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# CORPORATE EFFECTIVE TAX RATES FOR RESEARCH AND POLICY

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IES Working Paper 41/2020

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

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**Bibliographic information:**

Janský P. (2020): " Corporate Effective Tax Rates for Research and Policy " IES Working Papers 41/2020. IES FSV. Charles University.

This paper can be downloaded at: <http://ies.fsv.cuni.cz>

# Corporate Effective Tax Rates for Research and Policy

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October 2020

**Abstract:**

How much companies pay in corporate income taxes is often better captured by effective tax rates (ETRs) rather than by statutory ones. Economists further distinguish between those modelled using the law – forward-looking ETRs – and those estimated from actual data on companies' profits and taxes – backward-looking ETRs. Moving beyond this binary distinction, I present a spectrum where backward-looking ETRs are further broken down by the type of data used to estimate them and where all ETRs may be located along with applicable statutory rates. Within that spectrum, I focus on backward-looking ETRs and, specifically, on those estimated using companies' balance sheet databases. Based on my review of recent findings, I argue that backward-looking ETRs – of multinational corporations in particular – have become more frequently estimated thanks to advances in data availability while also becoming more relevant as a result of ongoing global corporate tax reform debates. Ultimately, I argue that the full range of various ETRs can play a useful role in both research and policy.

**JEL:** C81; F21; F23; H25; H26

**Keywords:** corporate income tax; effective tax rate; forward-looking effective tax rate; backward-looking effective tax rate; multinational corporation; profit shifting

**Acknowledgements:** I thank Molly Scott Cato, Kimberly Clausing, Javier Garcia-Bernando, Sarah Godar, Tibor Hanappi, Hans-Peter Huber, František Nejedlý, Miroslav Palanský, Alexandra Rusu, Caroline Schimanski, Victor Steenbergen and Thomas Tørsløv for helpful comments. I acknowledge support from the Czech Science Foundation (P403/18-21011S) and the Greens/EFA Group in the European Parliament.

# 1 Introduction

Economists studying corporate income taxation have long understood the importance of distinguishing between statutory corporate income tax rates and effective tax rates (ETRs). How much companies pay in corporate income taxes in reality is often better captured by ETRs rather than by statutory rates. Governments can use ETRs to judge how much companies pay in corporate taxes individually and on average across sectors or within an entire economy. ETRs are therefore commonly used in recent policy proposals, both to evaluate and to establish them. For example, the 2017 US tax reform introduced what in principle amounts to a global minimum ETR for multinational corporations (MNCs) (Clausing, 2020), while OECD (2019) proposes a minimum ETR on MNCs' profits in response to the digitization of the economy. Similarly, both Dowd et al. (2017) and Tørsløv, Wier, & Zucman (2020) use ETRs to estimate the scale of profit shifting by MNCs. Despite their usefulness, ETRs can seem complicated. For example, there is a whole range of ETRs with different estimation strategies and interpretations and it is not always clear how they differ or which ones are better suited for a particular situation. Consequently, ETRs can be puzzling, in particular for researchers who are not estimating ETRs themselves but who would like to use existing estimates in their research. At present, these researchers lack a critical survey of recent literature. This paper is devoted to filling the gap and aims to provide an overview how various ETRs differ and what implications they have for researchers and policy makers.

In this paper I provide an overview of existing methodological approaches to estimating corporate ETRs and a review of recent empirical literature dedicated to ETRs. I also discuss conceptual differences between the various concepts of ETRs and statutory corporate income tax rates. In agreement with existing economics literature, I distinguish between forward-looking and backward-looking ETRs and discuss how the latter differ by the type of data used to estimate them. As I move beyond a binary distinction between backward-looking and forward-looking ETRs, I distinguish between various data sources used for estimating backward-looking ETRs; in doing so, I present a spectrum on which all ETRs can be located. I then focus on backward-looking ETRs and, in particular, those estimated using companies' balance sheet databases and those of MNCs. I provide a detailed overview of recent findings conducted using both Orbis and Compustat databases, which have never been reviewed to such an extent before, and I explain how the databases and, consequently, ETRs differ. In this paper, I also discuss selected estimates obtained using confidential tax returns and other data that have only become available recently. Overall, this review aims to provide a suitable decision-making basis for researchers who are interested in using ETRs but are overwhelmed by the sheer variety of ETRs available or are unsure which ETRs are appropriate for their purposes.

A comprehensive up-to-date survey of empirical literature focused on corporate ETRs has been lacking. Earlier comparisons of some ETRs are provided by Fullerton (1983), Mendoza, Razin, & Tesar (1994), Leibrecht & Hochgatterer (2012) and Gravelle (2014) and – with Ireland used an example – by Coffey & Levey (2014), while Nicodème (2001) and Ruiz & Gerard (2008) provide a comparison of various ETRs for the EU. More recently, some

reviews of ETR-related literature have appeared. Both Beer et al. (2019) and Cobham & Janský (2020) review empirical literature on international tax avoidance by MNCs in economics, while Hanlon & Heitzman (2010), Wilde & Wilson (2018) and, most recently, Wang et al. (2020) do so for accounting and finance literatures; all of these reviews use ETRs as one of the variables of interest. Perhaps most notably from the point of view of using ETRs in these reviews, Wang et al. (2020) argue that ETR is one of the two most common measures of corporate tax avoidance and use the tax rate definition to classify studies on horizontal tax competition. Whereas Wang et al. (2020) and others before them (e.g. Hanlon & Heitzman, 2010, and Wilde & Wilson, 2018) focus on tax avoidance in accounting literature, in this review I focus on ETRs in economics literature. Similar uses of ETRs appear in other recent reviews, e.g. in related fields such as economic geography by Aalbers (2018) or international political economy by Dietsch & Rixen (2016) and Christensen & Hearson (2019). In economics, reviews have recently focused on other aspects of taxation such as tax compliance (Alm, 2019), tax enforcement (Slemrod, 2019), presumptive taxation (Bucci, 2020), capital taxation (Bastani & Waldenström, forthcoming) or the taxation of economic rents (Schwerhoff et al., 2020).

While a recent review has been lacking, a significant amount of new research has recently focused on ETRs. Most relevant recent papers deal with ETRs in one of two ways. Some authors focus on estimating one specific ETR version: Devereux & Griffith (1999, 2003), Spengel et al. (2014), Congressional Budget Office (2017), Hanappi (2018) (forward-looking ETRs), Markle & Shackelford (2012a) and Dyreng, Hanlon, Maydew, & Thornock (2017) (backward-looking ETRs estimated on the basis of Compustat). A second category of papers do not focus primarily on ETRs, but instead use them as indicators of e.g. profit shifting by MNCs: Joshi (2019) and Tørsløv et al. (2020). Rather than estimating a new ETR or using ETRs in associated research, I aim to review the above-mentioned papers as well as other relevant work.

I structure the rest of the paper as follows. In section 2, I introduce the basic definitions of statutory and effective tax rates and I discuss seminal papers as well as recent contributions to forward-looking ETRs. In section 3, I introduce the various types of data used for estimating backward-looking ETRs. In section 4, I focus on backward-looking ETRs of MNCs estimated mostly on the basis of Orbis and Compustat balance sheet databases. In section 5, I conclude with an argument that almost any one specific ETR may be put to good use in either policy or research.

## **2 Statutory rates and forward-looking effective tax rates**

The statutory corporate income tax rate is the official tax rate paid by a corporation on a taxable income. Although establishing statutory corporate income tax rates is usually straightforward and they are legally binding, a few qualifications apply. For example, where the rates apply at different levels of governments, the overall rate can be a combination of central and sub-central rates for resident corporations. Also, where a progressive, rather than flat, rate structure applies, this definition will be applied to a certain income bracket. Moreover, there might also be tax rates targeted to specific industry or income types. While statutory rates will always have their justified uses (especially if wide country coverage is

needed), in reality, how much companies pay in corporate income taxes is often better captured by effective tax rates (ETRs or averages thereof, abbreviated as AETRs or EATRs) since the ETR is the ratio of actual taxes paid to actual profits.

The effective tax rate can be more generally defined as

$$\text{Effective tax rate} = \frac{\text{Corporate income tax}}{\text{Profit}} = \frac{\text{Statutory tax rate} \times \text{Taxable profit}}{\text{Profit}}$$

ETRs can be either expressed as a ratio of actual corporate income tax payments to actual profits or with the tax payments expressed as the product of statutory tax rate and taxable profits. As a consequence, measuring ETRs is intertwined with measuring profits. Taxable profit (or tax base for tax purposes) can be lower than real profit (real tax base) due to a variety of factors that all lead to lowering taxable profits and lower ETRs. These include tax breaks, tax deductions, tax holidays, tax arrears, tax evasion, and tax avoidance. There are also mismatches between various countries' definitions of taxable profits that create opportunities for tax avoidance. These various tax provisions are quite diverse and numerous even within the European Union (European Commission, 2015; "tax provisions may limit the rate effectively applied", European Commission, 2018, p. 34). Consequently, ETRs are often lower than statutory rates. Also, this way of defining ETRs makes it clear that ETRs can be low due to low statutory rates or differences between taxable and real profits.

The definition of the ETR above captures what the ideal hypothetical measure of ETR would be. In reality, there is usually not available information of sufficient quality on taxable and real profits to estimate that ideal measure of ETR with accuracy. There are two main approaches that try to go around this limitation. The first one is forward-looking ETRs (ex ante or law-based), derived from the law, that I outline briefly below. The second one is backward-looking ETRs (ex post or data-based), from actual data on companies' economic activities (as proxies for profits, accounting profits can be used from Orbis or Compustat or foreign affiliates statistics or country-by-country reporting data), that I describe in more detail in the subsequent sections. In theory, both approaches should arrive at the same numerical value of the ideal hypothetical measure of ETR, but in practice they are imperfect measures and usually differ. Generally, since both forward-looking and backward-looking ETRs have their good uses, it is a welcome development that an increasing number of them are being developed and estimated.

Forward-looking ETRs are ETRs modelled on the basis of corporate income tax rules as detailed in the law. More specifically, forward-looking ETRs are synthetic tax policy indicators estimated for a prospective, hypothetical investment project or company using tax code provisions. An influential and frequently used methodology developed by Devereux & Griffith (1999, 2003) calculates forward-looking ETRs for rent-earning investments (they also mention but do not estimate backward-looking ETRs). A forward-looking ETR is the ratio of the present value of taxes to the present value of profits. It is obtained by constructing a forward-looking hypothetical investment project and calculating the impact of the corporate tax system (statutory rate, depreciation allowances, holidays, etc.) on the cost of capital of a profit-making value-maximising firm (Abbas and Klemm, 2013). Moreover, sometimes also even rules at the personal level are included such as personal income taxes on interest and

dividend income as these might also affect investors' choices. A special case of the forward-looking ETR, in which a project is yielding a post-tax economic rent of zero, is the effective marginal tax rate (i.e. EMTR). Forward-looking ETRs are usually derived using modelling and the law (although there are exceptions, as e.g. Egger, Loretz, Pfaffermayr, & Winner (2009b) use company data to estimate them). Since forward-looking ETRs are thus available for many mostly developed countries, their relatively good availability has contributed to their widespread use in research.

Forward-looking ETRs have been used in a large share of research on effective company taxation. Recent examples with a good discussion of related literature apply the methodology of Devereux & Griffith (1999, 2003) to EU member states (Spengel et al., 2014), G20 countries (Congressional Budget Office, 2017) and 36 OECD and other countries (Hanappi, 2018), with the latter estimates also used by Dressler, Hanappi, & Dender (2018) and most recently updated to 70 countries (OECD, 2020). While these forward-looking ETRs can be useful e.g. for tracking investment climate in a country over time, they are not quite as helpful for other purposes (Bolwijn, Casella, & Rigo, 2018). For example, Egger & Stimmelmayer (2017) argue that using ETRs to explain MNCs' behaviour is problematic because these tax rates are computed for firms that are held and operate in a single country and are thus national rather than multinational in scope. Bösenberg & Egger (2017) compute ETRs on profits from R&D investment, while Bösenberg, Egger, & Zoller-Rydzek (2018) use them to study the effects of broad capital taxation on economic growth in small open economies. Egger, Loretz, Pfaffermayr, & Winner (2009a) computed ETRs at country-pair level to account for bilateral aspects of taxation, thus pointing out bias which appears when ETRs are computed only at country level. Also, forward-looking ETRs are frequently used in policy publications. For example, PwC and the World Bank (2016) have been using a version of it for years in the Doing Business Paying Taxes report (Stewart, 2014) while the European Commission (2018) uses these ETRs as an additional indicator of the tax burden on corporations. Similar estimates of forward-looking ETRs compiled on the basis of stylised business models by ZEW (2016) and ZEW (2017) have been used by the European Commission (2018c) in their assessment of digital economy taxation.

On the one hand, forward-looking ETRs have been estimated extensively and as such provide important policy insights and are useful in research. On the other hand, forward-looking ETRs are by definition based on modelling rather than on the observed behaviour of companies; for some purposes, this inherent characteristic constitutes a disadvantage. In addition, the number of non-standard tax incentives that can be implemented in the models is limited. Moreover, forward-looking ETR capture legal provisions and no ad-hoc arrangements such as tax rulings with tax authorities which might for example be relevant for countries offering unilateral tax deals to MNCs. In this sense forward-looking ETRs might reflect the effective tax burden as generally intended by the legislator but not necessarily the taxes actually paid. Therefore, forward-looking ETRs can differ from the tax-paying experience of companies in reality. A case in point is the taxation of MNCs, which have multiple ways of tax avoidance at their disposal (e.g. Beer et al., 2019) and which are difficult to reflect when modelling forward-looking ETRs (see Hanappi & Cabral, 2020, for a potential approach and an application to OECD's Pillars One and Two). When studying MNCs, with their complex tax structures and

the considerable role played by profit shifting, backward-looking ETRs are likely to provide more realistic estimates of the tax rates which MNCs face in reality. In this specific respect, backward-looking ETRs seem more suitable and the review of recent research provided here should simplify their use by other researchers.

### **3 Backward-looking effective tax rates**

Most backward-looking metrics are calculated as the simple ratio of corporate income tax payments and pre-tax income from reported accounting data. While the distinction between backward-looking and forward-looking ETRs is useful, in combination with data used for estimating backward-looking ETRs, all ETRs can be positioned on a spectrum rather than merely allocated to one of two groups. This spectrum is summarized in Table 1, which includes key research contributions to the development and estimation of various ETRs. The spectrum ranges from statutory tax rates and forward-looking ETRs based on laws and economic models to backward-looking ETRs estimated using a variety of real-world data sources, including company tax returns which are confidential in most countries. One end of the spectrum includes statutory tax rates which do not attempt to take into account any tax provisions. In contrast, these provisions are taken into account by ETRs estimated using tax returns which more closely reflect reality and which are found at the other end of the spectrum.

Across all types of data used for the estimation of backward-looking ETRs, the resulting values reflect not only the statutory rates and tax provisions, but also to what extent companies in fact make use of them. This constitutes a crucial advantage of backward-looking ETRs. On the other hand, backward-looking ETRs are endogenous, which has been discussed as a disadvantage by Devereux and Griffith (2002) and Dharmapala (2014). Recently, e.g. Beer et al. (2019) argue that backward-looking ETRs are outcomes of past profit shifting behaviour and raise reverse causality concerns (i.e. low levels of reported profits after shifting imply a high ETR, generating a spurious positive correlation between the two variables). While backward-looking ETRs are indeed endogenous, so are forward-looking ETRs and statutory tax rates. This argument is supported by Dowd et al. (2017, p. 5), who argue that both statutory and average tax rates suffer from endogeneity issues, as discussed by Huizinga & Laeven (2008) or by the IMF (2014), since tax policy – which can be represented by any of the tax rates found in the spectrum above – is not necessarily exogenous to pre-tax profits.

Key data sources frequently used to estimate backward-looking ETRs include the foreign affiliates of MNCs. Foreign affiliates' statistics are often provided by governments and usually have good coverage. The Bureau of Economic Analysis (BEA) publishes these country-level statistics annually for US-headquartered MNCs and includes foreign taxes paid in many countries worldwide. Desai, Foley, & Hines (2004) use the BEA data to estimate each ETR as the ratio of foreign income taxes paid to foreign pre-tax income for each affiliate and employ the medians of these rates as country-level observations for each country and year. Bosworth, Collins, & Chodorow-Reich (2007) use the BEA data to estimate ETRs. BEA data has also been used to estimate ETRs by Stewart (2014), Clausing (2016), Wright & Zucman (2018), Cobham and Janský (2019), Janský (2020a) and Tørsløv, Wier, & Zucman (2020). It is also possible to combine the BEA data with other sources – for example, Zucman

(2014) computes ETRs by dividing all corporate taxes paid to the US and foreign governments by US corporate profits, as recorded in national accounts. Another US-centred data source, the US Treasury on Form 5471 by US-controlled foreign corporations in manufacturing, is used by Mutti & Grubert (2004) to estimate country average effective corporate income tax rates. While the good quality and coverage of the BEA data facilitates interesting research findings, it is limited to US MNCs.

**Table 1. Comparison of various measures of corporate income tax rates, focus on MNCs**

Name	Basis or type of data	Selected methodology	Selected other references
Statutory	Law	The main statutory rate as set out in the law on corporate income tax.	(OECD, 2018b)
Effective tax rates (or often effective average tax rates; EATRs)	Law and hypothetical investment project	Devereux & Griffith (2003) calculate forward-looking ETR for rent-earning investments as the ratio of the present value of taxes to the present value of profits of a forward-looking hypothetical investment project.	Devereux & Griffith (1999), Devereux & Griffith (2003), Hanappi (2018)
Effective tax rates	National statistics	Slemrod (2004a) estimates average corporate tax rate as the ratio of corporation income tax revenues to GDP using country-level data. Tørsløv, Wier, & Zucman (2020) estimate the ratio of corporate income tax payments to corporate profits in national accounts.	Slemrod (2004a), Tørsløv, Wier, & Zucman (2020)
Effective tax rates	Foreign affiliates statistics	Desai, Foley, & Hines (2004) use the BEA data to estimate ETR as the ratio of foreign income taxes paid to foreign pre-tax income for each affiliate and employ the medians of these rates as country-level observations for each country and year	Desai, Foley, & Hines (2004), Clausing (2016)
Effective tax rates	Company balance-sheets	Garcia-Bernardo, Janský, & Tørsløv (2019b) estimate ETRs as the ratio of corporate income tax to gross income.	Markle & Shackelford (2012a), Garcia-Bernardo, Janský, & Tørsløv (2019b)
Effective tax rates	Country-by-country reporting	For large US MNCs, Garcia-Bernardo et al. (2019a) estimate ETRs as dividing corporate income tax by gross income.	OECD (2018a), Garcia-Bernardo et al. (2019a)
Effective tax rates	Confidential tax returns	Dowd et al. (2017) create country-year average tax rates as profit-weighted averages of company-specific rates within a country for a given year.	Dowd et al. (2017), Bilicka (2019)

*Source: Author*

Data sources on the foreign affiliates of MNCs are also published by countries other than the US. While some data is published by governments, data for many countries is published by the OECD or Eurostat. These databases often lack some of the data needed for estimating ETRs, e.g. corporate income tax. This is also the case with Germany's MiDi data, which has been used in research e.g. by Weichenrieder (2009), Hebous & Johannesen (2015) and Gumpert et al. (2016). In addition to the frequently missing tax data, another drawback of foreign affiliates' statistics is that they often aggregate information from company to country level and present the data publicly only in aggregated form, which thus lowers the precision of estimated ETRs and does not allow for an estimation of ETRs for different groups of companies (e.g. classified by sectors).

In addition to company balance sheet databases reviewed below in a separate section, ETRs may be estimated using several alternative company-level data sources. After comparing various measures of ETRs, Nicodème (2001) also computes effective corporate taxation for eleven European countries, the US and Japan using financial statements of companies and points out differences between statutory and effective taxation. Furthermore, official company reporting to the US Securities and Exchange Commission (10-K filings) can be used to derive ETRs, as recently carried out e.g. for Apple (Clancy & Christensen, 2018).

Several recent alternative data sources are also promising. First, national accounts data, which include information on corporate income tax payments and corporate profits, may be used to estimate ETRs (Tørsløv, Wier, & Zucman, 2020). Likewise, data available from country-by-country reporting constitute another emerging alternative (Clausing et al., 2020). For European banks, for example, country-by-country reporting data were recently used to estimate bank-specific ETRs by dividing taxes by gross income (Janský, 2020b). At present, almost all large MNCs are required to report information on their worldwide activities to their headquartered country's tax authority on a country-by-country basis (and one consequence of this is a creation of internationally consistent definition of profits, which would prevent the current cross-country mismatches of taxable profits that provide opportunities for tax avoidance). While such data are not accessible to the public or researchers, they were made available for year 2016 by the OECD in an aggregate and anonymised form for the first time in July 2020 (OECD, 2018a). Despite these limitations, the data have been published already and ETRs have been estimated for US-headquartered MNCs for years 2016 and 2017 (Garcia-Bernardo et al., 2019a). Future releases of such data for additional years should thus be of considerable research interest.

In terms of accuracy, the use of confidential corporate tax returns is even more promising. Confidential corporate tax returns have recently been used to estimate ETRs, for example, by the Government Accountability Office (2008) and Dowd et al. (2017) for the United States and by Habu (2017) for the United Kingdom. Using US data from the Internal Revenue Service, the Government Accountability Office (2008) shows that effective tax rates on the foreign operations of US MNCs vary considerably by country and that effective tax rates are correlated with where income is reported. Dowd et al. (2017) estimate average tax rates as averages weighted by positive profits. The tax returns data includes taxes actually paid (i.e. cash taxes rather than reported or accrued taxes) but are not as easily accessible or comparable across countries as e.g. Orbis data. More generally, actual taxes can be either cash paid taxes

or accrued taxes and the two can differ a lot both empirically (e.g. a company carrying forward losses might accrue non-zero taxes but pay zero cash taxes in a current year) and conceptually (e.g. there might be an uncertainty whether the accrued taxes will ever be paid), but both might make good sense for ETRs. Therefore, in case both are available in the data (as is the case with Compustat, for example) and one needs to be chosen, averaging cash paid taxes over several years or companies might be the compromise approach.

#### **4 Backward looking effective tax rates: Orbis and Compustat**

Both leading global company balance sheet databases, i.e. Orbis and Compustat, have been used to estimate backward-looking ETRs. They are comparable in a number of aspects and both provided by private companies, Orbis by Bureau van Dijk, which grew out of Europe (its Europe-only version is named Amadeus) and is now owned by Moody's, and Compustat, which focuses on the US, by Standard and Poor's. To the best of my knowledge, no definitive study comparing the two leading company balance sheet databases quantitatively and in detail is currently available. One of the earlier conceptual comparisons is provided by Fuest & Riedel (2012), who compare Orbis and Compustat characteristic by characteristic and a recent empirical comparison is provided by Garcia-Bernardo et al. (2019a). Orbis covers a much higher number of companies than Compustat, which contains information only for companies listed on the stock exchange. While Orbis provides ownership information, Compustat does not link subsidiaries to parent company information. As a result, researchers working with Compustat sometimes combine it with ownership information from Orbis. Furthermore, the above mentioned downsides likely explain why no ETR studies have been explicitly conducted using unconsolidated Compustat data and why e.g. Markle & Shackelford (2012a) exclude all unconsolidated firm years from their sample to potentially avoid including both parents and their subsidiaries as separate observations.

A major advantage of Compustat is that cash taxes are available and it is thus possible to estimate cash ETRs (i.e. ETRs on the basis of tax accounting). Unlike in the case of Orbis – and for most non-US firms in Compustat as well – where only accounting taxes are available and where it is thus possible to estimate only accounting ETRs (i.e. ETRs on the basis of financial accounting). When possible, the two may be combined: e.g. Joshi (2019) matches observations between Orbis and Compustat to estimate the impact of public CBCR on effective tax rates. Overall, Orbis appears to be the best currently available database of balance sheet data in case ownership information and company coverage are significant for the research question at hand. However, in case cash taxes and ETRs are deemed more important than coverage, Compustat seems to be the preferred data source. In Table 2, I summarise the existing estimates of backward-looking ETRs using the two databases (i.e. in Table 2, I thus study one row of Table 1 in detail) and discuss them in greater detail below.

**Table 2. Backward-looking ETRs recently estimated using global company balance sheet databases Orbis and Compustat**

Source	Data	Focus	Estimation of ETRs	Selected findings
Johansson, et al. (2017)	Orbis (unconsolidated)	Profit shifting	Ratio of tax expense to profit reported in the financial statements of the company	100–240 billion USD revenue foregone worldwide annually due to profit shifting
Fuest & Riedel (2012) and follow-up research	Orbis (unconsolidated)	Profit shifting	Tax to profit ratio	MNCs with tax haven ownership links differ in their ability to shift profit
Cobham & Janský (2018)	Orbis (unconsolidated)	Profit shifting	Weighted and non-weighted averages of company-level ETRs	ETRs are relevant for profit shifting of MNCs
Garcia-Bernardo et al. (2020)	Orbis (unconsolidated)	ETRs	Ratio of tax to gross income for all affiliates of MNCs in country	ETRs differ substantially from statutory rates for some countries
Egger, Loretz, Pfaffermayr, & Winner (2009b)	Orbis (mostly unconsolidated)	ETRs	Tax payments as a fraction of earnings before interest and taxation	Firm-level component of tax burden more important than country-level one
Garcia-Bernardo, Janský, & Tørsløv (2019b)	Orbis (consolidated)	ETRs	Sum of taxes divided by sum of gross incomes of headquartered MNCs	ETRs differ by headquartered country as well as over time
Markle & Shackelford (2012a, 2012b)	Compustat (consolidated)	ETRs	Preferred indicator: actual cash taxes paid to net income before income taxes	Falling ETRs over time; location of MNCs affects their worldwide ETRs
Dyreng, Hanlon, Maydew, & Thornock (2017)	Compustat (consolidated)	ETRs	Cash ETR, ratio of cash taxes paid to pre-tax accounting income	US and some cross-country results of ETRs over time
Overesch, Schenkelberg, & Wamser (2018)	Compustat (consolidated)	ETRs	ETR as tax expenses divided by pre-tax income	US MNCs pay less foreign taxes, but have higher total taxes than EU ones
Other, e.g. rates Dyreng, Hanlon, & Maydew (2008)	Compustat (consolidated)	ETRs	E.g. long-run cash ETR excludes taxes upon settling of tax disputes	Various (e.g. annual ETRs do not predict long-run ETRs well)

*Source: Author*

#### 4.1 Backward looking effective tax rates: Orbis

The researchers have thus far preferred to use unconsolidated Orbis data to estimate ETRs. Egger, Loretz, Pfaffermayr, & Winner (2009b), who use a combination of unconsolidated data, which account for a vast majority of the observations, and consolidated data, thus constitute something of an exception. Egger, Eggert, & Winner (2010) who use Bureau van Dijk's Amadeus, i.e. Orbis, for European companies only, observe that tax payments of foreign-owned firms are lower than those of domestic companies in high-tax countries but higher in low-tax countries. In a recent addition to existing literature, Egger, Strecker, & Zoller-Rydzek (2018) argue that bargaining power may explain the tax differences between MNCs and local companies beyond MNCs' profit shifting. Larger firms (mostly MNCs) are more valuable for tax authorities for various reasons. In threatening relocation, larger firms extract greater deductions, resulting in a regressive ETR schedule and lower ETRs due to size reasons. MNCs face lower relocation costs than local companies, which enhances their bargaining position. Using French firm-level Orbis data and entropy balancing, Egger, Strecker, & Zoller-Rydzek (2018) find that the regressive nature of the French tax schedule reduces MNCs' ETRs by 2.52 % (size effect), while their relocation threat leads to a 3.58 % reduction. MNCs usually have lower ETRs, but this is not the only systematic difference reported in existing research.

Some ETRs estimated using unconsolidated Orbis data are part of studies on profit shifting by MNCs. OECD researchers estimate that around 100–240 billion USD in annual government tax revenue is lost due to profit shifting (Johansson et al., 2017). They use ETRs estimated using unconsolidated Orbis data as part of their empirical strategy. Specifically, Johansson, et al. (2017) estimate ETRs as the ratio of tax expense to profit reported in company financial statements at an unconsolidated level. They compare the ETR of a multinational entity in a given country and year to the ETR of a domestic entity. The comparison is based on a regression analysis controlling for other firm characteristics that may influence the ETR. Other recent studies have also used these ETRs as indicators of profits shift. Cobham & Janský (2018) use unconsolidated Orbis data to estimate ETRs and employ these in a model to estimate the scale of profit shifting across countries using a methodology developed by Crivelli et al. (2016). Fuest & Riedel (2012) show that MNCs differ with respect to their ability to shift profit depending on their ownership links with tax havens, using the taxes to profits ratio as one indicator. In what is thus far one of a small number of research papers to exploit consolidated Orbis data to estimate ETRs, Garcia-Bernardo, Janský, & Tørsløv (2019b) break down these ETRs' decreases into profit shifting and several other components. The consolidated Orbis data, which has better international coverage than both unconsolidated Orbis and Compustat data, thus still likely provide unexploited opportunities for future research.

A specific challenge posed by Orbis data is that it includes information from companies' balance sheets on the basis of financial accounting rather than on the basis of tax accounting, with only the latter featuring in corporate tax returns. Orbis data thus provide information on what companies paid in taxes according to financial accounting rather than what they actually paid – and reported to a relevant tax authority. Distinguishing between data on taxes paid

according to financial or tax accounting is important, as the two often differ. Tax and accounting literature on this topic is available, including e.g. a review of research in accounting for income taxes by Graham, Raedy, & Shackelford (2012), who argue that this area of financial reporting is complex as the rules and principles governing accounting principles may differ from those governing income tax reporting (e.g. corporate income tax payments might be zero according to tax accounting while being non-zero according to financial accounting). Book-tax conformity is a measure of the scale of alignment between tax and financial reporting. Proposals for increasing book-tax conformity argue that the dual system currently used in the US allows firms to simultaneously manage their taxable income downwards while managing their book income upwards. Hanlon & Maydew (2009) discuss the implications of book-tax conformity for MNCs. Using US data, their simulations indicate that, under book-tax conformity, the tax base would be broadened. Hanlon, Maydew, & 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 records are. With Orbis only capable of providing financial reporting data and with information based on tax accounting missing, Orbis-based ETRs suffer from a potential bias and one that cannot be quantified or controlled using available data.

#### **4.2 Backward looking effective tax rates: Compustat**

In existing literature, Compustat has been used more frequently than Orbis to estimate backward-looking ETRs. This is perhaps because of its US focus as well as due to recent interest in these ETRs by US-based finance and accounting academics. Kemsley (1998) uses Compustat to estimate average foreign tax rates of US MNCs by dividing current foreign taxes by pre-tax foreign earnings to study the effect of taxes on the location of production. The Compustat database is also used in an analysis which shows that ETRs vary substantially across companies and by sector (Bostock et al., 2013). In a series of papers Graham (1996a, 1996b) develops a methodology to estimate the corporate marginal tax rate and other simulated tax rates and used by other researchers, the database is updated by the author on the basis of Compustat. In one of the most intensive uses of the Compustat database of US firms, Dyreng, Hanlon, Maydew, & Thornock (2017) estimate what they term cash ETR, computed as the ratio of cash taxes paid to pre-tax accounting income. While they focus on the development of US companies' ETRs over time, they also compare these to selected countries.

Perhaps the most comprehensive estimates of cross-country backward-looking ETRs thus far come from a 2012 paper. Markle & Shackelford (2012a) use the Compustat financial statement databases information on 11,602 public corporations from 82 countries from 1988 to 2009 to estimate country-level ETRs. While they do use Orbis, its use is limited to the provision of information on the location of ultimately-owned subsidiaries. To estimate ETRs, the authors use net income before income taxes as a denominator and three different numerators: actual cash taxes paid (i.e. cash ETR, their preferred indicator), current worldwide income tax expense (current ETR) and total worldwide income tax expense (total ETR). They find that the location of a multinational corporation and its subsidiaries

substantially affects its worldwide ETR: Japanese and US MNCs face some of the highest ETRs, while MNCs in tax havens face the lowest taxes. By contrast with other research, they find little difference between the ETRs of MNCs and domestic firms. The same authors also investigated correlations between these firm-level ETRs and leverage, intangible assets and tax havens (Markle & Shackelford, 2012b).

A more recent paper focuses on differences between US and European MNCs. Overesch, Schenkelberg, & Wamser (2018) suggest that US MNCs face significantly lower ETRs compared to their European counterparts. They use consolidated financial information obtained from the Compustat and Compustat Global databases. European MNCs are not obligated to disclose foreign taxes and foreign pre-tax income; therefore, to estimate foreign ETRs for European MNCs, the authors use approximation with the help of the Amadeus database. They approximate foreign ETRs for European MNCs by subtracting domestic taxes and domestic pre-tax income from the overall tax expenses and pre-tax income. They obtain domestic information for European MNCs by combining ownership information with financial information taken from the Amadeus database.

Other researchers also estimate ETRs using Compustat data. For example, they find that around one quarter of their sample firms maintain lower ETRs and that annual cash effective tax rates are not very good predictors of long-run cash effective tax rates (Dyreng et al., 2008), that family firms are less tax aggressive than their non-family counterparts (Chen et al., 2010), that corporate tax avoidance is positively associated with firm-specific stock price crash risk (Kim et al., 2011), that equity risk incentives are a significant determinant of corporate tax aggressiveness (Rego & Wilson, 2012), that tax avoidance increases in the separation of ownership and control (Badertscher et al., 2013), that there is a negative association between firms' tax aggressiveness (Chyz et al., 2013), that some executives are personally more tax aggressive (Chyz, 2013), or that entering a tax haven country for the first time results in a slight reduction in the firm's ETR and that shifts in ETR depend on whether the subsidiary is a financial conduit or an operating subsidiary (Markle & Shackelford, 2014).

Although alternative data sources discussed above, such as foreign affiliates' statistics and tax returns, do not provide a combination of coverage and detail offered by Orbis and Compustat, they are often superior to Orbis or Compustat in at least one aspect – and thus capable of complementing these two databases quite well. While advances in data availability of both Orbis and Compustat have contributed to backward-looking ETRs being more frequently estimated, this is likely also partly due to their usefulness in ongoing global corporate tax reform debates in response to profit shifting.

## **5 Backward-looking effective tax rates: selected findings**

One research area where the use of backward-looking ETRs is relevant is the expanding literature on profit shifting by MNCs. While I have hinted at the relationship between ETRs and profit shifting several times thus far, I discuss two interrelated findings of this research agenda in detail below, i.e. that MNCs often pay lower ETRs than local companies and that MNCs with links to tax havens pay lower ETRs than MNCs without links to tax havens. In addition, let me note that backward-looking ETRs of MNCs can be useful for testing the

hypothesis about the development of tax revenue paid by MNCs (which might stay stable as a share of GDP, while MNCs' profits increase as a share of overall corporate profits or GDP and MNCs pay lower ETRs on their increased profits). For example, corporate income tax revenues can rise even if ETRs decline in case the share of corporate profits in national income increases more rapidly (Griffith & Miller, 2014).

Most existing evidence points to ETRs being lower for MNCs than for local firms. Vandebussche & Tan (2005) argue that the lower ETRs of Belgian MNCs in comparison to local firms are the outcome of their better position to bargain for lower taxes with governments as a result of their footloose nature. Using Bureau van Dijk's Amadeus, i.e. Orbis for European companies only, Egger, Eggert, & Winner (2010) observe that tax payments of foreign-owned firms are lower than those of domestic firms in high-tax countries but higher in low-tax countries. Huesecken & Overesch (2015) show that tax rulings, tailor-made for ETRs, contribute to lower ETRs of MNCs in comparison with other companies. In a recent addition to the existing body of literature, Egger, Strecker, & Zoller-Rydzek (2018) argue that bargaining power may explain the tax differences between MNCs and local companies beyond MNCs' profit shifting. Larger firms (mostly MNCs) are more valuable for tax authorities for various reasons. In threatening relocation, larger firms extract greater deductions, resulting in a regressive ETR schedule and lower ETRs due to size. MNCs face lower relocation costs than local companies, which enhances their bargaining position. Using French firm-level Orbis data and entropy balancing, Egger, Strecker, & Zoller-Rydzek (2018) find that the regressivity of the French tax schedule reduces MNCs' ETRs by 2.52 % (size effect), while their relocation threat leads to a 3.58 % reduction. While MNCs usually have lower ETRs, this is not the only systemic difference reported in existing research. By contrast, Dyreng, Hanlon, Maydew, & Thornock (2017), use a sample of US firms to suggest that domestic companies pay higher taxes than MNCs. Similarly, Fuest & Riedel (2012) use Orbis data for several large developing Asian countries to show that domestic firms have higher tax payments per profit or per asset than MNCs. Using information on European companies from Orbis, Egger, Eggert, & Winner (2010) show that the ETRs of MNCs are lower than domestic firms in high-tax countries but higher in low-tax countries.

Furthermore, the ETRs of MNCs with links to tax havens have been found to be lower than those of MNCs without links to tax havens. Fuest & Riedel (2012) show that MNCs differ with respect to their ability to shift profit depending on their ownership links to tax havens; more recently, using the taxes to profits ratio as one indicator, a similar empirical strategy has been applied by Janský and Prats (2015), Janský and Kokeš (2015, 2016) or Nerudova et al. (2019). A number of papers on profit shifting discussed above reveal a similar pattern with MNCs having lower ETRs such as Clausing (2016) and Tørsløv, Wier, & Zucman (2020). Furthermore, existing literature has employed various empirical strategies to explain lower ETRs of MNCs, including a comparison between ETRs of MNCs and other companies within countries by e.g. Jog & Tang, 2001, Buettner & Wamser, 2009, Egger et al., 2010, and Fuest & Riedel, 2012. Generally, profit shifting influences ETRs most visibly at the MNC group level rather than at the MNC affiliate level. If profits are shifted out of a MNC affiliate, then both taxable and real profits fall and ETRs should thus be unaffected. Consequently, the research by Fuest & Riedel (2012) and others focus on the ETRs of the whole MNC group.

To conclude this section, I provide more general thoughts about ETRs in profit shifting studies. Most profit shifting studies to date likely use statutory rather than effective tax rates, as reviewed recently by Johannesen et al. (2019) and Beer, De Mooij, & Liu (2018). On the one hand, ETRs seem more suitable for these estimates than statutory rates since they better reflect the actual average tax paid, which is usually relevant for profit shifting estimates. Since ETRs differ substantially from statutory tax rates for some countries, this may have implications for empirical profit shifting estimates. On the other hand, Dharmapala (2014) argues that statutory rates might be a better proxy for the marginal incentive to shift income by MNCs and Beer et al. (2019) argue that backward-looking ETRs are outcomes of past profit shifting behaviour and raise reverse causality concerns. Overall, good practice might be to report results using both statutory tax rates and ETRs as done by Crivelli et al. (2016), who use forward-looking ETRs, or Cobham & Janský (2018), who use both forward- and backward-looking ETRs. Overall, backward-looking ETRs are bound to stay a useful source for profit shifting research.

## **6 Conclusion**

The rates at which governments tax company income naturally vary across countries, as each country designs its own tax policy. Perhaps less obviously, a variety of corporate income tax rate concepts may be consistently defined across countries, though the values of these are likely to differ within a country. I explore these various concepts in this survey of recent empirical literature. While I review the key contributions to the development and estimation of forward-looking ETRs, I primarily focus on backward-looking ETRs. And, in particular, I discuss the various data sources used to estimate backward-looking ETRs, which range from the increasingly available foreign affiliates statistics to confidential tax returns, which constitute the current state-of-the-art. Within this range I focus on Orbis and Compustat – two leading companies’ balance sheet databases which have been used intensively in recent research and which provide good company coverage for the United States and Europe, respectively. While I review studies conducted using Compustat, mainly used in accounting and finance research rather than in economics, I acknowledge that I might not have fully done justice to all ETR-related research in the accounting and finance literature as this review is primarily focused on research in economics. A potential limitation I would nevertheless like to highlight is that I explicitly focused on backward-looking ETRs rather than on forward-looking ETRs; this is due to, as discussed in section 2 of this paper, the latter being reviewed at more length in recent papers focusing on forward-looking ETRs.

Reviewed information sources of corporate income tax rates differ in terms of e.g. availability and country coverage as well as in how close the rates are to what companies actually pay in taxes. All in all, each rate has its pros and cons. In a nutshell, while statutory tax rates are clearly identifiable in legislation, they oversimplify by focusing on one number only; on the other hand, although ETRs are more complex to derive, they provide a richer understanding of the taxation companies face. Specifically, forward-looking ETRs also systematically reflect other legally stipulated tax provisions from the law than statutory tax rates, including e.g. tax deductions, which are more likely than not to decrease the applicable rate below the statutory rate. On the other hand, backward-looking ETRs reflect the interaction of these tax provisions

with the characteristics and behaviour of individual companies. The outcomes of these interactions may be tracked to company level with some data sources used to estimate backward-looking ETRs, including Orbis and Compustat, neither of which has comprehensive coverage across countries or companies.

Having reviewed a variety of corporate tax rates, deciding which one is most suitable depends on what is specifically expected of it. For example, when one is interested in taxes paid in one country, backward-looking ETRs estimated on the basis of tax return data are likely the most suitable choice. Moreover, backward-looking ETRs are and should be mainly used to indicate profit shifting and other forms of corporate tax avoidance. In contrast, forward-looking ETRs are and should be mainly used when analysing investment or capital structure decisions. Surprisingly, when the best possible worldwide coverage is required, broadly available statutory tax might in fact generally constitute the best option. Consequently, the full range of various rates can play a useful role in either research or policy.

The implications of ETRs for future research and policy are intertwined. Much of the future research of ETRs is likely to be driven by policy needs, at least in the short term. At the same time, how much ETRs will in fact influence policy will likely depend on how much related research progresses. A common requirement across the wide spectrum of ETRs is a need for reliability: while there are established sources of forward-looking ETRs, such as those published by the OECD, there are, at the moment, no equally respected sources of backward-looking ETRs that could be referenced without hesitation by researchers or policy makers. This is in part due to the backward-looking ETRs' challenging methodology and data choices, as reviewed in this paper. Reliable estimates of ETRs can provide useful tools for designing minimum effective taxation or for approximating the extent of profit shifting and these are in turn becoming increasingly relevant in discussions of global corporate tax reforms, e.g. Pillar Two of the OECD reforms.

Furthermore, future research should disaggregate these estimates according to company characteristics, such as sectors – in particular for backward-looking ETRs. Such findings could provide insights into whether and how effective taxation differs systematically across sectors despite the same statutory rate being applicable across all sectors in most countries. Moreover, the ability of future research to break down the differences between statutory and effective rates into specific tax provisions would provide information on the consequences of the current tax system and might in effect guide future tax policy reforms.

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