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$$\frac{n!}{(n-1)!} p^{m-1} (1-p)^{n-m} = p \sum_{\ell=0}^{n-1} \frac{\ell+1}{n} \frac{(n-1)!}{(n-1-\ell)! \ell!} p^{\ell} (1-p)^{n-1-\ell} = p \frac{n-1}{n} \sum_{\ell=0}^{n-1} \left[\frac{\ell}{n-1} + \frac{1}{n-1} \right] \frac{(n-1)!}{(n-1-\ell)! \ell!} p^{\ell} (1-p)^{n-1-\ell} = p^2 \frac{n-1}{n} +$$

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Multinational Corporations and Tax Havens: Evidence from Country-by-Country Reporting

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Abstract:

A growing body of economics literature shows that multinational corporations (MNCs) shift their profits to tax havens. We contribute to this evidence by comparing a range of available data sets focusing on US MNCs, including country-by-country reporting data which has been released in December 2018 for the first time. With each of the datasets, we analyse the effective tax rates that US MNCs face in each country and the amount of profits they report. Using country-by-country reporting data, we have been able to establish that lower effective corporate tax rates are associated with higher levels of reported profits when compared with different indicators of real economic activity. This corresponds to the notion that MNCs often shift profits to countries with low effective tax rates – without also shifting substantive economic activity. Consequently, we identify the most important tax havens for US MNCs as countries with both low effective tax rates and high profits misaligned with economic activity.

JEL: C81, F21, F23, H25, H26

Keywords: Effective tax rate, profit shifting, tax haven, country-by-country reporting, multinational enterprise, foreign direct investment, tax competition

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1 Introduction

The existence and scale of profit shifting from countries where multinational corporations (MNCs) locate their production and retail operations to other countries, often labelled tax havens, where they report profit thanks to lower taxation, has been extensively discussed in economics literature. US-headquartered MNCs are a good example of such practices. As established by e.g. Clausing (2009), Zucman (2014), the United States Joint Committee on Taxation (2014) and Clausing (2016) using various methods, government revenue foregone due to profit shifting amounts to approximately one fifth of the US corporate tax base. In a related strand of research, Guvenen, Mataloni Jr, Rassier, and Ruhl (2017) find that profit shifting leads to an undercalculation of US GDP and go on to argue that the missing corporate profits should be reattributed from a small group of tax havens. While all of these studies rely on the US government's Bureau of Economic Analysis (BEA) survey of MNC data, Dowd et al. (2017) use confidential corporate tax returns to confirm the importance of profit shifting and show that reported profits are much more sensitive to tax rate changes in low tax countries than in high tax countries. However, data sets other than those provided by the BEA and the combinations thereof have thus far been seldom used in economics literature on US-headquartered MNCs.

To contribute to the existing body of academic literature as well as to ongoing policy discussions, we use the newly available country-by-country reporting (CBCR) data set released for the first time in December 2018 by the Internal Revenue Service (IRS). In contrast to other data sources, IRS CBCR includes the most reliable country-level information about MNCs' tax payments and profits to date; moreover, it covers an extensive range of countries, including tax havens often omitted from existing data sources. By design, the IRS CBCR data set does not suffer from a selection bias in country coverage since, for the first time, MNCs have been required to report on country-by-country basis for all countries worldwide where any given MNC has any economic activity. Although CBCR data are as not as detailed as previously discussed (Murphy, 2009, Murphy and Sikka, 2015, Wójcik, 2015), they constitute an improvement in comparison with existing data sources in at least some aspects, including e.g. the quality of tax payment information and country coverage. Furthermore, while De Simone and Olbert (2019) use other already existing data to show that the requirement for large MNCs to share their CBCR data with governments has already had its effect on MNCs' transparency, even prior to the publication of CBCR data, this paper aims to provide the first evidence of the effective tax rates of MNCs using the newly published IRS CBCR data set itself.

This study utilizes IRS CBCR data to answer two interrelated research questions. First and foremost, we aim to establish which tax havens are most important for US-headquartered MNCs. We define most important tax havens as countries where US-headquartered MNCs pay low effective tax rates (ETRs) while reporting large amounts of profits and little economic activity (misaligned profit). The primary research question will be answered in three steps. First, we estimate ETRs, calculated as ratios of taxes and gross income. Second, we quantify the scale of misaligned profit, measured as the profits lacking proportionate economic activity in terms of assets, revenue or employees; using newly available CBCR data, we then revisit questions of profit shifting scale and destinations as practiced by US MNCs. In the third step, we examine

the relationship between ETRs and misaligned profits to test whether more misaligned profits are reported in countries with lower effective tax rates, thus indicating key tax havens.

Examining both ETRs and misaligned profits as well as their relationship makes good sense since, we argue, they are two sides of the same coin. On the one hand, countries compete with each other to attract MNCs' reported profits by lowering their ETRs. A country's ETR can thus be used as a proxy of its tendency to attract foreign profits. On the other hand, a country's success in attracting profits can be measured by the misaligned profits reported in that country. While both measures are the result of interactions between MNCs, the country in question and other countries, we argue that enabling low ETRs is primarily at the governments' discretion while reporting profits without proportionate economic activity is ultimately due to the MNCs' actions. Both ETRs and misaligned profits have been studied before, but few studies have focused on their interrelationship. Profit shifting studies typically use only one data source, such as the BEA for US MNCs, and the opportunity to combine several suitable datasets has thus far been significantly underexploited.

Our secondary research objective aims to identify how the new IRS CBCR data set differs from existing data sets. We answer this question both conceptually and empirically while providing answers to our primary research question throughout the paper. We compare IRS CBCR to other available relevant data sources in terms of basic variables included in the data as well as using the estimated indicators of ETRs and misaligned profits. Examined data sources include the BEA's and Eurostat's foreign affiliate statistics, controlled foreign corporation data provided by the IRS and two private databases which include company balance sheet information, Bureau van Dijk's Orbis and Standard & Poor's Compustat. Comparing these data sets with IRS CBCR is of interest due to the arguably superior quality of country-level information about MNCs' tax payments and profits as well as the better country coverage found in the IRS CBCR data set; we will show exactly how much the various data sets differ.

By exploiting a variety of available data sources, we reach several consistent findings that we briefly preview here. While strong correlation between individual datasets is generally the case, we also highlight important conceptual and statistical differences between the data sources: for example, the extent of this correlation differs across economic variables and country groups. We estimate effective tax rates and profit misaligned with economic activity and find a negative correlation between these two: the lower the effective tax rate, the higher the profits misaligned with economic activity. Indeed, across all data sets, we locate several countries with US MNCs activity which share a number of common characteristics. These tax havens exhibit low ETRs and high shares of profits in contrast with much lower shares of employee numbers and other indicators of economic activity.

By utilizing the findings outlined above, we aim to contribute to the existing body of literature in several ways. These intended contributions are described below.

Various kinds of ETRs have been designed by economists and accountants to shed light on corporate income tax rates actually applicable to MNCs. ETR values may be derived either from legislation or from actual data on companies' economic activities, including their profits and taxes. A basic distinction thus exists between so-called forward-looking (ex ante) law-based ETRs, which have been heavily used in relevant academic literature to date, and backward-

looking (ex post) MNC-data-based ETRs, such as the one we employ here (a more detailed recent comparative discussion of the two is provided by Janský, 2019). Through forward-looking ETRs, derived from hypothetical business models, are certainly useful for some purposes, they are less effective than backward-looking ETRs in the case of MNCs. Recent examples with good discussions of related literature have applied the forward-looking ETR methodology by Devereux and Griffith (2003) to EU member states (Spengel et al., 2014, the European Commission, 2018), G20 countries (Congressional Budget Office, 2017) and 36 OECD and other countries (Hanappi, 2018). However, since backward-looking ETRs depict the actual taxation of MNCs, they are capable of providing a good indication of the extent to which particular countries actually use low taxes to attract MNCs and this is also why we focus on backward-looking ETRs in this paper.

We follow the common approach of estimating ETRs as ratios of corporate income tax and gross income and apply this approach to all utilized data sources. Several existing studies have estimated ETRs using BEA data, including Bosworth, Collins, and Chodorow-Reich (2007), Stewart (2014), Clausing (2016), Cobham and Janský (2019), Wright and Zucman (2018) and Tørsløv, Wier, and Zucman (2018). For example, Desai, Foley, and Hines (2004) use BEA data to estimate ETR as the ratio of foreign income taxes paid to foreign pre-tax income for each affiliate and use the medians of these rates as country-level observations for each country and year. Mutti and Grubert (2004) estimate country average effective corporate income tax rates with another US-centred data source, the so called US Treasury Form 5471 by US controlled foreign corporations in manufacturing . Perhaps even more promising in terms of accuracy is the use of confidential corporate tax returns, as recently used to estimate ETRs by the Government Accountability Office (2008) and Dowd et al. (2017) for the United States, the latter using averages weighted by positive profits, with which we are able to compare our estimates.

In addition to ETRs, misaligned profits are a second key indicator used in this paper. We estimate the scale of misaligned profits as the profits lacking proportionate economic activity in terms of assets, revenue or employees. This is a similar but broader measure than profit shifting indicators commonly found in literature. Profit shifting by US MNCs has long been well recognised in economics literature (Hines and Rice, 1994, Grubert, 2012, Dowd et al., 2017, Guvenen, Mataloni Jr, Rassier, and Ruhl, 2017), including its transfer mispricing channel (Clausing 2003, Bernard, Jensen, and Schott, 2006, Flaaen 2017). Both US-centred (Clausing, 2009, Zucman, 2014, United States Joint Committee on Taxation, 2014) and cross-country estimates (Clausing, 2016, Tørsløv et al., 2018, Cobham and Janský, 2018, Janský and Palanský, forthcoming) agree that profit shifting is costly in terms of foregone revenue, in particular for the US government.

The relationship between profit shifting and ETRs has been somewhat less intensively studied. Using US data from the Internal Revenue Service, the Government Accountability Office (2008) shows that effective tax rates on US MNCs' foreign operations vary considerably by country and that ETRs correlate with the locations where income is reported. Wright and Zucman (2018) use BEA data to show that in sectors other than oil, the effective foreign tax rate has fallen by half since the late 1990s and that almost half of this decline results from the rise of profit shifting to tax havens. Relying on the same data source, Cobham and Janský (2019)

show a rough correlation between ETRs and misaligned profits. In contrast with these previous studies, we use the newly available and, in some respects superior, CBCR data to investigate this relationship.

Furthermore, to address our secondary research question, we aim to shed new light on the extent to which the IRS CBCR data is useful for studying ETRs and profits in tax havens. We would like to investigate whether the CBCR data in fact re-establish appropriate disclosure and ultimately the accountability of multinational corporations, as for example Cobham, Janský, and Meinzer (2018) have argued. OECD (2018) envisions that its Base Erosion and Profit Shifting (BEPS) Action 11 final report's key recommendation to collect aggregated and anonymised CBCR data will play an important role in supporting the OECD/G20 Inclusive Framework's ongoing work on BEPS measurement and monitoring. While OECD (2018, p. 42) stresses the usefulness of such data for governments, this paper focuses on contributing to academic research and to an evidence base for policy discussions. To paraphrase OECD (2018, p. 42), our aim is to provide researchers and the public with a more complete view of the global activities of the largest MNCs. We agree with OECD (2018, p. 42) that one of the major challenges associated with measuring profit shifting is that only limited information is available on the location of MNCs' income, taxes, and business activities and that CBCR represents a step forward in supporting the measurement of profit shifting with jurisdiction-specific information. We aim to estimate the scale of the improvement that the CBCR data represents by comparing it with other available data sources.

Last but not least, we aim to address important policy issues and thus contribute to ongoing discussions. Governments around the world and economists in policy forums at OECD and elsewhere have been recently dealing with the question of how taxing rights on income generated from cross-border activities in the digital age should be allocated among jurisdictions (OECD, 2019, p. 5). The OECD's latest proposals are divided into two groups and our work is relevant to both. According to OECD (2019, p. 6), the so-called Pillar One focuses on the allocation of taxing rights, and seeks to undertake a coherent and concurrent review of profit allocation and nexus rules. Pillar Two focuses on the remaining BEPS issues and seeks to develop rules that would provide jurisdictions with a right to "tax back" where other jurisdictions have not exercised their primary taxing rights or where payment is otherwise subject to low levels of effective taxation. While our misaligned profit estimates are relevant to profit allocation discussions in Pillar One, our effective tax rates estimates speak directly to low levels of effective taxation referred to in Pillar Two. Moreover, our results confirm how the two, misaligned profits and ETRs, or Pillars One and Two, are interrelated.

We structure the rest of the paper as follows. First, we describe and compare the data sources. We then introduce our methodology, focusing on the indicators of ETRs and misaligned profits. Third, we present our results, providing descriptive statistics and statistical comparisons of the various datasets as well as estimates of effective tax rates and misaligned profit and their relationship. Finally, we conclude and discuss policy implications.

2 Data

To contribute to the existing body of literature and answer our two research questions, we exploit a new dataset and its combinations with a range of previously utilized data sets. Most of these data sets are well-established sources for studying MNCs. BEA was recently employed and described by Wright and Zucman (2018), Eurostat by Tørsløv, Wier, and Zucman (2018), Compustat by Dyreng, Hanlon, Maydew, and Thornock (2017), data on US-controlled foreign corporations by Mutti and Grubert (2004), and Orbis by Garcia-Bernardo, Fichtner, Takes, and Heemskerk (2017). More general overviews of relevant data sources for the study of profit shifting of MNCs around the world and specifically in the US are provided by OECD (2015) and Keightley and Stupak (2015), respectively. In contrast, IRS CBCR has only recently been released and as such has hardly been used for any analysis, until autumn 2019 with the exception of social media (e.g. Setser, 2019). As of mid-October 2019, two other papers have used the data and both are concurrent to our paper and both are focused on the evaluation of recent policy proposals: one is by Cobham, Faccio, and FitzGerald (2019) and another one is by International Monetary Fund's (IMF) de Mooij, Liu, and Prihardini (2019). Given the relative lack of academic literature using and describing this new data set, IRS CBCR is introduced in more detail below.

2.1 Country-by-country reporting data

CBCR data on US-headquartered MNCs for 2016 was published only in December 2018 by the IRS. The following description of the data draws primarily on information available from the IRS (2019a) for the relevant Form 9975. It focuses on United States persons who constitute the ultimate parent entity of a United States multinational enterprise (US MNC) group with annual revenue for the preceding reporting period of over \$850 million. The filer must list the US MNC group's constituent entities, indicating each entity's tax jurisdiction, country of organization and main business activity, and provide financial and employee information for each tax jurisdiction in which the US MNC conducts business. Supplied financial information includes revenues, profits, income taxes paid and accrued, stated capital, accumulated earnings, and tangible assets other than cash. IRS CBCR data includes information on both income taxes paid (income tax paid on a cash basis) and accrued (total accrued current income tax expense recorded on taxable profits or losses, reflecting only operations in the relevant annual period and excluding deferred taxes or provisions for uncertain tax liabilities).

Several notable aspects of IRS CBCR data are worth discussing in greater detail. Having considered these aspects, we find the data suitable and insightful for the analysis at hand; however, we also expect qualitative improvements in future data releases. First, the data constitute a sample rather than a full sample since the tables released by the IRS state that "all figures are estimates based on a sample". This implies, as we learned from information provided by an IRS staff member, that filing by companies was not mandatory for that first reporting year of 2016 and only approximately three quarters of all relevant companies submitted the required information. Since it is not possible to establish which companies submitted the information and how representative or biased the sample might be, we would like to highlight this as a concern and a potential explanation of some of the differences observed below.

Nevertheless, we continue to work with the data as provided, assuming that the sample might be close to a representative or a full sample. Only data released in future years based on full samples will prove or disprove this assumption.

Second, IRS CBCR data do not include foreign controlled US corporations, which file country-by-country reports in a foreign country rather than in the US. However, these corporations are included, in another data source we use, i.e. the US Treasury Form 5471 on controlled foreign corporations. Even more promisingly, these corporations will be included in the CBCR data for large MNCs headquartered in other countries than the US, which are bound to be published in 2020.

A third specific feature of IRS CBCR data is its inclusion of a “stateless” option as one of the country categories. IRS instructions (2019a) and a follow-up clarification provide an explanations which we briefly sum up here. According to these instructions, in case an MNC group includes any stateless entities, these must be reported by the MNC. Also, any business entity that does not have a tax jurisdiction of residence is considered stateless (this could include income difficult to allocate to one specific country). These stateless entities include US—organized constituent entities that are fiscally transparent US business entities (perhaps including partnerships) as well as any other constituent entities of a US MNC group that do not have a tax jurisdiction of residence. The stateless category may include any amount of pass-through income which should have actually been reported in the US or in another country, where it would thus change the value of our estimated ETRs and misaligned profit. Future clarifications by the IRS should shed more light on what is included in this stateless category as it is an important category by the scale of income.

A fourth notable aspect is the past accumulation of earnings in foreign countries by US MNCs, in which cases taxation has been effectively deferred. IRS CBCR data include information on accumulated earnings (which are negative for some countries, i.e. accumulated losses). We understand the concept of accumulated earnings as overlapping with that of permanently reinvested earnings; furthermore, it is worth noting that with the passage of Public Law 115-97 both the accumulated earnings and any new earnings not taxed on a current basis will no longer need to be designated as permanently reinvested earnings (Joint Committee on Taxation, 2018). Permanently reinvested earnings constitute a financial accounting concept reflecting the cumulative amount of foreign earnings designated as “indefinitely reinvested” for which no accrued income tax expense is recorded on financial statements (Laplante and Nesbitt, 2017). In other words (Mock and Simon, 2010), if a firm has a plan in place (i.e. sufficient evidence) to retain unremitted earnings offshore indefinitely, the earnings may be designated as permanently reinvested earnings and the firm may defer recording the US income tax expense attributable to these foreign earnings until such earnings are repatriated back into the US, or until they are no longer considered indefinitely reinvested (otherwise the income tax expense attributable to deferred taxes on unremitted foreign earnings is to be recorded e.g. in filings to the SEC).

CBCR data released for US MNCs are a pioneering component of a worldwide effort. In 2020, the OECD is scheduled to publish aggregated CBCR data for large MNCs (as outlined in Annex C of a recent report by the OECD, 2018) and IRS CBCR data are a preliminary part of

that larger release. According to the OECD (2018), OECD/G20 Inclusive Framework members have agreed to provide three main data tables summarising information reported on CBCR according to jurisdictions where MNCs operate and the tax rates they face. IRS published the CBCR data using a similar structure featuring three main tables. Table A2 in the Appendix lists the table titles for comparison. Given the similarity, we can expect that CBCR data published by IRS are a good proxy for what might be published for other countries (the main difference likely being the lower number of MNCs and the related need to suppress more information for confidentiality reasons). Nevertheless, some differences are to be found as well. Two of the IRS tables contain a sectoral breakdown: IRS Table 1D provides the number of constituent entities by main business activities and IRS Table 2 reports the same breadth of information as IRS Table 1A by major industry group for a smaller number of specific countries. In contrast, IRS provides information by effective tax rate of multinational enterprise sub-groups in IRS Table 3, but lacks an overview of MNC activities based on the tax rate faced by whole MNCs, as discussed by OECD (2018) and expected as OECD Table 2. There are also other disadvantages. For example, the information is provided in aggregated form, although the data includes far more information than similar CBCR data for individual banks (Bouvatier, Capelle-Blancard, and Delatte, 2017, Janský, 2018) or extractive industry companies. Despite this, certain characteristics of the CBCR data make it the best available data set for some research questions. These characteristics include no double counting of related party dividend payments as well as the fact that a check-the-box election for foreign eligible entities does not affect their tax jurisdiction of residence of the foreign entity and thus has no impact on CBCR.

2.2 Other data sources

Additional data sources relevant to US MNCs are briefly compared in this section. Though we use all available data sources, some are used more frequently than others – for example, we consider IRS CBCR to constitute a preferred data set for our empirical analysis in a number of respects; on the other hand, Compustat has only limited use for us given the unavailability of country-level unconsolidated data. Table 1 below provides a brief comparison of the data sources relevant for US MNCs and Table A2 in the Appendix provides a more detailed overview of the various sources. For example, BEA provides a number of data series for income of MNCs. Its net income series includes double-counting as discussed by Clausing (2016), among others. In contrast, we choose two alternative measures that we distinguish as BEA (based on profit-type return and likely to underestimate profits) and BEA 2 (the best currently available measure developed by Clausing, 2019) in Table 1 and henceforth.

The various data sets differ conceptually with respect to the sample of companies included. Sample coverage and data source overlaps are outlined in Figure 1. The BEA and Eurostat data sets include the largest sample of US MNCs (they both include practically all of them). Separately from IRS CBCR, other data collected and published by the IRS is based on information about US persons with respect to controlled foreign corporations (CFCs) (IRS, 2019b). An IRS CFC includes a stratified random sample, oversampling large MNCs, of all US persons (e.g., corporations, individuals, trusts), similarly to data used by Grubert and Mutti (2000). Also, a future version of IRS CBCR should include all large US MNCs; this is reflected in Figure 1 (on the other hand, the currently available version, as discussed above, only provides

a sample). These four data sources (i.e. BEA, Eurostat, IRS CFC and IRS CBCR) in principle cover all MNCs and thus do not suffer from any sample selection bias. In contrast, Orbis does not guarantee a full or representative sample and, as systematically and empirically shown below, the opposite is sometimes true.

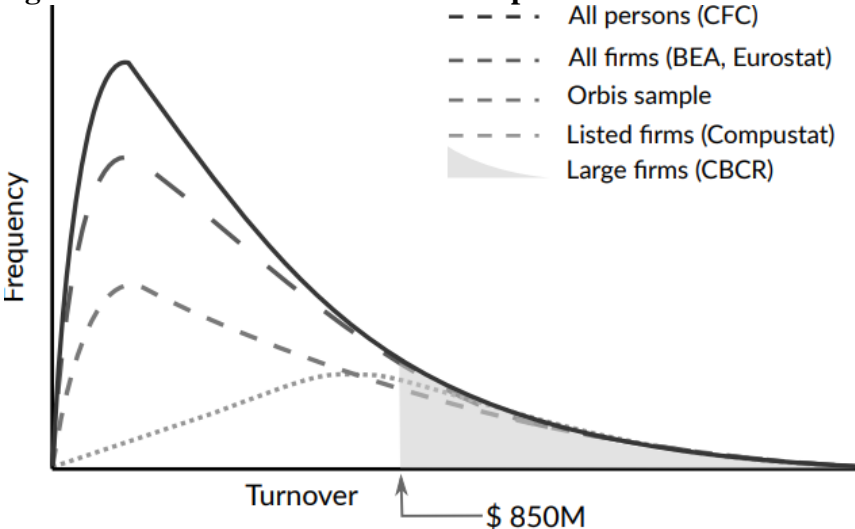
Table 1. Available data sources relevant to US MNCs

	Code in Figures	Sample	Profit variables – definitions	Tax variables – definitions
IRS CBCR	CBCR (all) and CBCR* (only with positive profits)	Large US-headquartered MNCs	Profits (profit or loss before income tax)	Income taxes paid and accrued (including deferred)
BEA	BEA	All US-headquartered MNCs	Profit-type return – net interest paid	Income taxes accrued
BEA 2	BEA 2	All controlled foreign corporations of US persons	The sum of net income divided by average parent ownership and foreign income taxes	Income taxes accrued
IRS CFC	CFC* (with positive profits)	Stratified random sample (oversamples large MNCs) and includes CFCs owned by persons	Current earnings and profits before income taxes	Income taxes
Eurostat	Eurostat	All US-headquartered MNCs	Gross operating surplus (value added with personnel costs excluded)	n. a.
Compustat	Compustat	Most large US publicly listed companies	Profits (profit or loss before income tax)	Income taxes paid and accrued (including deferred)
Orbis	Orbis (all) and Orbis* (only with profits)	Non-random subsample of all companies	EBIT is total profits without financial profits	Income taxes accrued

Source: Authors

The data sets also differ in the level of country reporting detail. While the private Orbis data set reports on all countries and jurisdictions where information is available, the government-supported data sets BEA, Eurostat, IRS CFC and IRS CBCR suppress or aggregate some countries' information, mainly for confidentiality reasons. Interestingly, IRS CBCR reports on a wider range of countries than BEA, including some small tax havens. In theory, the data sets could be combined to benefit from each others' conceptual strengths. For example, BEA might be compared with IRS CBCR to provide information on the properties of large MNCs while Orbis might be adjusted for coverage by combining it with either BEA or IRS CBCR. In turn, Orbis might be used as a source of its detailed ownership information in the form of the global ultimate owner of each entity, for which Orbis uses a threshold of 50% to determine legal ownership. Several such comparisons are tested in practice in the results section below.

Figure 1. US MNC data source overlaps



Source: Authors.

Note: This is an illustrative diagram only. For representation purposes, the distributions shown are less skewed than the empirical distributions.

A further challenge presented by all data sets is the difference between accounting and tax concepts of profit and tax. In line with balance sheet regulations and methodologies utilized by individual data sets, these data sources are based on financial accounting rather than on tax accounting. As a result, the data indicates amounts paid by MNCs in taxes according to financial accounting rather than amounts in fact paid and reported as such to a tax authority. It is important to distinguish between data on taxes paid according to financial or tax accounting, as they differ e.g. with respect to how they deal with carry-losses, deductions or depreciations. Tax and accounting literature on this topic is available, including a review of research in accounting for income taxes by Graham, Raedy, and Shackelford (2012), in which the authors argue that this is a complex area of financial reporting because the rules and principles that govern accounting principles are sometimes different from those that govern income tax reporting. Still, it is possible to measure the difference between the two concepts.

The leading indicator in this accounting literature is the book-tax conformity, which is a measure of the scale of alignment between tax and financial reporting. Proposals for increasing

book-tax conformity argue that the dual system in the US has enabled firms to simultaneously manage their taxable income downwards and their book income upwards. Hanlon and Maydew (2009) discuss the implications of this for MNCs. Their simulations, conducted using US data, indicate that, under book-tax conformity, the tax base would be broadened. Hanlon, Maydew, and Shevlin (2008) acknowledge that increasing book-tax conformity could curtail both earnings management and aggressive tax planning, but empirically find that it could also result in a decrease in how informative the firms' accounting earnings are. With financial reporting data limited to our data sources – and no information acquired on the basis of tax accounting – we are left with a potential bias in the data that we use for tax, but we cannot quantify or control that bias with the available data. The scale of this bias is hinted at in a recent paper that uses UK tax returns data and compares it with accounting data. Bilicka (2019) finds that the ratio of taxable profits to total assets reported by foreign multinational subsidiaries is half that of comparable domestic standalones and that the majority of the difference may be attributed to the fact that a higher proportion of foreign multinational subsidiaries report zero taxable profits. She documents how the estimated difference is related to profit shifting and shows that using accounting data leads to much smaller estimates of the difference.

In addition to the data sets used here, data sets with potentially relevant information on US MNCs do exist, but are not directly used in our paper for two different reasons. First, at least two data sources are available only to US government workers or US citizens with approved access: confidential firm-level information from the US governmental Bureau of Economic Analysis' foreign affiliate statistics (e.g. Blonigen, Oldenski, and Sly, 2014) and tax returns data from the IRS (e.g. Dowd et al 2017, whose estimates are used for comparison purposes below). These two data sources have a number of clearly advantageous characteristics (i.e. full, company-level data sample) which are discussed in detail in published research which does make use of them. However, since these data sources are not readily available to researchers and indeed are unavailable to foreign researchers (we do not have access to them), we do not include them in our comparisons. Second, IMF and United Nations Conference on Trade and Development each publish country-pair or country-level data on foreign direct investment. These foreign direct investment stocks only partly reflect the activities of US MNCs, since other investments such as private equity (Mesias, 2015, p. 17) or collective investment institutions (OECD, 2008, p. 23) are included in FDI statistics as far as their basic FDI criteria are met. For these reasons we consider the above mentioned data sources impractical for inclusion in our comparisons or empirical analysis.

3 Methodology

For each pair of examined data sets, we start by visualizing the correlation for each of our indicators: profits, taxes, revenue, number of employees and assets. This exercise enables us to understand which data sets are comparable and to detect outliers. We then analyse the difference in the total value of the indicators in selected geographic regions, which provides us with information about regions for which a given data set is most suitable. Next, we analyse ETRs and misaligned profit – described in detail in sections 3.1 and 3.2. These indicators are established in academic literature and fall into three groups of measures of tax burden, profits relative to economic activity and other, as discussed by OECD (2018). Finally, we analyse the

relationship between misaligned profit and ETRs. Various methodological dilemmas associated with examined indicators, emerging in the case of each of the data sets, are dealt with as systematically and openly as possible. For example, in the case of IRS CBCR data we have the option of either using the data set for all MNCs or only the data set for those with positive profit before income tax. While the former data set is more comparable with BEA, the latter might suffer from a practice where MNCs prefer to report losses in countries with high taxes, while locating their profits in countries with low taxes, which would bias the sample in favour of MNCs with positive profits only. On the other hand, the calculated ETRs of the latter dataset are more robust to yearly fluctuations. On balance, we use both data sets, but we adopt the latter as a standard for comparisons with other data sources.

3.1 Effective tax rates

We estimate ETRs at country level as an indicator of the amount of taxes paid by MNCs in various countries. We estimate ETRs as consistently as possible across a range of data sets. For example, in the case of Orbis, ETRs are calculated using the unconsolidated accounts of foreign entities of US MNCs, as described in Janský (2019), and in contrast to ETRs using consolidated company data as in, for example, Garcia-Bernardo, Janský, and Tørsløv (2019). For each US MNC affiliate in the Orbis data, we divide accrued corporate income tax by gross income to calculate their ETR. We then use a weighted average of these ETRs to arrive at a country-level ETR for all MNC affiliates in a given country. We estimate ETRs using unconsolidated company data for each country i and year t in the following way:

$$Effective\ tax\ rate_{it} = \frac{\sum Corporate\ income\ tax_{it}}{\sum Gross\ income_{it}},$$

where the sum of corporate income tax is the sum of unconsolidated taxes accounted for in the balance sheets of MNC affiliates located in country i . Also, the sum of gross income is the sum of these taxes and unconsolidated net income accounted for in the balance sheets of the MNC affiliates located in country i (definitions in the various data sets are detailed in Table 1 above and Table A2 in the Appendix). This provides us with a weighted average of the company-level ETRs of MNC affiliates located in country i . While we focus on a specific country i , the US (domestic), we also estimate ETRs for other countries i with available data (and presenting a weighted average of these in the results section (foreign) for comparison. For Orbis we carry out this aggregation from company- to country-level ourselves, whereas for BEA, IRS CFC and IRS CBCR we only have access to already aggregated country-level information.

ETRs estimated using unconsolidated data enable us to study how much the ETRs that US MNCs face differ across countries or from statutory tax rates (CIT). When compared with statutory rates, ETRs reveal the effect of tax deductions (including tax holidays and other *ad hoc* arrangements) and other tax provisions that co-determine tax paid by MNCs and how they differ across countries. For example, if an MNC affiliate makes use of tax incentives or is granted an advantageous tax ruling, then its ETR is bound to be lower than the statutory rate.

Effective tax rates also differ depending on whether taxes are accrued or paid. In financial accounting, the difference between the two corresponds to deferred taxes (accrued taxes that are not paid). US MNCs were taxed by the US government on their worldwide income, but they

were able to defer such taxes by keeping profits offshore (typically in conduit tax havens). According to IRS CBCR data, US MNCs deferred a total of \$14.9 billion in 2016, which reduces ETR from 18.9% to 17.4%. For other countries, the differences between ETRs calculated using tax paid and tax accrued are small (Figure A2 in the Appendix), since deferred taxes correspond to only a small fraction of all taxes. The relatively small difference might also result from deferred liabilities and assets offsetting each other when aggregated across MNCs.

3.2 Misaligned profit

The misaligned profit indicator shows the difference between the location of MNCs' profits and the location of those MNCs' economic activity. As such, it helps us shed light on the upper bound of profits which might be artificially shifted from where economic activity takes place to other countries. The methodological approach we employ here draws on Janský (2017) and builds on existing literature. For example, Tørsløv et al. (2018) use the ratio of pre-tax corporate profits (net of interest and depreciation) to employee compensation as their main profit shifting indicator. We use the misaligned profit measure as in Cobham and Janský (2019), which operationalises what the OECD stated when it launched its BEPS initiative in 2013 with the specific aim of reforming international corporate tax rules so that they “better align rights to tax with economic activity” (OECD 2013: 11). The following formula shows how we estimate MNCs' misaligned profit for each country i and year t :

$$\text{Misaligned profit}_{it} = \text{Share of economic activity}_{it} * \text{Total global profit} - \text{Profit}_{it},$$

where profit is gross profit (the sum of net income and income taxes, summed up from positive values of all companies in the case of company-level data) and total global profit is the sum of all profit across all countries. The share of economic activity is estimated using either revenues, tangible assets, number of employees, wages, or a combination of those indicators for the given country, divided by that indicator's global total.

Our estimation of misaligned profits enables us to simulate the distribution of profits in case they were allocated in line with the indicators of economic activity, commonly known as formula apportionment or unitary taxation. One of the most important reforms, the Common Consolidated Corporate Tax Base (CCCTB), was proposed by the European Commission (2011) and European Commission (2016). Under the CCCTB, economic activity is estimated as one-third tangible assets, one-third sales, and one-third split equally between compensation costs and a number of employees. Let us make two brief notes on how we operationalise the CCCTB estimates. In the case of sales we use information on where the sales are reported rather than the otherwise preferred information on the location of the final customer, especially since data are usually available only on the former. Also, since we do not have information on employee compensation costs for most data sets, we approximate employee compensation costs as the product of the number of employees and GDP per capita, which – given the lack of available data – is a rough but reasonable assumption. We use this as our preferred formula and we refer to CCCTB below for this specific combination of economic activity indicators. Additionally, we provide results for components of economic activity other than the preferred CCCTB combination, i.e. individual indicators of sales, tangible assets, total assets, employment and compensation. This enables us to understand which countries would benefit

from increasing the weight of a specific component, and which components more closely reflect the current allocation of profits across countries.

4 Results

In the results section, we begin by studying descriptive statistics and empirically comparing the most relevant available data sets on US MNC. We then move on to effective tax rates and misaligned profits and, ultimately, their combination using the IRS CBCR data.

4.1 Descriptive statistics

For the most part, we find that the data sets are strongly correlated with each other, but we also highlight a number of empirical differences between them (Figure 2). The correlation between CBCR, BEA, BEA 2, and Eurostat for the number of employees, turnover and tangible assets is very high (88–99%) for all combinations (Fig 2A–B). The correlation between Orbis and CBCR or BEA data is lower, between 51 and 79%. However, the correlation between Eurostat and Orbis* is very high (97% for employees and 96% for turnover), which indicates that the data in Orbis is good for European countries. The correlation between all data sets for profits is lower although still high (75–87%) (Fig. 2C), likely because the different databases use different definitions of profits (see Table 1). For taxes, we once again see excellent correlation between CBCR and BEA (93–100%), while Orbis has moderate correlations (62–72%). The correlation between IRS CFC and IRS CBCR is moderate, however, unlike the case of Orbis, this is caused by only four large outliers: the Netherlands, Luxembourg, Bermuda and Cayman Islands (Fig. 2). The correlation without the four countries increases to 92%. Since the IRS CFC data included foreign entities owned by US persons (corporations and individuals), this indicates that foreign entities of non-corporations are more predominant in those jurisdictions than foreign entities of MNCs.

Next, we analyse the correlation between our base data set (CBCR*) and all other data sets (Fig. 2, scatter plots below each correlation matrix), which provides information about which databases provide consistent estimates for which countries. In general, we see that most countries lie close to the diagonal. However, that is not the case for Orbis, for which several countries are covered less thoroughly. For tangible fixed assets, some countries have higher coverage in Orbis compared with other databases. This is due to the use of fixed assets instead of tangible fixed assets in Orbis (Table 1), which includes intangibles and overestimates the assets in countries where holding companies are typically situated (e.g. United Kingdom, Ireland, the Netherlands, Belgium).

Since the differences between the data sets seem to be linked to specific regions (e.g. South America), we continued by investigating the coverage at the regional level (Figure 3). For this, we visualize the share of the CBCR* data that is present in other data sets (1 corresponds to equal coverage). At first sight, we observe substantial heterogeneity in the observed data coverage. For example, Orbis* has almost no coverage of most information in Africa, South-East Asia, Latin America and the Middle East, while it is comparable, largely together with BEA, BEA 2, and Eurostat, for most variables for the EU member states. For North-East Asia and Canada, Australia and New Zealand, Orbis* contains approximately 2/3 of the information

present in the other databases (with the exception of Canada, for which Orbis* has poor data). Comparing BEA and CBCR to CBCR*, we see that BEA and CBCR usually contain higher revenues, employees, assets and taxes. This is expected since both samples include all companies, while CBCR* includes only companies with profits. The increased coverage in BEA and CBCR is more marked for Africa, the Middle East, CA/AU/NZ, and especially offshore financial centres. As expected since using “profit-like returns” underestimate the profits that have been shifted, the coverage of profits in BEA is only 12.7% in such countries, while for other regions it is within 32% (Middle East), 18% (Africa) or 13% (other regions) of the CBCR data. This is corrected in the BEA 2 data, which uses “Income without current-cost adjustment” similarly to Clausing (2019). Finally, since IRS CFC data includes all US persons, it generally exhibit higher coverage than IRS CBCR.

4.2 Effective tax rates (ETRs)

Having compared the raw indicators, we now focus on our first derived variable: ETRs (taxes accrued over profits). For ETRs, we include two extra data sets. The first data set (Dowd et al, 2017) uses micro-data from confidential tax returns to calculate ETRs for individual companies, and also calculates the average ETR after discarding the 5% most extreme observations (we use the two most recent years included in the study, 2010 and 2012). The second data set, with statutory corporate income tax rates collected from various sources by Janský and Palanský (2019), includes the statutory corporate income tax rates (CIT in Figure 4) for the year 2016.

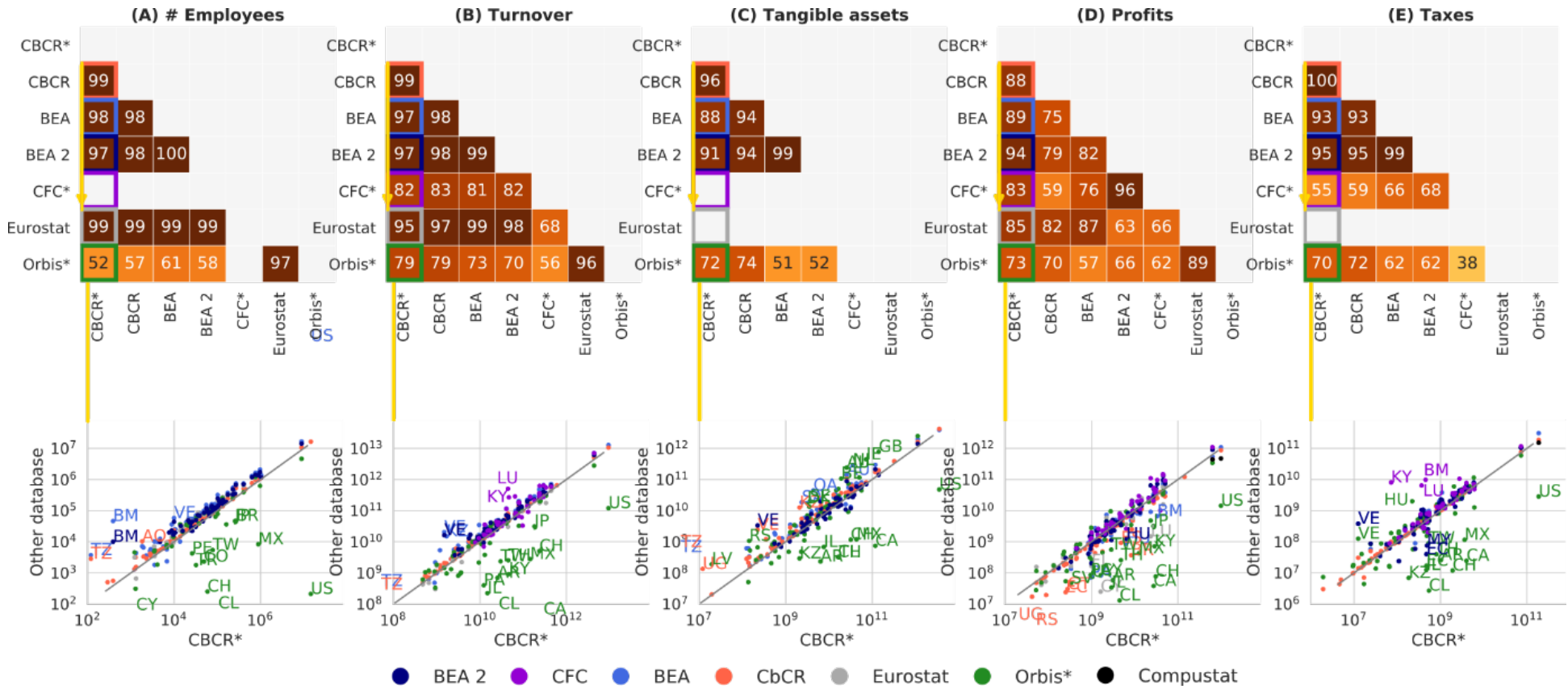
We begin our analysis by calculating the ETRs for US subsidiaries of US MNCs (domestic) and, in addition, for foreign subsidiaries of US MNCs (Table 2). We find large differences between the databases regarding domestic tax rates. The completeness of Orbis is only around 1% for both profits and taxes, but the estimated tax rates are the closest to CBCR data. BEA includes multinationals with large domestic presence, and both the profits (\$1,077 B) and taxes accrued (306B) are larger than evidenced in the other databases. CBCR yields lower estimates for profits than Compustat (\$472B compared with \$867B), but similar estimates for taxes accrued (\$151B compared with \$185B). The effective foreign tax rates are closer, ranging from 10.7 to 24%. Here, the completeness of Orbis is around 80% for both profits and taxes accrued. BEA data once again produces larger reported profits (\$536B) and taxes accrued (\$103B). CBCR yields similar estimates for profits when compared Compustat (437B compared with 438B), but lower levels of taxes accrued (\$85B compared with \$119B). BEA 2 and IRS CFC data produce comparable profits (\$896B and \$1093B) and taxed accrued (\$103B and \$116B) to those yielded by IRS CBCR.

Table 2. Foreign and domestic tax rates from different sources

	CBCR*	CBCR	CFC*	BEA	BEA 2	Orbis*	Compustat
Domestic	18.9%	21.4%	-	28.5%	-	19.4%	32.0%
Foreign	11.6%	17.5%	10.7%	19.4%	11.6%	19.0%	24.0%

Source: Authors

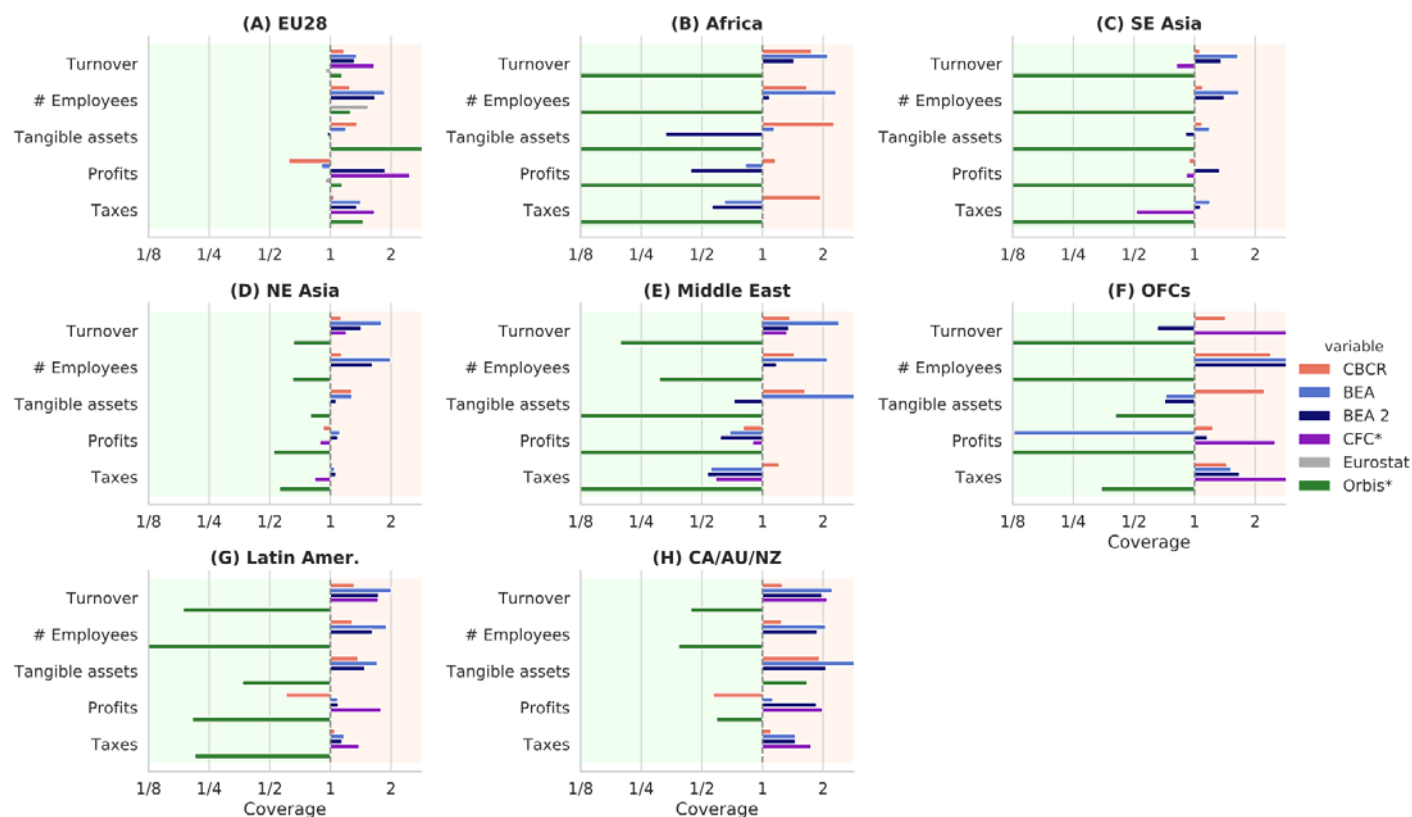
Figure 2. Correlation between the data sets



Source: Authors on the basis of the various data sets.

Notes: IRS data on companies with positives profit (CbCR*), IRS data on all companies (CbCR), IRS data on all CFCs with positive profits (CFC*), BEA data (BEA), BEA data without income cost adjustment (BEA 2), Eurostat data and Orbis data on companies with positive profits (Orbis*). The correlation is visualized for the five indicators analyzed: (A) Employees, (B) Turnover, (C) Tangible assets, (D) Profits, and (E) Taxes accrued. For each of the colored squares, representing the correlation between CbCR* and other databases, a scatter plot showing the outliers is shown.

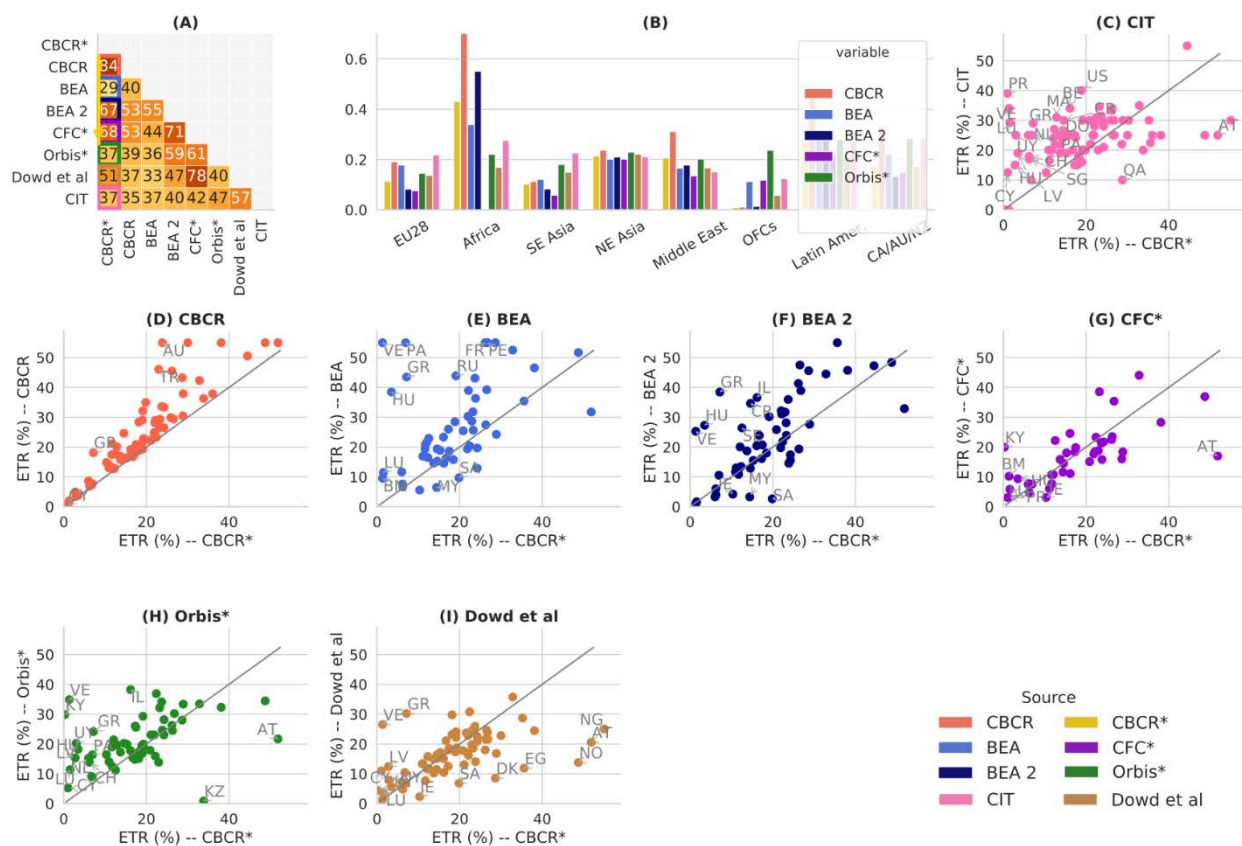
Figure 3. Differences between samples by region



Source: Authors on the basis of the various data sets.

Notes: aggregated values of IRS data on companies with positives profits (CBCR*) compared with the following data sets: IRS data on all companies (CBCR), IRS data on all CFCs with positive profits (CFC*), BEA data (BEA), BEA data without income cost adjustment (BEA 2), Eurostat data and Orbis data on companies with positive profits (Orbis*) samples. Coverages below one (shaded in green) indicate higher values in the CBCR* data set. The list of countries by region can be found In the Appendix. Note that the BEA sample is more comparable with CBCR (not CBCR*), since both samples include all companies, including those with negative profits. Orbis uses fixed assets instead of tangible assets, which leads to the overestimation of assets in (A).

Figure 4. Estimates of effective tax rates



Source: Authors on the basis of the various data sets.

Notes: (A) Correlation between IRS data on companies with positives profits (CBCR*), IRS data on all companies (CBCR), IRS data on all CFCs with positive profits (CFC*), BEA data (BEA), BEA data without income cost adjustment (BEA 2), Orbis data on companies with positive profits (Orbis*), tax returns data from IRS (Dowd et al) and statutory corporate income tax (CIT) rates. (B) ETR by region. The tax rate is unweighted for all but Dowd et al and CIT, since data on profits and taxes by region is unavailable for those data sets. (C–G): Correlation between CBCR* and (C) CIT rates, (D) CBCR, (E) BEA, (F) Orbis*, and (G) Dowd et al. Countries where the estimations differ by more than 50% are annotated.

We next disaggregate foreign effective tax rates at the country level. The correlation between data sets decreases to 29–57% (Fig. 4A). The lower correlation is between the CBCR* and BEA databases is particularly surprising given the quality of both data sets. However, the correlation increases with the BEA 2 data, which includes shifted income to shell companies. The average tax rates for all regions are within 5 percentage points, with the notable exceptions of Africa and offshore financial centres (Fig. 4B). In general, the correlation is affected by the presence of outliers (Fig 4C–G). In the comparison between CIT (Fig. 4C) and CBCR* those outliers are caused by large tax deductions in some countries (e.g. Luxembourg, the Netherlands, Puerto Rico, Panama, Switzerland), as well as by fluctuations in the 2016 profits earned in some countries (e.g. Austria, Venezuela and Greece are outliers in all comparisons). Another reason for the variation is the secrecy of some jurisdictions (Cayman Islands, Panama, Luxembourg), which produces an overestimation of the tax rates for offshore financial centres in all data sets, and especially in Orbis*.

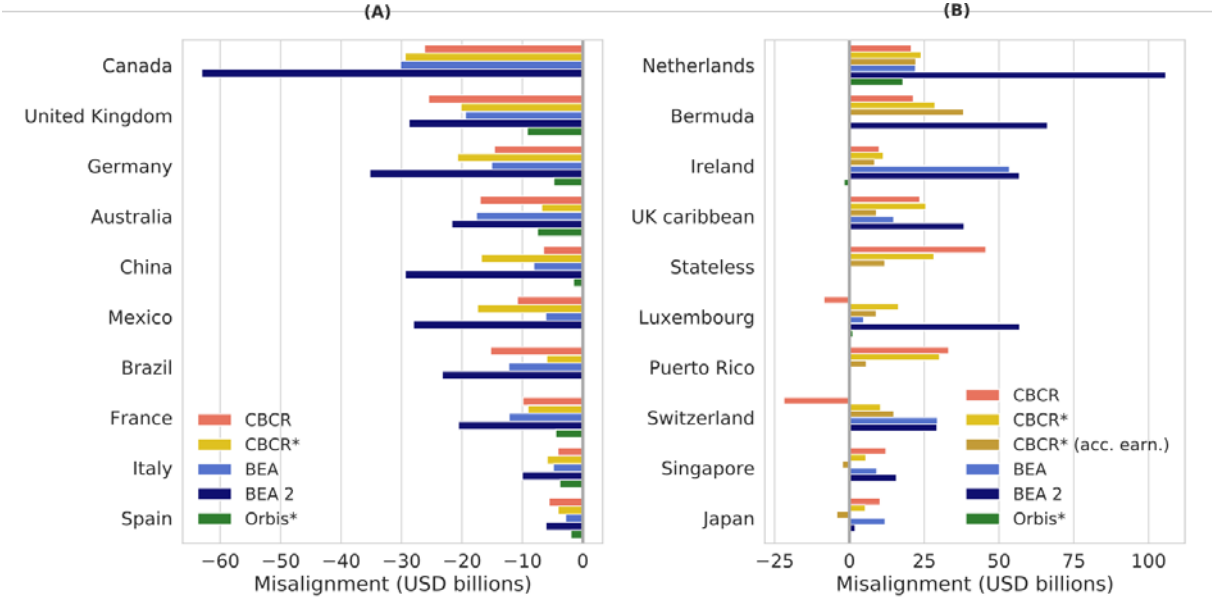
4.3 Misaligned profits

We continue by calculating the misaligned profits using the formula proposed by CCCTB to calculate economic activity (1/3 tangible assets, 1/3 revenue, 1/6 number of employees and 1/6 wages). Figure 5 provide estimates of misaligned profit using our data sets for the top 10 countries with the highest missing (negative) and excess (positive) profits. The largest trading partners of the United States, including Canada, Australia, China, Brazil are, consistently across the data sets, among the countries with the largest negative misalignments (Fig. 5A), i.e. where more profits should be reported if they were perfectly aligned with economic activity.¹

While the estimations of misaligned profits are consistent across databases, the estimations of excess profits are more variable, partly due to the low availability of data in BEA (e.g. the Bahamas) and Orbis (most countries in the list). However, some clear patterns do emerge; the Netherlands, Ireland, Bermuda, Puerto Rico, UK Caribbean (mainly Cayman Islands and British Virgin Islands), Singapore, Switzerland and the Bahamas are the countries with the highest excess profits (Fig. 5B). Unsurprisingly, given the use of fiscally transparent entities and entities with no tax jurisdiction in tax avoidance strategies, Stateless also appears among the top jurisdictions for positive misaligned profits, but we are not able to draw any firm conclusions regarding this category before further clarifications from the IRS since Stateless could, for example, include any amount of pass through income that should have actually been reported in the US or another country, which would have changed our estimates. Except for Stateless, these results are consistent across the data sets with at most one of them showing in the other direction (such as the negative estimate for Switzerland using CBCR with negative profits included). The only surprising country in the list is Japan, which has high ETRs. These results are consistent with other US-centred studies such as Zucman (2014) and Cobham and Janský (2019a), which point to a similar set of tax havens using only the BEA data.

¹ Including the United States in the analysis would reveal that the country with the largest negative misalignment is the United States (Fig. A4). We chose to exclude the US from the analysis because 2/3 of US multinationals' total activity is domestic, which greatly distorts the total revenues, assets and employee numbers and thus also the calculation of misalignment profits for all other countries.

Figure 5. Top 10 countries with the largest negative (A) and positive (B) misaligned profits.



Source: Authors on the basis of the IRS CBCR, BEA and Orbis data.

Notes: (A) Negative misalignment. (B) Positive misalignment. The misalignment profits are calculated using the CCCTB formula, where the location of assets, revenue, employees and wages determines the expected location of the profits. The databases used were: IRS data on companies with positive profits (CBCR*), IRS data on all companies (CBCR), IRS data on all CFCs with positive profits (CFC*), BEA data (BEA), BEA data without income cost adjustment (BEA 2), Orbis data on companies with positive profits (Orbis*). The location of the accumulated earnings (divided by 10) is marked in brown (CBCR* (acc. Earn.)).

The IRS CBCR data also provides us with information about accumulated earnings (the cumulative amount of foreign earnings designated as “indefinitely reinvested” for which no accrued income tax expense is recorded on the financial statements). We use this information to obtain a long-term perspective on the location (Fig. 6B), finding that indefinitely reinvested profits accumulate in the same locations as excess profits, with the exceptions of Singapore, the Bahamas and Japan.

The higher granularity of the CBCR data enables us to learn about some of the geographically smaller tax havens. For example, the CBCR data provides information separately for the Cayman Islands and the British Virgin Islands (while BEA aggregates them into "UK Caribbean"). Thanks to this, we can observe that the Cayman Islands are more important than the British Virgin Islands in terms of misaligned profit. Similarly, Puerto Rico is not treated separately in BEA but comes out as one of the jurisdictions with the highest excess profits in the IRS CBCR, second only after the Stateless category. Puerto Rico's importance can be traced to the pharmaceutical industry (see for example Tørsløv et al., 2018).

The CCCTB formula tries to account for the main components of real activity. However, different formulas allocate profits to different places. Table 3 shows the most advantageous factor (or least disadvantageous) for each country. If profits are allocated according to revenue,

the countries where MNCs book their sales would benefit (e.g. Switzerland, Ireland, Singapore, Hong Kong); this would also be a less disadvantageous option for some important tax havens (e.g. Bermuda, Cyprus, UK Caribbean, the Netherlands). Among the countries that increase their profit share across all bases, the most advantageous factor is always either number of employees or wages, where highly developed countries prefer wages and all others prefer employee numbers. The findings suggest that (tangible) assets would be favoured by a number of countries that are rich in natural resources (e.g. Nigeria, Qatar, Chile, Norway) as well as some other countries such as Bangladesh and Thailand. Overall, these results are relevant for the European Commissions' CCCTB proposals and, more recently, OECD's (2019) ongoing work on the so called Pillar One, which focuses on the allocation of taxing rights. Even more generally, our results highlight why some countries might be in favour of specific proposals, assuming they are incentivised by increased tax base in the form of profits.

Table 3. Most advantageous component of the CCCTB formula by country.

Reduce profits in all cases		Increase profits in some cases			Increase profits in all cases		
Turnover	Employment	Turnover	Employment	Assets	Employment	Employment	Wages
Bermuda	Tanzania	Switzerland	Kenya	Nigeria	Croatia	South Africa	Korea
UK caribbean	Uganda	Ireland	Latvia	Bangladesh	Russia	Costa Rica	United Kingdom
Cyprus	Venezuela	Singapore	India	Egypt	China	Mexico	Denmark
Puerto Rico	Hungary	Hong Kong	Vietnam	Qatar	Malaysia	Serbia	Finland
Netherlands		Panama	Saudi Arabia	Angola	Guatemala	Bulgaria	Taiwan
Uruguay	Assets	Belgium	Argentina	Kazakhstan	El Salvador	Romania	Australia
	Luxembourg		Lithuania	Ghana	Slovakia	Czech Republic	New Zealand
	Trinidad&Tobago	Wages	Morocco	Indonesia	Portugal	Poland	Spain
		Japan	Ukraine	Peru	Honduras		France
		Sweden	Dominican Rep.	UAE			Austria
		Israel	Colombia	Thailand			Canada
			Greece	Chile			Italy
			Ecuador	Norway			Germany
			Turkey				Slovenia
			Bolivia				
			Brazil				
			Philippines				
			Nicaragua				

Source: Authors on the basis of the IRS CBCR data.

4.4 Relationship between ETR and misaligned profits

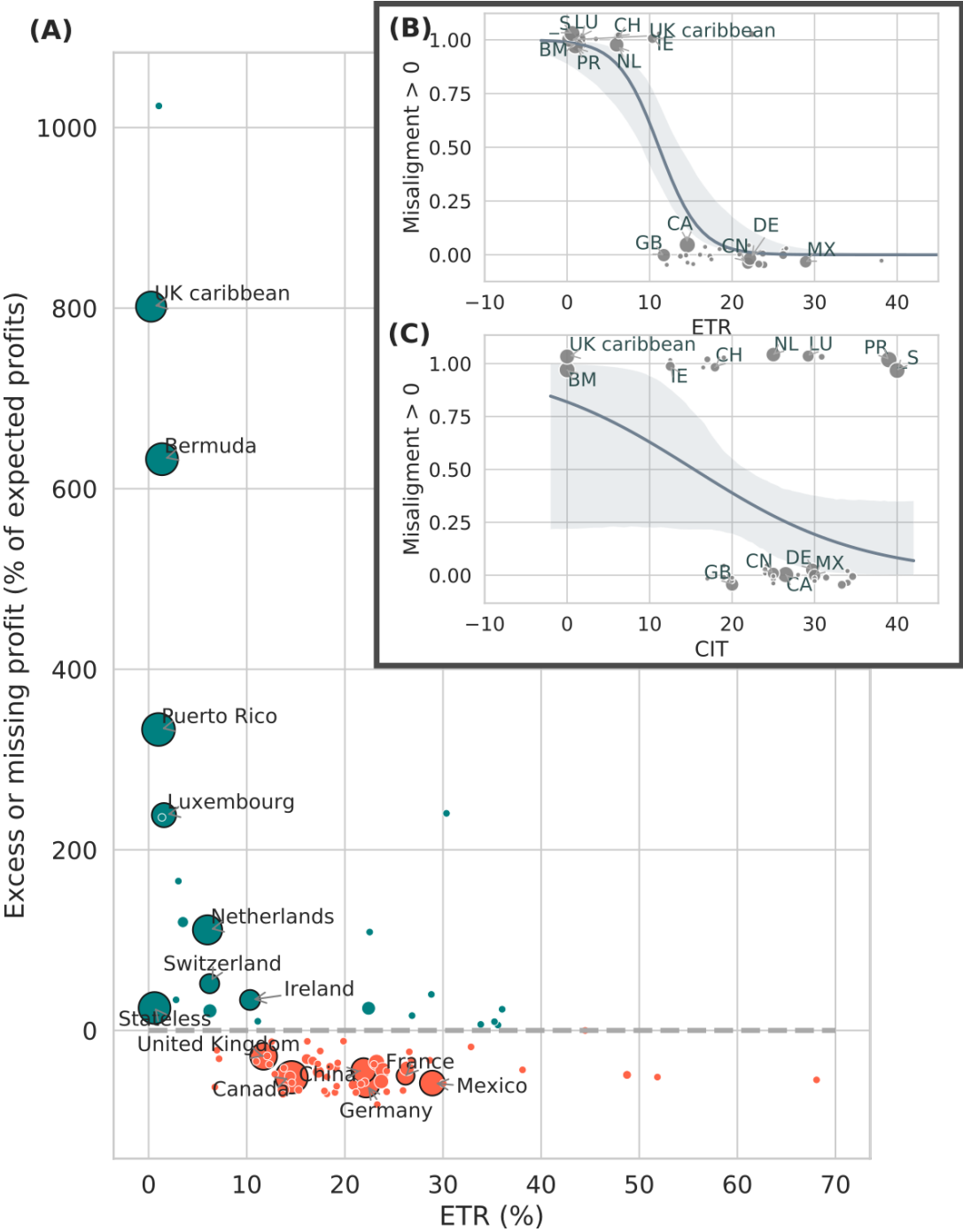
We now test the hypothesis that low ETRs are correlated with higher excess profits and we thus investigate the relationship between the variables observed so far in section 4. Figure 6A plots misaligned profit as a share of allocated profits using the CCCTB formula. Countries below the zero line are missing profits, while countries above the zero line have excess profits. The size of each country is proportional to the total misaligned profits. This enables us to see that the excess profit in UK Caribbean is larger than the missing profits in any of Canada, Germany, Mexico or China, despite the former having less than 150,000 inhabitants while the latter have populations of between 37 and 1300 million.

Given the extreme outliers in the data, we tested our hypothesis that lower ETRs are positively correlated with higher excess profits using a logistic regression, where the dependent variable is a dummy variable indicating whether the misalignment is positive (Fig. 6B). We find that all (7/7) countries with ETRs below 11% and absolute misaligned profits above one US billion have positive misaligned profits. In terms of coefficients, increasing the ETR by one percentage

point decreases the odds-ratio by 0.40 units (CI [-0.67,-0.13]), while the correlation is weaker for CIT: increasing the CIT by one percentage point decreases the odds-ratio by 0.10 units (CI [-0.19,-0.01]). This was expected, since large shares of the missing profits are located in countries with relatively large CITs but also large tax deductions on profits derived from loans and intangibles, products that are typically used by MNCs to shift profits.

Finally, we perform the same analysis using accumulated earnings (Figure A3 in the Appendix). Unsurprisingly, given the correlation between the location of excess profits and accumulated earnings, we find that the ETR alone explains a large fraction of the variability in the data.

Figure 6. Correlation between ETR and misaligned profits



Source: Authors on the basis of the IRS CBCR data.
 Notes: (A) Relationship between the ETR and profit misalignment (measured as profits in excess of expected profits). Note that countries with the highest positive misalignment tend to have lower ETRs. (B) Relationship between ETR and the probability of positive misalignment. (C) Relationship between CIT and the probability of positive misalignment for countries with at least USD 100 million absolute misalignment. Line indicates the modelled logistic regression and shaded area indicates 95% confidence intervals calculated from 1000 bootstrap samples. Countries in (B) and (C) have been slightly moved vertically to improve legibility. The confidence intervals for the coefficient of ETR/CIT are (B) [-0.67, -0.13] and (C) [-0.19, -0.006].

5 Conclusion

When the effects of the 2017 US tax reform on US MNCs are discussed in the future, there should be ample evidence available based on the newly published country-by-country reporting data. These CBCR data, released for the first time in December 2018 for the year 2016, promise to capture the reform's effects on profit shifting across various countries well. In this paper, we have compared this new data source with other available, more established data sources on US MNCs while also providing new estimates of effective tax rates, misaligned profit and their interrelationship.

Our results answer two research questions. First, we have identified the most important tax havens for US MNCs – where high profits are misaligned with economic activity – as countries with low effective tax rates. These include Bermuda, Ireland and The Netherlands, confirmed across most of our datasets. Moreover, we have revealed how sensitive formula apportionment is in making these observations. We have established that if profits were allocated according to revenue, countries where MNCs book their sales would benefit (e.g. Switzerland, Ireland, Singapore, Hong Kong), and that this scenario would also be less disadvantageous for several important tax havens (e.g. Bermuda, Cyprus, UK Caribbean, The Netherlands). While revenue would favour tax havens, such formula apportionment might still be favourable to the current status quo. Existing literature stipulates that agreement on a specific formula would be difficult; we thus also provide a quantification of the challenges ahead. In answer to our secondary question, we have found that the IRS CBCR data, in particular when published as a full sample in the future, are conceptually superior in some respects, such as country coverage, to existing datasets. Furthermore, we have indicated that they differ substantially when compared empirically.

Our results are relevant and timely for recent and ongoing policy debates at OECD, both Pillars One and Two discussed recently by OECD (2019), and elsewhere, including those that consider the potential introduction of effective minimum taxes on MNCs' profits. In view of the low ETRs we have observed for many countries and their negative correlation with misaligned profits, one form or another of global minimum tax, which is a part of Pillar Two proposal, might be worth exploring. On the basis of presented evidence we have not been able to clarify what form this should take or what effects an implementation of this proposal might have. However, our research clearly highlights a need for the determination of specific data sources and explicit definition of rates, ETRs or otherwise, as an integral part of future policy debates.

In addition to these policy aspects, at least two promising areas for further research associated with profit shifting using this combined data set based on leading data sources have emerged. First, while a majority of existing economics literature on profit shifting by MNCs estimates the semi-elasticity of reported profits with regard to tax rates, this kind of analysis could be revisited using all currently available data sets. Second, general literature on the determinants of foreign direct investment (e.g. Djankov, Ganser, McLiesh, Ramalho, and Shleifer, 2010, Economou, Hassapis, Philippas, and Tsionas, 2017) could be revisited in the light of the newly available data. For example, our various estimates of ETRs might be employed instead of the traditionally used statutory rates.

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7 Appendix

List of countries by region:

EU28 = Bosnia and Herzegovina (BA), Cyprus (CY), Romania (RO), Croatia (HR), Finland (FI), Luxembourg (LU), Spain (ES), Austria (AT), Latvia (LV), Slovak Rep. (SK), Poland (PL), Italy (IT), Norway (NO), United Kingdom (GB), Netherlands (NL), France (FR), Hungary (HU), Germany (DE), Portugal (PT), Greece (GR), Bulgaria (BG), Belgium (BE), Estonia (EE), Denmark (DK), Malta (MT), Sweden (SE), Slovenia (SI), Ireland (IE), Lithuania (LT),

Africa = Sierra Leone (SL), Uganda (UG), Sudan (SD), Lesotho (LS), Eritrea (ER), South Sudan (SS), Réunion (RE), Togo (TG), Saint Helena, Ascension and Tristan da Cunha (SH), Seychelles (SC), Gabon (GA), Morocco (MA), Egypt, Arab Rep. (EG), Sao Tome and Principe (ST), Mauritania (MR), Ghana (GH), Malawi (MW), Equatorial Guinea (GQ), Madagascar (MG), Djibouti (DJ), Botswana (BW), Angola (AO), Guinea-Bissau (GW), Mauritius (MU), Congo (Dem. Rep.) (CD), Zimbabwe (ZW), Guinea (GN), Cameroon (CM), Burundi (BI), Ethiopia (ET), Niger (NE), Mali (ML), Rwanda (RW), Benin (BJ), Comoros (KM), Cabo Verde (CV), Tanzania, United Republic of (TZ), Senegal (SN), Kenya (KE), Algeria (DZ), Central African Republic (CF), Ivory Coast (CI), Mayotte (YT), Zambia (ZM), The Gambia (GM), Liberia (LR), Somalia (SO), Nigeria (NG), Libya (LY), Mozambique (MZ), Eswatini (SZ), Burkina Faso (BF), South Africa (ZA), Tunisia (TN), Chad (TD), Congo, Rep. (CG)

Southeast_Asia = Malaysia (MY), Singapore (SG), Laos (LA), Cambodia (KH), Timor-Leste (TL), Viet Nam (VN), Philippines (PH), Indonesia (ID), Myanmar (MM), Thailand (TH), Brunei Darussalam (BN)

Northeast_Asia = Russia (RU), Taiwan (TW), China (CN), Japan (JP), Korea, Democratic People's Rep. of (KP), South Korea (KR), Mongolia (MN)

Middle_East = Lebanon (LB), Jordan (JO), Oman (OM), Kuwait (KW), Ukraine (UA), Israel (IL), Iran (IR), Bahrain, Kingdom of (BH), West Bank (PS), Syrian Arab Republic (SY), Turkey (TR), Yemen, Republic of (YE), Iraq (IQ), Qatar (QA), Saudi Arabia (SA)

OFCs = Cyprus (CY), St. Vincent and the Grenadines (VC), Togo (TG), Seychelles (SC), Anguilla (AI), Samoa (WS), Liechtenstein (LI), Belize (BZ), Isle of Man (IM), UK Caribbean (Montserrat (MS), Cayman Islands (KY), Turks and Caicos Islands (TC), Virgin Islands, British (VG)), Mauritius (MU), Panama (PA), St. Kitts and Nevis (KN), Guyana (GY), Cayman Islands (KY), Bermuda (BM), Netherlands Islands, Caribbean (CW), Guernsey (GG), Gibraltar (GI), Marshall Islands, Republic of (MH), Jersey (JE), Barbados (BB), Virgin Islands, British (VG), Liberia (LR), Bahamas, The (BS),

Source: Authors.

Table A1. Indicative comparison of published IRS and expected OECD tables

OECD (2018)	IRS
OECD Table 1: Where do the business activities of MNCs take place?	<p>IRS Table 1A: Country-by-Country Report (Form 8975): Tax Jurisdiction Information (Schedule A: Part I) by Major Geographic Region and Selected Tax Jurisdiction, Tax Year 2016</p> <p>IRS Table 1B: Country-by-Country Report (Form 8975): Tax Jurisdiction Information (Schedule A: Part I) Limited to Reporting Entities with Positive Profit Before Income Tax by Major Geographic Region and Selected Tax Jurisdiction, Tax Year 2016</p> <p>IRS Table 1C: Country-by-Country Report (Form 8975): Tax Jurisdiction Information (Schedule A: Part I) Limited to Reporting Entities with Negative or Zero Profit Before Income Tax by Major Geographic Region and Selected Tax Jurisdiction, Tax Year 2016</p>
OECD Table 2: What are the tax rates paid by MNCs?	-
OECD Table 3: What is the relationship between tax rates and the business activities of MNCs?	IRS Table 3: Country-by-Country Report (Form 8975): Tax Jurisdiction Information (Schedule A: Part I) by Effective Tax Rate of Multinational Enterprise Sub-groups, Tax Year 2016
-	<p>IRS Table 1D: Country-by-Country Report (Form 8975): Number of Constituent Entities (Schedule A: Part II) by Geographic Region, Selected Tax Jurisdiction, and Main Business Activities, Tax Year 2016</p> <p>IRS Table 2: Country-by-Country Report (Form 8975): Tax Jurisdiction Information (Schedule A: Part I) By Major Industry Group, Geographic Region, and Selected Tax Jurisdiction, Tax Year 2016</p>

Source: Authors on the basis of OECD (2018) and IRS data

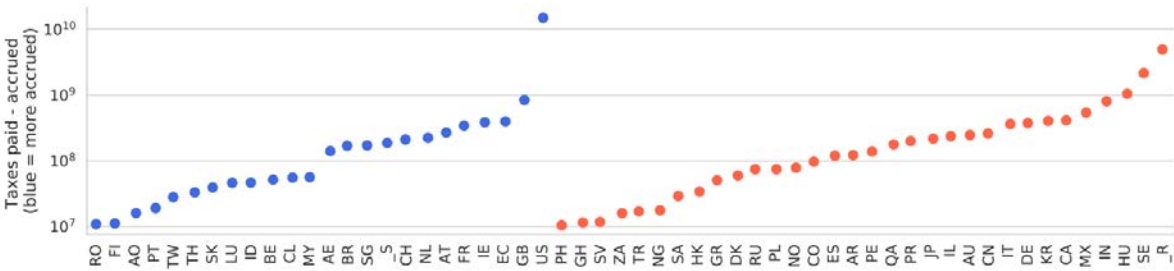
Table A2. Overview of the available data sources relevant for US MNCs

	Code in Figures	Sample	Period	Level of aggregation	Other sample restrictions	Profit variables - definitions	Tax variables - definitions	Other variables	Other MNCs than US?	Examples of references	Number of countries included	Source:
IRS CBCR	CBCR (all companies) and CBCR* (only companies with positive profits)	Big US-headquartered MNCs	2016	Country- or industry-level aggregate data	Groups with annual revenue for the preceding reporting period of \$850 million	Profits (profit or loss before income tax)	Income taxes paid and accrued (including deferred)	Revenues, stated capital, accumulated earnings, and tangible assets other than cash	Similar data to be published later by OECD	-	138 (85 in CBCR*)	IRS https://www.irs.gov/statistics/soi-tax-stats-country-by-country-report https://www.irs.gov/forms-pubs/about-form-9875
BEA	BEA	All US-headquartered MNCs	1983-2016	Country- or industry-level aggregate data		Profit-type return – net interest paid	Income taxes accrued	Sales, net income, employees, total assets, number of employees, wages. For some years “property, plant, and equipment assets” are also available.	Similar data available via country-specific sources (such as MiDi for Germany) or via Eurostat	Zucman (2014), Clausing (2016), Wright & Zucman (2018), Cobham & Janský (2019),	55	BEA https://www.bea.gov/international/di1usdop
BEA 2	BEA 2	All controlled foreign corporations of US persons	1983-2016	Country- or industry-level aggregate data		Net income divided by the average parent ownership + foreign income taxes	Income taxes accrued	Sales, net income, net property, plant, and equipment, employees, total assets, number of employees, among others.	Similar data available via country-specific sources (such as MiDi for Germany) or via Eurostat	Clausing (2019)	55	Net income without current-cost adjustment from https://www.bea.gov/international/di1usdbal Other variables from https://www.bea.gov/international/usdia2016p (majority owned affiliates) The average parent ownership is unpublished data, which the following values: 2004: 65.6%, 2005: 65.3%, 2006: 65.0%, 2007: 65.0%, 2008: 64.0%, 2009: 58.1%, 2010: 58.2%, 2011: 57.8%, 2012: 57.2%, 2013: 56.5%, 2014: 53.4%, 2015: 56.6%

IRS CFC	CFC*	All US persons (e.g., corporations, individuals, trusts)	2004-2012, every two years	Country- or industry-level aggregate data	Only companies with positive profits (the complete data is also available)	Current earnings and profits before income taxes	Income taxes	Assets, receipts, dividends, subpart F income, accumulated earnings and profits	No	(Grubert & Mutti, 2000)	42	https://www.irs.gov/statistics/soi-tax-stats-controlled-foreign-corporations
Eurostat	Eurostat	All US-headquartered MNCs	ca 2008-2016	Country- or industry-level aggregate data	Only foreign affiliates in the EU	Gross operating surplus (value added minus personnel costs.)	n. a.	Revenues, number of employees, wages,	Yes, other developed, mainly European countries	Tørsløv, Wier, & Zucman (2018)	30	https://ec.europa.eu/eurostat/web/structural-business-statistics/global-value-chains/foreign-affiliates http://appsso.eurostat.ec.europa.eu/nui/show.do?data set=fats_g1a_08&lang=en
Compustat	Compustat	Most big US publicly listed companies	ca 1990-2018	Consolidated firm-level data	Does not separate by country, only foreign/domestic	Profits (profit or loss before income tax)	Income taxes paid and accrued (including deferred)	Revenue, total assets, EBIT, intangible assets, among many others	Yes, but much less coverage than for US	Dyreg, Hanlon, Maydew, & Thornock (2017)	1	Private database by Standard & Poor's
Orbis	Orbis (all companies) and Orbis* (only companies with profits)	A non-random subsample of all companies	ca 1990-2018	Consolidated and unconsolidated firm-level data	Sample quality and coverage differs by country	EBIT = Total Profits – Financial profits (include interest and equity income)	Income taxes accrued	Revenue, number of employees, tangible assets, total assets, among many others	Yes	Garcia-Bernardo, Fichtner, Takes, & Heemskerk (2017), Johannessen, Tørsløv, & Wier (2017)	70	Private database by Bureau van Dijk (owned by Moody's Analytics)

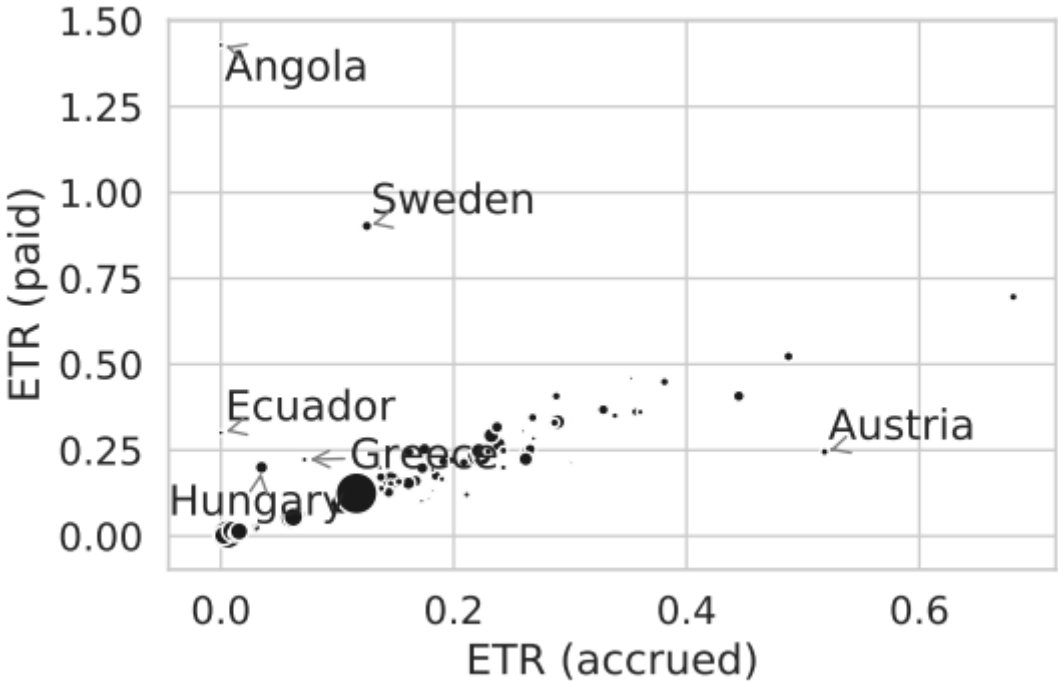
Source: Authors

Figure A1. Tax accrued versus tax paid



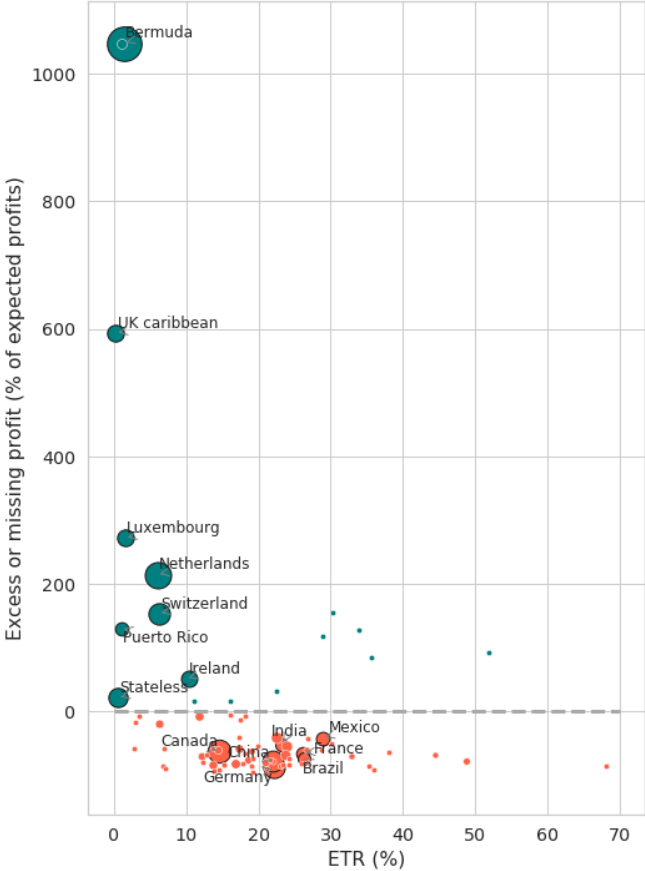
Source: Authors on the basis of the IRS CBCR data.

Figure A2. Effective tax rate using tax accrued versus tax paid



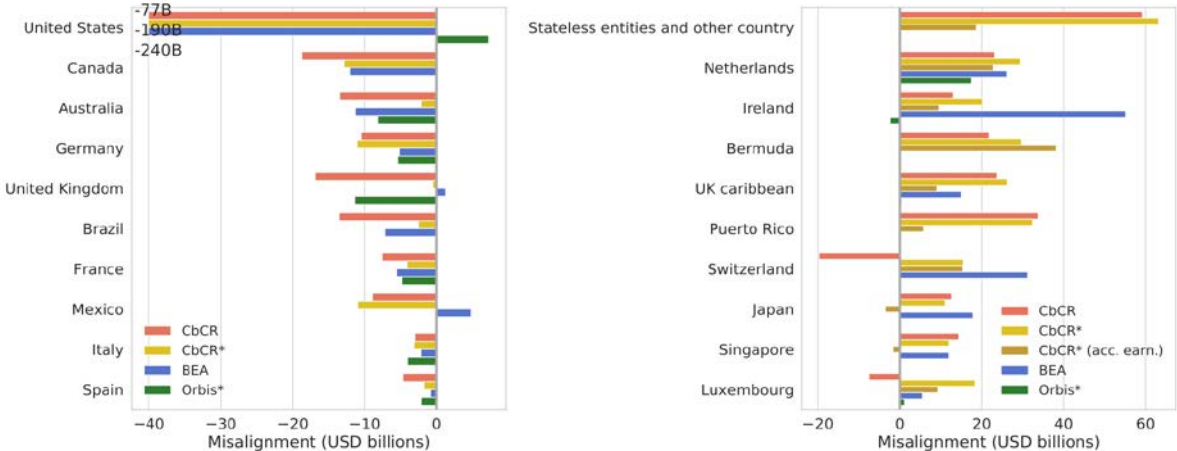
Source: Authors on the basis of the IRS CBCR data.

Figure A3. Correlation between ETR and misalignment profits using accumulated earnings



Source: Authors on the basis of the IRS CBCR data.

Figure A4. Top 10 countries with the largest negative (A) and positive (B) misaligned profits with the US included (in contrast with Figure 5)



Source: Authors on the basis of the IRS CBCR, BEA and Orbis data.

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