sample are absent from certain tax havens. For instance, the data report no commercial presence in Samoa and St Kitts Y Nevis that are recorded as tax haven in 9 lists, or in Barbados recorded in 8 lists. In turn, some banks have a commercial presence in Bahamas, Panama and Cayman Islands (which are recored in 9 lists), in Bermuda (recorded in 8 lists), or in Isle of Man, Jersey, Guernsey or Monaco (7 lists). In particular, 9 banks have affiliates in Jersey, 8 in Monaco and 7 in Guernsey or Mauritius. It is most probably due a sample bias because of the exclusive inclusion of European banks in the sample.

A last comment on the sample is necessary: the absence of activity in a jurisdiction or country is an insightful information that we would like to take into account. Therefore we extend the sample to include 227 countries where the absence of reporting is completed by a zero. In the next Section we will explain the empirical approach adopted to account for the zeros in the dependent variable.

In Appendix, we display additional descriptive statistics such as business ratios, country summary statistics and two cartograms scaled by GDP which emphasize a fair concentration of tax havens in Europe.

4 Specification and estimator

We analyze the determinants of banks' commercial presence abroad within a standard gravity framework and we rely on a the Poisson pseudo-maximum likelihood to account for zeros.

4.1 The baseline specification: the gravity model

The baseline turnover model is given by:

$$\begin{aligned} Turnover_{k,i,j} &= \exp(\alpha_k + \beta_1 \log(GDP_j^{percap}) + \beta_2 \log(Pop_j) + \beta_3 \log(dist_{i,j}) + \beta_4 Contig_{i,j} \\ &\quad + \beta_5 L_{i,j} + \beta_6 Colony_{i,j} + \beta_7 RTA_{i,j} + \beta_8 Territory_{i,j} + + \beta_9 GFC_j^{Dum} \\ &\quad + \beta_{10} GFC_j^{Rating}) + \varepsilon_{k,i,j} \end{aligned}$$

where the subscripts refer to the foreign affiliate of bank k with headquarter in country i that declares turnover in partner country j. The GDP per capita (GDP_j^{percap}) and the population in country j (Pop_j) are used as economic mass variables in the gravity specification. The corresponding variables in country i are not included because of the inclusion of headquarter fixed effects (see below). These data are collected from the World Factbook database provided by the Central Intelligence Agency (CIA).[19]

The standard gravity variables also include a set of bilateral country variables that proxy frictions. In the baseline specification, we include the geographical distance ($dist_{i,j}$) and dummy variables indicating the presence of a common border ($Contig_{ij}$), a common language (L_{ij}), a colonial relationship ($Colony_{i,j}$), the signature of a regional trade agreement ($RTA_{i,j}$), and that the partner country (j) is a dependent territory of country i ($Territory_{i,j}$). These variables, except $RTA_{i,j}$ and $Territory_{i,j}$, come from the CEPII distance database. Variable $RTA_{i,j}$ comes from de Sousa (2012) and variable $Territory_{i,j}$ is computed by the authors.[20] In the gravity specification, the distance is

[19]The World Factbook database is cross-sectional but covers a larger number of countries (i.e. sovereign states and dependent territories) than other databases as the one provided by the United Nations Statistics Division.

[20]The RTA database used by de Sousa (2012) has been updated by the author (http://jdesousa.univ.free.fr/data.htm). The database covers 1999 countries over the time period 1958-2015. In this paper, we can consider up to 228 partner countries while banks' headquarters are located in European Union (EU). Therefore, we rely on the RTA database provided by the World Trade Organization (WTO) to cover all the RTA between EU and the 228 partner countries considered in this paper.

considered to be the main friction so coefficient β_3 is expected to be negative. However, the effect of distance can be overestimated for neighboring countries because countries sharing a common border have generally more relationships. Coefficient β_4 associated with the contiguity dummy variable is therefore expected to be positive. Furthermore, the variables $L_{i,j}$, $Colony_{i,j}$, $Territory_{i,j}$ and $RTA_{i,j}$ are expected to positively affect the turnover. Indeed, the same official language makes the commercial presence easier as well as a relationship of former colony and the dependency from the controlling state. In addition, RTAs are meant to promote trade in goods and services activities, including financial services.[21]

In addition, GFC_j^{Dum} and GFC_j^{Rating} account for agglomeration economies due to financial infrastructures. We rely on the Global Financial Centres Index (GFCI) computed by the Z/Yen Group that provides profiles, ratings and rankings for financial centres. More precisely, we control whether the partner country has a financial centre classified as global in 2015 in the GFCI financial centre profiles.[22] The variable GFC_j^{dum} is a dummy variable equal to 1 if country j has a city classified among the global financial centres, and 0 otherwise. This first control draws from Park (1982) who distinguished primary off shore centers (OFC) such as London or New York which serve worldwide clientele and act as international financial intermediaries from secondary OFC such as Cayman Islands, Bahamas, Panama which are booking, collecting and funding centers. Furthermore, the global financial centres can record quite different ratings. For instance, New York and London have higher ratings than Paris. Therefore, we also control for the rating recorded by the the global financial centres. The variable GFC_j^{Rating} normalizes the ratings provided by the GFCI

[21]See the RTA database provided by the WTO (http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx) to have information on agreements that have been notified to the WTO.

[22]More precisely, we rely on the Global Financial Centres Index 18 (sept. 2015) and the Global Financial Centres Index 17 (march 2015). We identify countries that have a financial centre classified as global. These global financial centres can be "broad & deep", "relatively broad" or "relatively deep". 16 countries have a global financial centre: Belgium, Canada, China, Hong Kong, France, Germany, Ireland, Japan, Luxembourg, Netherlands, Republic of Korea, Singapore, Switzerland, United Arab Emirates, United Kingdom of Great Britain and the United States of America.

in 2015 to range between 0 and 1.[23]

Last, the model specification includes a headquarter fixed effect (α_k) to control for unobserved heterogeneity at the bank level.

4.2 The augmented specifications: accounting for tax havens

4.2.1 Which lists?

As much as Bermuda and the Cayman Islands are notable and uncontroversial examples of tax havens, there is unfortunately not one single official list of tax havens. In fact governments, international institutions, NGO and scholars identify tax havens along different criteria. While the European commission identified 30 jurisdictions in 2015 (European Commission, 2015, see *Oxfam for references*), Hines and Rice (1994) listed 41 major tax havens; last the list computed by the Tax Justice Network in 2009 included 60 jurisdictions.

In total, there are at least 10 lists of tax havens (FSI, OECD, UNCTAD, EP, EC, GAO, FTSE, IMF, BIS, EU investigations, TJN). Retaining too a large list would imply an over-estimation of the role of tax havens and too a small list would under-estimate it. In order to account for the

[23]There is a usual confusion between tax havens and offshore financial centers, i.e. financial places providing financial services to non-residents (OFC). For example, Switzerland is considered a tax haven (3 lists) and is ranked as 7th largest financial center ranked by banks' external assets (BIS, 2008). A lot of tax havens are indeed large OFC, by nature. Similarly the Netherlands is regarded a tax haven and it is one of the most prominent OFCs by different measures of capital flows. The Netherlands is similar to Luxembourg and Ireland, all can be considered a conduit center with large ingoing and outgoing capital flows related to activities of MNCs. However not all tax havens are OFC: for example Lebanon appears on 5 lists of tax havens but is not in the top 50 financial centers. In turn, some major OFC are not tax havens: United Kingdom and France are not on any list of tax haven and are ranked first and fourth largest financial center. Therefore controlling for the agglomeration economies in financial centers with a binary dummy could result in underestimating tax haven effects while not controlling for them would overestimate it (think of Switzerland).

different criteria, we estimate the following augmented specification :

$$\begin{aligned} Turnover_{k,i,j} &= \exp(\alpha_k + \beta_1 \log(GDP_j^{percap}) + \beta_2 \log(Pop_j) + \beta_3 \log(dist_{i,j}) + \beta_4 Contig_{i,j} \\ &+\beta_5 L_{i,j} + \beta_6 Colony_{i,j} + \beta_7 RTA_{i,j} + \beta_8 Territory_{i,j} + +\beta_9 GFC_j^{Dum} \\ &+\beta_{10} GFC_j^{Rating} + \beta_{11} TH_j) + \varepsilon_{k,i,j} \end{aligned}$$

with TH_j being alternatively:[24]

- TH_j^{Hines} : a dummy variable equal to 1 if country j is classified as tax haven by Hines and Rice (1994) and 0 otherwise;
- TH_j^{Count} : a count variable equal to the number lists of tax havens on which country j is recorded.
- TH_j^{Top15} : a dummy variable equal to 1 if country j is ranked in the top 15 of tax havens defined by OXFAM and 0 otherwise;

Next step is to investigate more precisely the factors related to tax havens.

4.2.2 Tax considerations

In order to test the factors related to tax differences, we estimate the following specification:

$$\begin{aligned} Turnover_{k,i,j} &= \exp(\alpha_k + \beta_1 \log(GDP_j^{percap}) + \beta_2 \log(Pop_j) + \beta_3 \log(dist_{i,j}) + \beta_4 Contig_{i,j} \\ &+\beta_5 L_{i,j} + \beta_6 Colony_{i,j} + \beta_7 RTA_{i,j} + \beta_8 Territory_{i,j} + +\beta_9 GFC_j^{Dum} \\ &+\beta_{10} GFC_j^{Rating} + \beta_{11} TR_j) + \varepsilon_{k,i,j} \end{aligned}$$

[24]Multiple British banks have different reporting standards regarding Jersey and Guernsey (together referred to as "the Channel Islands") and Isle of Man. Some report on the Channel Islands as one jurisdiction. Others also include the Isle of Man in this small group. This limits the way in which this research can draw conclusions regarding Jersey, Guernsey and the Isle of Man as three separate jurisdictions. In order to minimise these limitations and avoid double counting, we chose to gather the three islands into one jurisdiction as one tax haven.

where TR_j stands for four alternative tax rates. We first introduce the statutory corporate tax rates which are the most obvious and readily available measures of fiscal pressure on corporate profits (STR_j). However it often does not represent the tax cost of reporting income due to various deductions and specific tax schemes (Dharmapala, 2014).[25] As in previous empirical studies, we therefore rely on the actual tax rate, often referred to as "effective" tax rate (ETR). While previous works use the effective tax rate by US firms provided by the Bureau of Economic, we prefer ETR calculated by Dowd et al (2016) from firm-level tax forms because their data are available for a larger number of countries (50 and 71 respectively).[26] This second measure is ETR_j^{Downd}. As introducing ETR drastically reduces the number of countries to 71, we fill the gap by estimating missing ETR. This is our third tax rate, $ETR_j^{predict}$. More precisely, we run an ETR determination model including the statutory corporate tax rate and a vector of controls (see the details in Appendix). We rely on a sample of 80 countries and obtain a determination model with an R2 statistics of 40%. In a second step, we collect all available statutory corporate tax rates from different sources and we predict the missing ETR for a total of 138 countries (sources and results Table are displayed in Appendix). Last, we create a dummy ETR_j^{Dum25} which takes the value of 1 if country j's ETR is in the bottom quartile (the lowest tax rates). In total, the estimates will be run on a restricted sample of 71 countries and larger one including 138 countries as in the baseline Eq. (1). We can then safely compare the results of the augmented specification and exclude the risk of sample bias.

4.2.3 Governance index

Dharmapala and Hines (2009) have documented that tax havens are better-governed than comparable nonhaven. Low tax rates might not attract MNEs as "only better-governed countries can

[25] In November 2014 Luxembourg leaks (or Luxleaks) disclosed Luxembourg's tax rulings and tax avoidance for over three hundred multinational companies based in Luxembourg.

[26] We confirm that the two samples are consistent, which should not be surprising as the aggregate rates are calculated based on the same micro data. We use American data by default as the equivalent of the BEA data do not exist for European MNE. It implies assuming that European MNE face a similar ETR than American MNE.

credibly commit not to expropriate foreign investors [..] or "mismanage the economy". To build on this important finding, we create a dummy based on the governance index used in Dharmapala and Hines (2009) which takes the value of 1 when the country's governance is in the top quartile (the highest governance quality) and zero instead, Gov_j^{Dum75}. To make sure that we properly identify jurisdictions with a low tax rate combined with a high governance, we interact this binary dummy with ETR_j^{Dum25}.

$$\begin{aligned} Turnover_{k,i,j} &= \exp(\alpha_k + \beta_1 \log(GDP_j^{percap}) + \beta_2 \log(Pop_j) + \beta_3 \log(dist_{i,j}) + \beta_4 Contig_{i,j} \\ &\quad + \beta_5 L_{i,j} + \beta_6 Colony_{i,j} + \beta_7 RTA_{i,j} + \beta_8 Territory_{i,j} + + \beta_9 GFC_j^{Dum} \\ &\quad + \beta_{10} GFC_j^{Rating} + \beta_{11} TR_j + \beta_{12} Gov_j + \beta_{13} ETR_j^{Dum25} \times Gov_j^{Dum75}) + \varepsilon_{k,i,j} \end{aligned}$$

4.3 The Poisson pseudo-maximum likelihood

Our augmented sample includes 228 countries including a lot of null values of the dependent variable, turnover. To address this statistical issue, we rely on the Poisson pseudo-maximum likelihood (PPML) estimator. In fact the PPML estimator has three main advantages to estimate a gravity model. First, the PPML estimator does not require a log-linear specification of the gravity model. Consequently, the PPML estimator is consistent in the presence of heteroskedasticity, while estimators requiring a log-linear specification, as the OLS estimator, can be bias and inconsistent (Silva and Tenreyro (2006)).[27] Second, the PPML estimator provides a natural way to deal with zero values of the dependent variable. The PPML estimator assumes that the zero and non-zero

[27] Heteroskedasticity would result from the log transformation of the original nonlinear gravity model used to get a linearized form. Consequently, this kind of heteroskedasticity does not only affect OLS standard errors but also OLS parameter estimates. As a result, OLS estimates might be biased and inconsistent. Alternatively, the PPML estimator provides consistent estimates of the original nonlinear gravity model (Silva and Tenreyro (2006)).

observations are produced by the same data generating process.[28] In other words, no observation is dropped to estimate the model and PPML estimates are not exposed to a sample selection bias. Conversely, OLS estimates, using log transformation of the dependent variable, imply to drop the zero observations and are particularly exposed to a sample selection bias. A simple strategy to deal with the zero observations might be to arbitrarily add a small positive number (usually 0.5 or 1) to all observations but such ad-hoc approach might perform poorly. Last, interpretation of estimated coefficients is straightforward; estimated coefficients are interpreted as elasticities for covariates entered in logarithms and as semi-elasticities for covariates entered in levels.[29]

For robustness check, we also consider the Negative Binomial Quasi-Generalised Pseudo-Maximum Likelihood estimator (NB QGPML) as suggested by Bosquet and Boulhol (2014).[30] This estimator is an alternative to the PPML estimator. More precisely, the NB QGPML estimator encompasses the Poisson assumption as a special case and might be more efficient when the dependent variable exhibit over-dispersion (i.e., the conditional variance of the dependent variable increases more than proportionally with the conditional mean).[31]

Last, we will also report the OLS estimates of the log-linear specification for the stake of comparison.

[28] Furthermore, note that the PPML estimator is consistent, as a PML estimator, even if the data are not Poisson-distributed.

[29] Note that estimated coefficients associated with dummy variables (as TH_j^{Hines} for instance) are not directly interpreted. The percentage change of the dependent variable when a dummy variable moves from 0 to 1 is given by $exp(\hat{\beta}) - 1$, where $\hat{\beta}$ is the estimated coefficients associated with dummy variable.

[30] The NB QGPML estimator proposed by Bosquet and Boulhol (2014) is scale invariante, contrary to standard NB QGPML estimators. Therefore, the NB QGPML estimator proposed by Bosquet and Boulhol (2014) can be applied to a continuous dependent variable (for which unit choice is arbitrary by definition).

[31] The PPML estimator assumes proportionality between the conditional variance and the conditional expectation of the dependent variable.

5 Results

5.1 The Baseline Specification

The first column of Table 3 reports the estimation results of specification (1) on the large sample of 228 countries.[32] The RESET test statistics value closed to zero confirms that the exponential specification is supported by the data.[33]

All variables are significant and the estimated coefficients have the expected sign except for the distance, $dist_{i,j}$, common language, $L_{i,j}$ and the global financial center dummy, GFC_j^{dum}. The estimate results obtained on the baseline sample including 138 countries reported in Table 4 confirm that the estimated coefficients are consistent.

The larger the economic size and the population of a country, the larger the local turnover booked by banks foreign affiliates. In addition, a common border, a former status of colony and a current status of dependent territory for country j all positively impact the reported turnover; the effect of a common language is probably already captured by the other three determinants, a fact that explains why this variable is not significant. A common regional trade agreement between both countries i and j is also found positively significant. Moreover, the more developed the financial infrastructures of countries j classified as global financial centers, the larger the local turnover booked by foreign affiliates. Note that the agglomeration effects are captured via the rating dummy, GFC_j^{rating} . Last, the finding of a not significant distance effect may be due to a sample bias including European banks.

What are the implications of not including country characteristics specific to tax havens? To gauge, we compute the abnormal turnover, i.e. a measure of the turnover amount not explained by

[32] In the following we comment the estimates on the largest sample only and display the results on the shortest sample including 138 countries (see Table 4)

[33] The comparison with RESET statistics reported in Table 6 showing alternative estimators suggests that the PPML estimator is consistent and more efficient than the OLS estimator.

our model. The computation of such measure is as follows:

$$AbTurnover_{k,i,j} = \frac{\widehat{\varepsilon_{k,i,j}}}{\widehat{turnover}_{k,i,j}}$$

where $\widehat{\varepsilon_{k,i,j}}$ stands for the residuals and $\widehat{turnover}_{k,i,j}$ of estimated values of turnover both taken from specification (1). We then compute the mean and median value of $AbTurnover_{k,i,j}$ by country j:

$$AbTurnover_j = \sum_{k=1}^{35} \frac{AbTurnover_{k,i,j}}{35}$$

The mean value of $AbTurnover_j$ is 0.92 with a standard deviation of 1.47, a result that indicates a large dispersion in the sample (see Table 3).[34] The median value is 0.3, i.e. lower than the mean, implying that the entries higher than the median are farther away from the median than the entries lower than it. Where does the right skewness come from? As we suspect that $AbTurnover_j$ captures omitted country characteristics, we compare the mean and median values calculated for the whole sample with their values calculated in tax haven only. Our suspicion are confirmed: in the tax haven, the mean and median values are significantly higher, 1.9 and 0.64 (with resp. t-stat for the mean and median tests of 2.4 and 2). It confirms that our specification fails to capture country characteristics related with tax haven attributes.

To be sure, we plot the top 10 values of $AbTurnover_j$ in Figure 5.1. We observe that 8 out of 10 countries are listed as tax haven.[35] In particular, the turnover reported by foreign affiliates in Luxembourg is 8.7 times higher than the prediction (and 7.4 times higher in Isle of Man and

[34] For illustration, the turnover booked by European banks affiliates in the United States is 17% higher than the prediction ($AbTurnover_{US} = 1.174$)

[35] We refer to one of the 10 lists used to construct TH_j^{Count} described in the previous Section .

Table 2: Analysis of abnormal turnover values

	Baseline Sample			Large Sample		
	All countries (138)	**TH def. by Hines** (26)	**Top 15** *TH* (14)	**All countries** (228)	**TH def. by Hines** (43)	**Top 15** *TH* (15)
Mean	0.9184	1.9063	1.9173	0.7077	1.5267	2.2442
Median	0.2951	0.6432	1.1102	0.1080	0.0182	1.1855
Mean test statistic ($p-value$)		2.39 (0.018)	1.69 (0.092)		2.33 (0.020)	2.14 (0.034)
Median test statistic ($p-value$)		2.03 (0.044)	2.52 (0.013)		−1.25 (0.214)	1.95 (0.053)

Note: OLS and quantile regessions are used to implement the mean test and the median test respectively. The standard errors used to implement the mean test and the median test are robust to heteroskedasticity (using the Huber/sandwich estimator). The null hypotheses are no difference in mean/median of abnormal turnover values between tax havens and non tax haven countries.

6.7 times higher in Guernsey). It is worth underlining that Luxembourg still ranks first even after controlling for its central geographic position in Europe and its financial development.

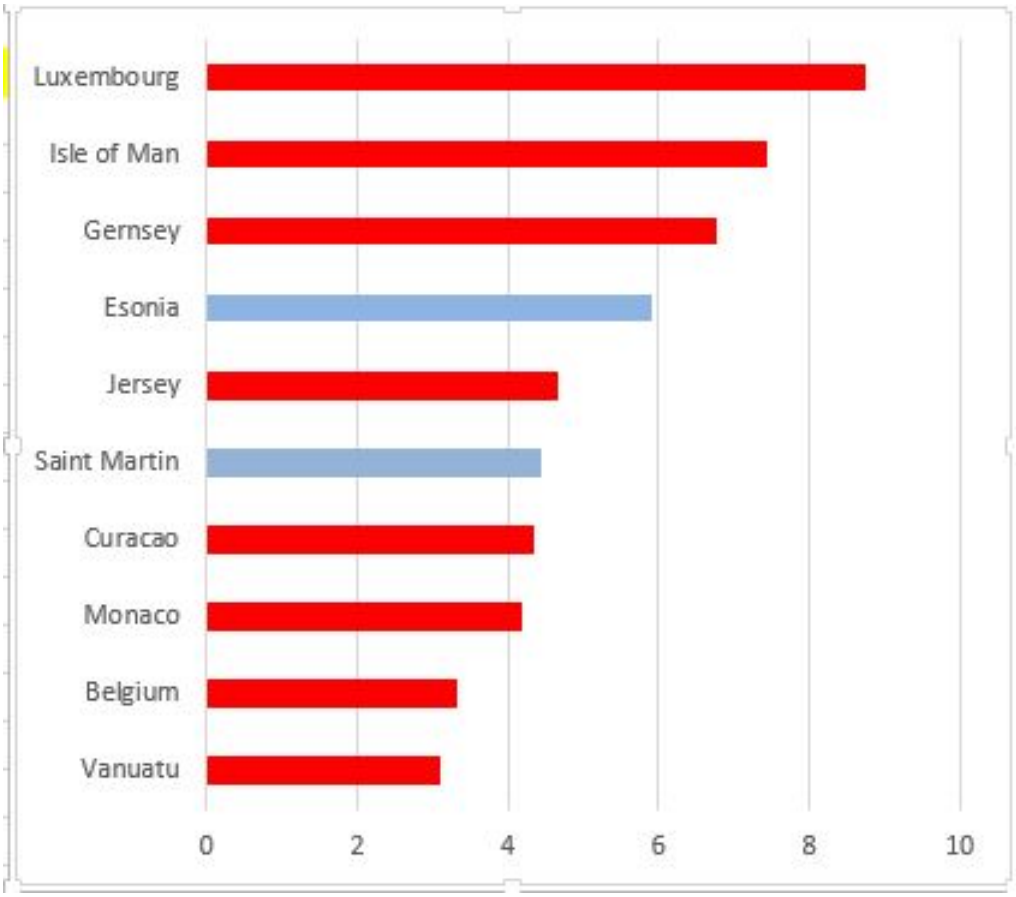
In sum, a first investigation of the drivers of commercial presence of banks in foreign jurisdictions suggest that omitting tax havens attributes implies mispecification. The commercial presence of European banks in these jurisdictions looks motivated by country characteristics related to tax havens attributes. In the following, we investigate more precisely the factors related to tax havens.

5.2 Introducing Tax Havens

Columns 2, 3 and 4 of Table 3 report the estimate results including three alternative dummies of tax havens.

The significance of the variables and the sign of the estimated coefficients are consistent with the aforementioned baseline estimate. Only exception is the global financial center dummy GFC_j^{dum} being significant with a negative estimated coefficient, contrary to expectations. Nevertheless in

Figure 1: Abnormal Turnover Ranking



total the combination of both estimated coefficients associated with GFC_j^{dum} and GFC_j^{rating} is positive, a consistent result confirming that the higher the financial development of a jurisdiction the larger the turnover reported by foreign banks affiliates.

The variable of interest, TH_j is significant and the estimated coefficient is positive in the three alternatives. The estimated coefficients associated with TH_j^{Hines} and TH_j^{Top15} in column 2 and 4 resp. are similar. In turn, the estimated coefficient associated with TH_j^{Count} is lower because it measures the marginal effect of being included in one additional list of tax havens. In sum, the estimates confirm that tax havens attract more commercial presence than non tax haven, once we control for standard factors. Now, we would like to understand what drives this extra activity in

tax havens.

Table 5 displays the estimates where we substitute the tax havens dummies with our four alternative tax rates. Note that we now estimate our model on the shorter sample including 138 countries because of a data availability constraint meaning that we still can compare our results with previous estimates. None of the four measures is significant, a result suggesting that a low tax rate is not sufficient to attract extra commercial presence of banks' affiliates. This conclusion may look at odd with the previous works on MNE data that low-tax jurisdictions attract investors. However it would be misleading to conclude that tax considerations are not driving banks activity abroad; in the following we control for the governance quality.

Table 6 displays the results of five alternative estimates including the governance dummy. While the tax and governance dummies are not significant when introduced separately, they become significant when we they interact (column 2 of Table 6. The sum of the three components is positive suggesting that combining low effective tax rates and high governance drives extra banking activity; however, a Wald test rejects the hypothesis that the sum is different from zero. In other words, accounting for governance adds some information but seems not enough to account for extra activity in tax havens. Adding a symmetrical dummy taking a value of 1 when country j's governance is in the bottom quartile does not change the wald test result but confirms that a poor governance diverts activity (the estimated coefficient is significant and negative). A last estimate interacting ETR_j^{dum25} with TH_j^{Hines} yields significant results. The Wald test confirms that the sum is different from zero. This last result suggests that there might be additional features beyond a high quality governance driving extra activity.

6 Conclusion

This paper uses public country-by-country reportings by the largest European banks to document the activity of banks in tax havens. Our empirical contributions are twofold: 1) we work with the largest possible sample of countries by exploiting the information on the absence of activity in some jurisidctions (228 countries); 2) we predict effective tax rates for a total of 138 countries; 3) we make sure that our results are not driven by sample biases when we explore additionnal channels by keeping stable sample size. In total our results uncover that tax havens attract extra banking activity beyond regular gravity factors. Low tax rates are however not sufficient enough to attract extra activity; a high quality governance is necessary but not sufficient to explain the extra activity. Future research is needed to document the other specific attributes attracting extra banking activity in tax havens.

Table 3: Baseline and augmented specifications on the large sample

Dependent variable:	$Turnover_{k,i,j}$		$Turnover_{k,i,j}$		$Turnover_{k,i,j}$		$Turnover_{k,i,j}$	
Estimator:	PPML		PPML		PPML		PPML	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
$\log(GDP_j^{percap})$	1.3205***	(0.1042)	1.3875***	(0.1039)	1.3780***	(0.0987)	1.3566***	(0.1027)
$\log(Pop_j)$	0.6177***	(0.0847)	0.7612***	(0.0758)	0.7562***	(0.0660)	0.7474***	(0.0739)
$\log(dist_{i,j})$	0.0693	(0.0835)	0.0660	(0.0858)	0.0168	(0.0810)	0.0401	(0.0856)
$Contig_{i,j}$	1.2495***	(0.4761)	0.8809	(0.5537)	1.1107**	(0.4784)	0.8594	(0.5492)
$L_{i,j}$	0.3276	(0.2430)	0.2719	(0.2477)	0.2963	(0.2354)	0.2454	(0.2475)
$Colony_{i,j}$	0.5781***	(0.1707)	0.6116***	(0.1771)	0.6319***	(0.1807)	0.6588***	(0.1823)
$RTA_{i,j}$	0.7802***	(0.2289)	0.9226***	(0.2056)	0.8924***	(0.2012)	0.8954***	(0.2077)
$Territory_{i,j}$	1.4418**	(0.6155)	1.4773***	(0.5677)	1.1006*	(0.6533)	1.5135***	(0.5838)
GFC_j^{Dum}	-0.4964	(0.3802)	-0.7958*	(0.4392)	-0.7309*	(0.3940)	-1.0154*	(0.5216)
GFC_j^{Rating}	1.5295***	(0.5485)	1.4764**	(0.5777)	1.5106***	(0.5504)	1.7116***	(0.6280)
TH_j^{Hines}			0.9861***	(0.3613)				
TH_j^{Count}					0.1789***	(0.0663)		
TH_j^{Top15}							1.0581**	(0.4156)
No. obs.	7912		7912		7912		7912	
No. positive obs.	811		811		811		811	
No. partners	228		228		228		228	
No. Tax Havens	-		43		56		15	
Log Likelihood	-394278		-386592		-386345		-385348	
BIC	788959		773597		773103		771110	
R2	0.2949		0.3035		0.3174		0.3055	
pseudo-R2	0.6191		0.6265		0.6268		0.6277	
RESET test	1.12		0.14		0.01		0.04	
$(p-value)$	(0.2895)		(0.7132)		(0.9995)		(0.8325)	

Note: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Heteroskedasticity robust standard errors (using Huber/White/sandwich estimator of variance) are in brackets.

Table 4: Baseline and augmented specifications on the small sample

Dependent variable:	$Turnover_{k,i,j}$		$Turnover_{k,i,j}$		$Turnover_{k,i,j}$		$Turnover_{k,i,j}$	
Estimator:	PPML		PPML		PPML		PPML	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
$\log(GDP_j^{percap})$	1.1330***	(0.1117)	1.2074***	(0.1083)	1.1985***	(0.1035)	1.1860***	(0.1056)
$\log(Pop_j)$	0.5493***	(0.0874)	0.6766***	(0.0789)	0.6776***	(0.0685)	0.6721***	(0.0769)
$\log(dist_{i,j})$	0.0626	(0.0837)	0.0575	(0.0845)	0.0165	(0.0796)	0.0323	(0.0842)
$Contig_{i,j}$	1.2657***	(0.4835)	0.9526*	(0.5461)	1.1429**	(0.4825)	0.9183*	(0.5434)
$L_{i,j}$	0.2614	(0.2433)	0.2230	(0.2460)	0.2351	(0.2355)	0.1991	(0.2462)
$Colony_{i,j}$	0.5932***	(0.1678)	0.6180***	(0.1734)	0.6408***	(0.1776)	0.6578***	(0.1779)
$RTA_{i,j}$	0.7057***	(0.2246)	0.8314***	(0.2010)	0.8154***	(0.1959)	0.8104***	(0.2031)
$Territory_{i,j}$	1.1979*	(0.6232)	1.2703**	(0.5725)	0.9440	(0.6463)	1.2946**	(0.5809)
GFC_j^{Dum}	-0.5036	(0.3847)	-0.7530*	(0.4387)	-0.7092*	(0.3984)	-0.9477*	(0.5178)
GFC_j^{Rating}	1.6849***	(0.5570)	1.6226***	(0.5780)	1.6519***	(0.5553)	1.8124***	(0.6219)
TH_j^{Hines}			0.8176**	(0.3489)				
TH_j^{Count}					0.1565***	(0.0645)		
TH_j^{Top15}							0.9079**	(0.4077)
No. obs.	4762		4762		4762		4762	
No. positive obs.	811		811		811		811	
No. partners	138		138		138		138	
No. Tax Havens	-		26		32		14	
Log Likelihood	-382104		-376758		-375973		-375613	
BIC	764589		753906		752336		751616	
R2	0.2970		0.3044		0.3180		0.3066	
pseudo-R2	0.5726		0.5785		0.5794		0.5798	
RESET test	0.08		0.31		0.98		0.58	
$(p-value)$	(0.7764)		(0.5749)		(0.3228)		(0.4458)	

Note: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Heteroskedasticity robust standard errors (using Huber/White/sandwich estimator of variance) are in brackets.

Table 5: Specification with ETR

Dependent variable:	$Turnover_{k,i,j}$		$Turnover_{k,i,j}$		$Turnover_{k,i,j}$		$Turnover_{k,i,j}$	
Estimator:	PPML		PPML		PPML		PPML	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
$\log(GDP_j^{percap})$	1.1278***	(0.1383)	1.1501***	(0.1902)	1.1031***	(0.0968)	1.1329***	(0.1254)
$\log(Pop_j)$	0.4777***	(0.1126)	0.5398***	(0.0639)	0.5084***	(0.0709)	0.5496***	(0.0767)
$\log(dist_{i,j})$	0.0644	(0.0922)	0.0610	(0.0865)	0.0435	(0.0876)	0.0626	(0.0828)
$Contig_{i,j}$	1.1808**	(0.5411)	1.2654***	(0.4805)	1.2398***	(0.4637)	1.2652**	(0.4920)
$L_{i,j}$	0.2612	(0.2639)	0.2722	(0.2245)	0.3302	(0.2286)	0.2613	(0.2370)
$Colony_{i,j}$	0.6852***	(0.2606)	0.5871***	(0.1798)	0.5602***	(0.1741)	0.5933***	(0.1716)
$RTA_{i,j}$	0.5403**	(0.2675)	0.7065***	(0.2281)	0.7369***	(0.2414)	0.7061***	(0.2043)
$Territory_{i,j}$	-0.2234	(1.0240)	1.2070**	(0.6581)	1.2082*	(0.6246)	1.1986**	(0.5807)
GFC_j^{Dum}	-0.6041	(0.4975)	-0.5001	(0.3839)	-0.5282	(0.3706)	-0.5040	(0.4012)
GFC_j^{Rating}	1.7645**	(0.7808)	1.6867***	(0.5515)	1.7026***	(0.5520)	1.6852***	(0.5816)
ETR_j^{Downd}	0.7542	(1.3058)						
$ETR_j^{predict}$			0.6824	(4.0521)				
STR_j					1.5496	(1.2756)		
ETR_j^{Dum25}							0.0016	(0.2772)
No. obs.	2282		4762		4762		4762	
No. positive obs.	621		811		811		811	
No. partners	71		138		138		138	
No. Tax Havens $(TH_j^{Hines}=1)$	10		26		26		26	
Log Likelihood	-329899		-382061		-380625		-382103	
BIC	660138		764512		761641		764597	
R2	0.1852		0.2962		0.2947		0.2970	
pseudo-R2	0.4599		0.5726		0.5742		0.5726	
RESET test $(p-value)$	0.02 (0.8952)		0.16 (0.6934)		0.37 (0.5413)		0.09 (0.7616)	

Note: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Heteroskedasticity robust standard errors (using Huber/White/sandwich estimator of variance) are in brackets.

Table 6: Specifications with ETR, governance and tax havens

Dependent variable:	$Turnover_{k,i,j}$		$Turnover_{k,i,j}$		$Turnover_{k,i,j}$		$Turnover_{k,i,j}$		$Turnover_{k,i,j}$	
Estimator:	PPML		PPML		PPML		PPML		PPML	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
$\log(GDP_j^{percap})$	1.0453***	(0.1262)	1.2117***	(0.1290)	1.1208***	(0.1319)	1.2789***	(0.1192)	1.2636***	(0.1173)
$\log(Pop_j)$	0.5389***	(0.0813)	0.5621***	(0.0757)	0.5594***	(0.0736)	0.6475***	(0.0791)	0.6363***	(0.0790)
$\log(dist_{i,j})$	0.0769	(0.0840)	0.0474	(0.0823)	0.0431	(0.0809)	0.0622	(0.0824)	0.0630	(0.0818)
$Contig_{i,j}$	1.2936**	(0.5095)	1.0710**	(0.5012)	1.0693**	(0.4848)	0.9729*	(0.5272)	0.9555*	(0.5203)
$L_{i,j}$	0.2430	(0.2392)	0.2282	(0.2320)	0.2079	(0.2286)	0.2677	(0.2401)	0.2045	(0.2369)
$Colony_{i,j}$	0.5736***	(0.1761)	0.6263***	(0.1786)	0.6415***	(0.1770)	0.5830***	(0.1722)	0.6189***	(0.1773)
$RTA_{i,j}$	0.6835***	(0.2109)	0.6674***	(0.2058)	0.6281***	(0.2068)	0.7495***	(0.2042)	0.7552***	(0.2010)
$Territory_{i,j}$	1.1495	(0.7530)	0.9134	(0.7093)	0.8876	(0.6984)	1.1071**	(0.5536)	1.0287*	(0.5544)
GFC_j^{Dum}	-0.5213	(0.3951)	-0.6968	(0.4270)	-0.7297*	(0.4294)	-0.7038	(0.4342)	-0.7500*	(0.4427)
GFC_j^{Rating}	1.6320***	(0.5762)	1.7039***	(0.6204)	1.7304***	(0.6217)	1.4889**	(0.6032)	1.5067**	(0.6090)
ETR_j^{Dum25}	-0.0164	(0.2799)	-1.7484***	(0.3614)	-1.7637***	(0.3671)	-0.6306**	(0.2481)	-0.9561***	(0.3255)
$Gouv_j^{Dum75}$	0.2255	(0.1752)	-0.0632	(0.2238)	-0.0965	(0.2258)				
$ETR_j^{Dum25} * Gouv_j^{Dum75}$			2.0527***	(0.5072)	2.0904***	(0.5122)				
$Gouv_j^{Dum25}$					-1.0254***	(0.3183)				
TH_j^{Hines}							1.2495***	(0.3231)	-0.6505	(0.4641)
$ETR_j^{Dum25} * TH_j^{Hines}$									2.2835***	(0.5920)
Wald test:										
$ETR_j^{Dum25} + ETR_j^{Dum25} * Gouv_j^{Dum75} = 0$			0.83 (0.3630)		0.97 (0.3239)					
$ETR_j^{Dum25} + ETR_j^{Dum25} * TH_j^{Hines} = 0$									6.01 (0.0143)	
No. obs.	4353		4353		4353		4762		4762	
No. positive obs.	787		787		787		811		811	
No. partners	130		130		130		138		138	
No. Tax Havens ($TH_j^{Hines} = 1$)	21		21		21		26		26	
Log Likelihood	-377634		-370090		-366078		-374215		-371658	
BIC	755654		740573		732558		748828		743723	
R2	0.2954		0.3013		0.3068		0.3040		0.3058	
pseudo-R2	0.5698		0.5784		0.5830		0.5814		0.5842	
RESET test ($p-value$)	0.38 (0.5363)		0.05 (0.8301)		0.49 (0.4841)		0.18 (0.6673)		0.40 (0.5274)	

Note: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Heteroskedasticity robust standard errors (using Huber/White/sandwich estimator of variance) are in brackets.

Table 7: Robustness check: alternative estimators

Dependent variable:	$Turnover$		$Turnover$		$\log(1+Turnover)$		$\log(1+Turnover)$		$\log(Turnover)$		$Turnover$	
Sample:	Baseline		Large		Baseline		Large		Positive obs.		Positive obs.	
Estimator:	NB QGPML		NB QGPML		OLS		OLS		OLS		PPML	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
$\log(GDP_j^{percap})$	1.3260***	(0.0905)	1.5760***	(0.0885)	0.2498***	(0.0186)	0.1799***	(0.0115)	0.3220***	(0.0829)	0.6746***	(0.1194)
$\log(Pop_j)$	0.6713***	(0.0543)	0.7788***	(0.0496)	0.1498***	(0.0114)	0.0867***	(0.0052)	0.2043***	(0.0412)	0.3851***	(0.0668)
$\log(dist_{i,j})$	-0.0096	(0.0727)	-0.0272	(0.0731)	-0.0970***	(0.0276)	-0.0595***	(0.0179)	-0.0376	(0.0646)	0.1491*	(0.0831)
$Contig_{i,j}$	1.2222***	(0.3738)	1.1660***	(0.3724)	0.4481*	(0.2452)	0.2661*	(0.1507)	0.9414**	(0.3763)	0.9499*	(0.5039)
$L_{i,j}$	0.1798	(0.2021)	0.2321	(0.2048)	-0.0172	(0.1096)	0.0395	(0.0715)	0.0406	(0.2017)	0.1730	(0.2267)
$Colony_{i,j}$	0.8065***	(0.1961)	0.8329***	(0.1999)	0.2891***	(0.1056)	0.1839***	(0.0692)	0.5244**	(0.2073)	0.4588**	(0.1819)
$RTA_{i,j}$	1.0390***	(0.1444)	1.1684***	(0.1385)	0.2864***	(0.0437)	0.1740***	(0.0308)	0.3097**	(0.1293)	0.4707**	(0.1874)
$Territory_{i,j}$	1.5766***	(0.3886)	1.9186***	(0.3838)	0.9157***	(0.2682)	0.5510***	(0.1705)	0.7364**	(0.3569)	0.4184	(0.5015)
GFC_j^{Dum}	-0.2712	(0.3476)	-0.2703	(0.3424)	0.2372	(0.2123)	0.5326**	(0.2201)	-0.1409	(0.2505)	-0.8033*	(0.4258)
GFC_j^{Rating}	1.0837**	(0.4877)	0.8924*	(0.4796)	2.4382***	(0.3589)	2.4321***	(0.3766)	1.4269***	(0.3593)	1.4864***	(0.5598)
TH_j^{Hines}	0.6531***	(0.2150)	0.8079***	(0.2056)	0.1257**	(0.0630)	-0.0169	(0.0358)	0.0501	(0.2231)	0.4553	(0.3747)
No. obs.	4762		7912		4762		7912		811		811	
No. positive obs.	811		811		811		811		811		811	
No. partners	138		228		138		228		137		137	
No. Tax Havens	26		43		26		43		25		25	
Log Likelihood	-168649		-150983								-226591	
BIC	337687		302380								453477	
R2					0.3321		0.3007		0.2697		0.2941	
RESET test	0.09 (0.7610)		1.12 (0.2905)		360.02 (0.0000)		481.68 (0.0000)		0.54 (0.4625)		12.37 (0.0004)	

Note: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Heteroskedasticity robust standard errors (using Huber/White/sandwich estimator of variance) are in brackets.

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Appendix

Additional descriptive statistics

Table 8 displays the activity of foreign affiliates broken down into non tax havens/ small and big tax havens. The small tax havens correspond to counties of less than 2 million people as in Hines and Rice (1994). 17% of the turnover recorded abroad was recorded in tax havens, while tax havens represent only 9% of the employees abroad, but 29% of the profit and 15% of taxes. More specifically, small tax havens represent 5% of the turnover recorded abroad, only 2% of the employment, 10% of the profits and 5% of the taxes.

Table 8: Bank activities in foreign countries

	Non havens (112)	Small havens (18)	Big havens (7)	Tax havens	Total Foreign
Turnover	229,216	13,639	34,959	48,598	277,814
In % of foreign	83%	5%	13%	18%	100%
Employees	1,108,140	22,649	83,460	106,109	1,214,249
In % of foreign	91%	2%	7%	9%	100%
Profits	53,983	7,656	14,492	22,147	76,130
In % of foreign	71%	10%	19%	29%	100%
Tax on profits	15,018	827	1,695	2,521	17,539
In % of foreign	86%	5%	10%	15%	100%
Turnover/GDP	0.2%	4.9%	1.9%	2.2%	0.3%
Turnover/Employees	21%	60%	42%	46%	23%
Profit/Turnover	24%	56%	41%	46%	27%
Profit/Employees	5%	34%	17%	21%	6%
Tax/Profit	28%	11%	12%	11%	23%

Note: Source : CbCR (2015). Sample : The 36 largest European banks. The sample includes only countries where European banks declare subsidiaries.

Table 9: Countries summary statistics

		Non havens	Small havens	Big havens
Panel A: Turnover >0				
Nb. countries		112	18	7
GDP (PPP, EUR bn)	Total	108,000	280	1,880
	Av.	963	16	268
	Percent.	98.0%	0.3%	1.7%
Pop. (thousand)	Total	6,500,000	5,479	44,200
	Av.	58,100	304	6,316
	Percent.	99.2%	0.1%	0.7%
GDP/capita (EUR)	Total	16,615	51,104	42,534
	Av.	22,731	48,822	44,029
Panel B: All countries				
Nb. countries		185	35	8
GDP (PPP, EUR bn)	Total	112,000	308	1,880
	Av.	605	9	235
	Percent.	98.1%	0.3%	1.6%
Pop. (thousand)	Total	7,260,000	6,942	48,500
	Av.	39,300	198	6,064
	Percent.	99.2%	0.1%	0.7%
GDP/capita (EUR)	Total	15,427	44,369	38,763
	Av.	17,786	36,643	38,763

Note: Source : CbCR (2015). Sample : The 36 largest European banks. In Panel A, the sample includes only countries where European banks declare subsidiaries.

Figure 2 compares business ratios across jurisdictions. Productivity calculated as the turnover per employee is twice higher in big tax havens than in non tax havens and 3 times higher in small tax havens. The profit rate is 1.7 higher in big tax havens and 2.5 higher in small tax havens (Profit/Turnover). Last the implicit tax rate in tax havens is 2.5 times lower than in non tax havens (Tax/Profit).

Figure 2: Business ratios across jurisdictions

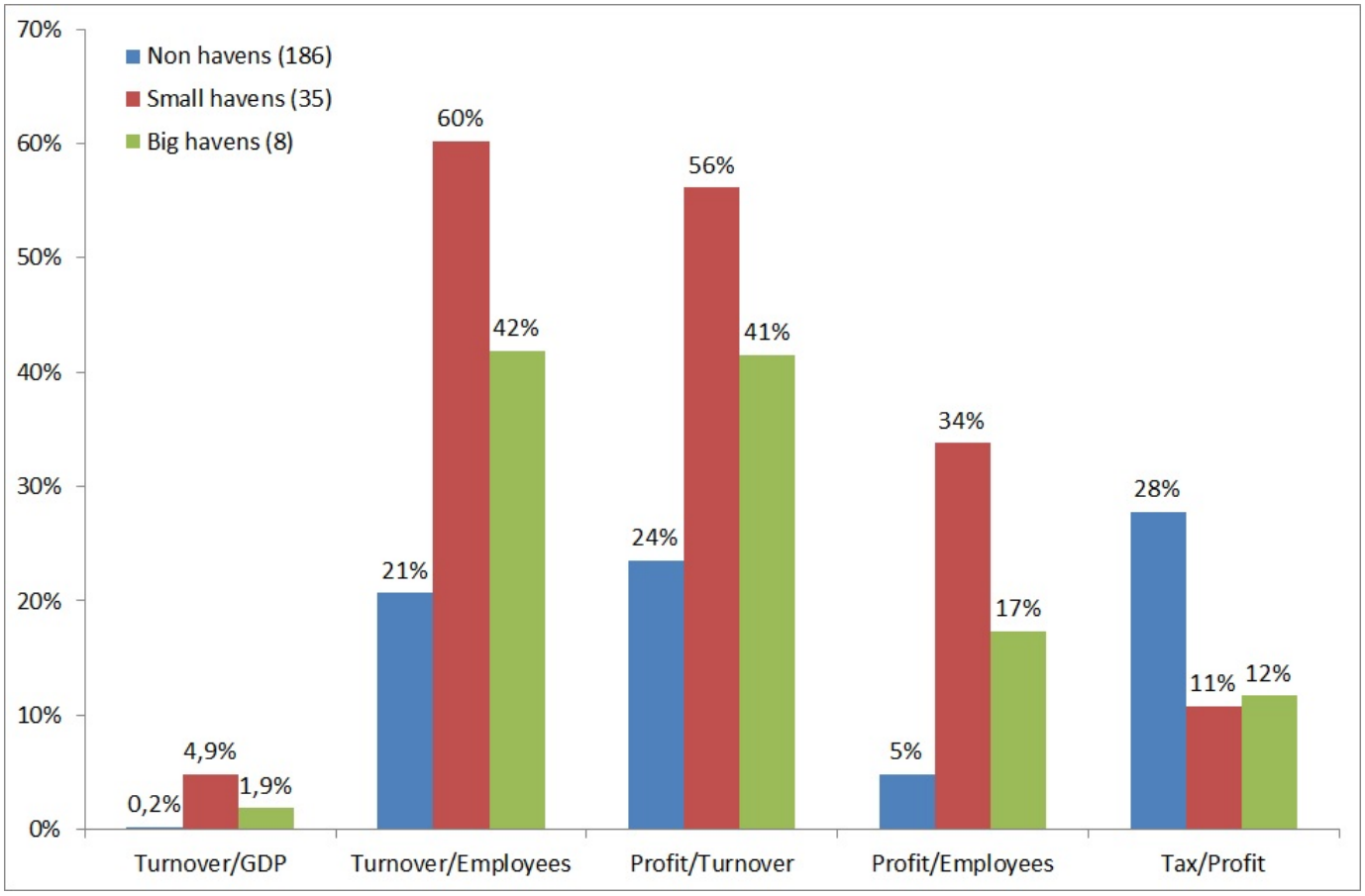


Figure 3: Turnover by banks

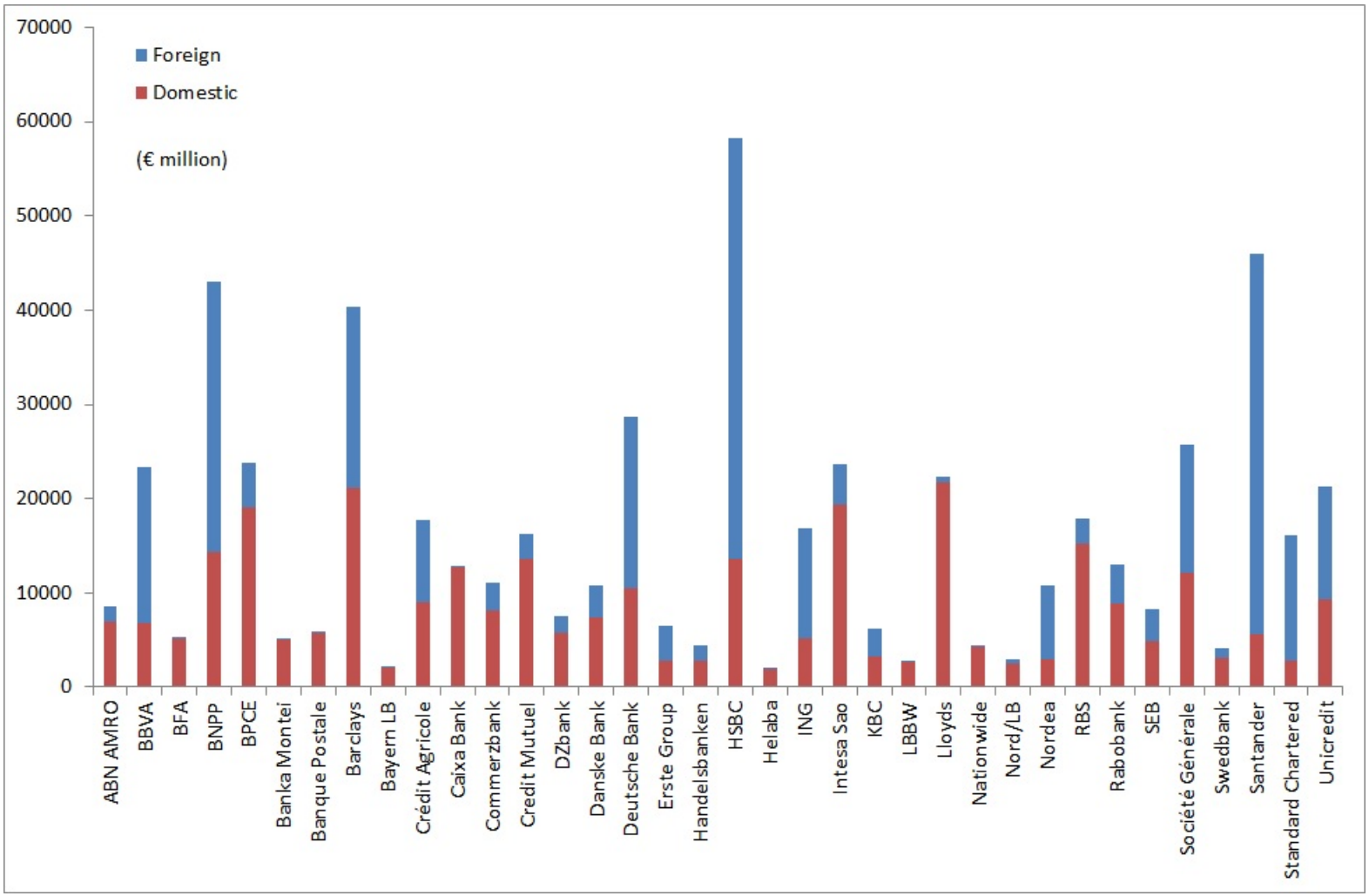


Figure 4: Cartogram: Worldwide View

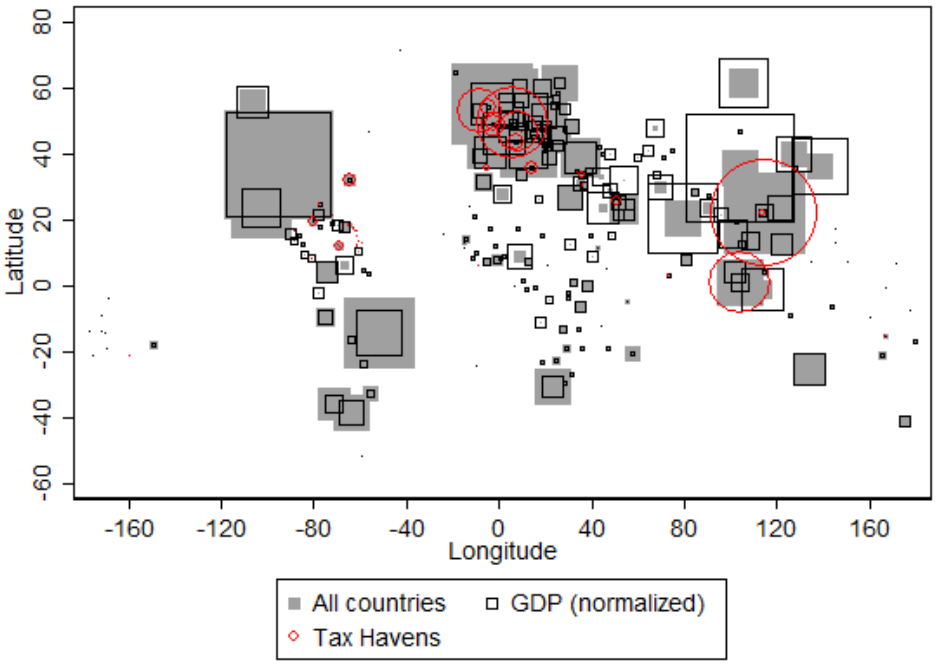
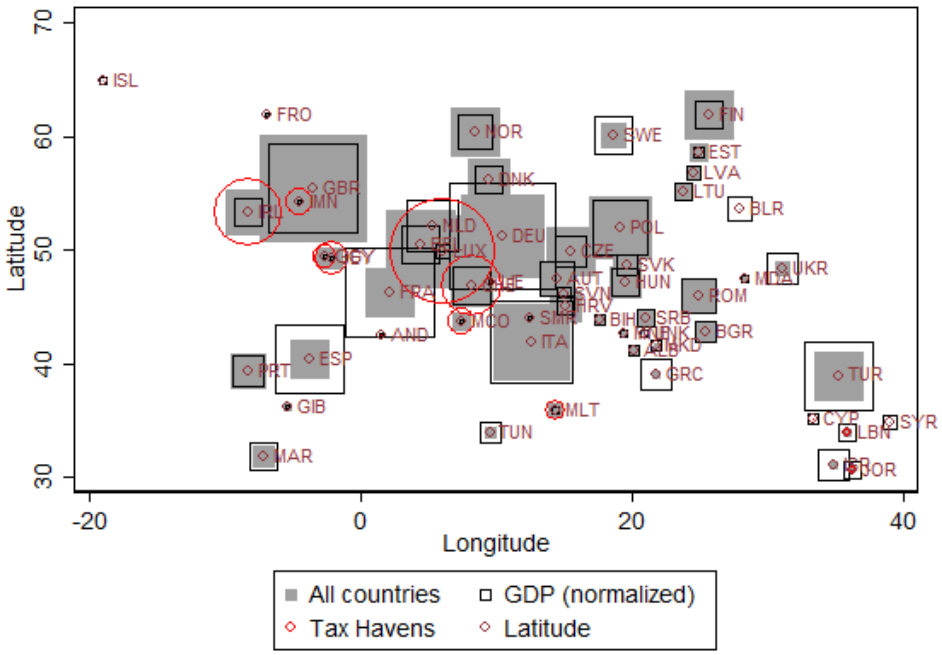


Figure 5: Cartogram: European View



Definitions

List of tax havens

The list of tax havens is derived from Hines and Rice (1994).

Andorra, Anguilla, Antigua and Barbuda, Bahamas, Bahrain, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Channel Islands (Jersey, Guernsey), Cook Islands, Cyprus, Dominica, Gibraltar, Grenada, Hong Kong*, Ireland*, Isle of Man, Jordan*, Lebanon*, Liberia*, Liechtenstein, Luxembourg*, Macao, Maldives, Malta, Marshall Islands, Monaco, Montserrat, Netherlands Antilles (Aruba, Curaao, Sint Maarten), Panama*, Saint Kitts and Nevis, Saint Lucia, Saint Martin, Saint Vincent and the Grenadines, Singapore, Switzerland*, Turks and Caicos Islands, Vanuatu.

Note: * Population $>$ 2 million.

Data definition

- $ETR_j^{Down d}$: We collect the data provided by Dowd et al. (2016). They calculate an average based on individual firm rates by dividing taxes paid by profits. They then create country-year average tax rates by taking the profit-weighted average of the firm-specific rates within a country and year.
- $GFCI_j$: The GFCI was created in 2005 and first published by Z/Yen Group in March 2007. The GFCI is updated and republished each September and March. It includes 84 financial centres. Using clustering and correlation analysis they determine a financial centre?s profile along 5 different dimensions of competitiveness: Business Environment, Financial Sector Development, Infrastructure, Human Capital and Reputational and General Factors.