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Corporate Effective Tax Rates for Research and Policy

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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 modeled using the law—forward-looking ETRs—and those estimated from actual data on companies' profits and taxes—backward-looking ETRs. In this article, I move beyond this distinction, and I break down backward-looking ETRs according to the type of data used to estimate them. I focus on backward-looking ETRs that are 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.

Keywords

corporate income tax, effective tax rate, forward-looking effective tax rate, backward-looking effective tax rate, multinational corporation, profit shifting

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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 U.S. 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, Landefeld, and Moore (2017) and Tørsløv, Wier, and Zucman (2022) 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 article is devoted to filling the gap and aims to provide an overview of how various ETRs differ and what implications they have for researchers and policy makers.

In this article, 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 differs by the type of data used to estimate them. As I move beyond a distinction between backward-looking and forward-looking ETRs, I distinguish between various data sources used for estimating backward-looking ETRs. 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 article, 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, and Tesar (1994); Leibrecht and Hochgatterer (2012); and Gravelle (2014) and—with Ireland used an example—by Coffey and Levey (2014), while Nicodème (2001) and Ruiz and 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. (2020) and Cobham and Janský (2020) review the empirical literature on international tax avoidance by MNCs in economics, while Hanlon and Heitzman (2010), Wilde and Wilson (2018) and, most recently, Wang et al. (2020) do so for accounting and finance literature; 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 and Heitzman 2010 and Wilde and Wilson 2018) focus on tax avoidance in accounting literature, in this review I focus on ETRs in the economics literature. Similar uses of ETRs appear in other recent reviews, for example, in related fields such as economic geography by Aalbers (2018) or international political economy by Dietsch and Rixen (2016) and Christensen and 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 and Waldenström forthcoming), or the taxation of economic rents (Schwerhoff, Edenhofer, and Fleurbaey 2020).

While a recent review has been lacking, a significant amount of new research has recently focused on ETRs. Most relevant recent articles deal with ETRs in one of two ways. Some authors focus on estimating one specific ETR version: Devereux and Griffith (1999, 2003); Spengel et al. (2014); Congressional Budget Office (2017); Hanappi (2018) (forward-looking ETRs); Markle and Shackelford (2012a) and Dyreng

et al. (2017) (backward-looking ETRs estimated on the basis of Compustat). A second category of articles does not focus primarily on ETRs, but instead uses them as indicators of, for example, profit shifting by MNCs: Joshi (2020) and Tørsløv et al. (2022). Rather than estimating a new ETR or using ETRs in associated research, I aim to review the above-mentioned articles as well as other relevant work.

I structure the rest of the article as follows. In the Statutory Rates and Forward-Looking ETRs section, I introduce the basic definitions of statutory and effective tax rates and I discuss seminal articles as well as recent contributions to forward-looking ETRs. In the Backward-Looking ETRs section, I introduce the various types of data used for estimating backward-looking ETRs. In the Backward Looking ETRs: Orbis and Compustat section, I focus on backward-looking ETRs of MNCs estimated mostly on the basis of Orbis and Compustat balance sheet databases. In the Backward-Looking ETRs: Selected Findings section, I discuss several findings that connect profit shifting by MNCs with backward-looking ETRs, including a reference to a quantitative comparison of backward-looking ETRs with statutory rates and forward-looking ETRs. In the Discussion section, I discuss how the full range of various rates can be put to good use in either policy or research. In the Conclusion section, I conclude with an argument that the implications of ETRs for future research and policy are intertwined. For example, how much ETRs will end up influencing policy likely depends on how much research, on backward-looking ETRs in particular, progresses.

Statutory Rates and Forward-Looking ETRs

The statutory corporate income tax rate is the official tax rate paid by a corporation on 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 a 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 ETRs (averages thereof, abbreviated as AETRs or EATRs) since the ETR is the ratio of actual taxes paid to actual profits.

The ETR can be more generally defined as

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

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 2018b: 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 no 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 modeled 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 and 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-maximizing 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; applied, e.g., by Overesch and Rincke 2009). Forward-looking ETRs are usually derived using modeling and the law (although there are exceptions, as, e.g., Egger et al. (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 and 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, and van Dender (2018) and most recently updated to 70 countries (OECD 2020). While these forward-looking ETRs can be useful, for example, for tracking investment climate in a country over time, they are not quite as helpful for other purposes (Bolwijn, Casella, and Rigo 2018). For example, Egger and Stimmelmayr (2017) argue that using ETRs to explain MNCs' behavior 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 and Egger (2017) compute ETRs on profits from R&D investment, while Bösenberg, Egger, and Zoller-Rydzek (2018) use them to study the effects of broad capital taxation on economic growth in small open economies. Egger et al. (2009a) computed ETRs at a country-pair level to account for bilateral aspects of taxation, thus pointing out the bias which appears when ETRs are computed

only at the country level. Also, forward-looking ETRs are frequently used in policy publications. For example, PwC and the World Bank (2017) have been using a version of it for years in the Doing Business Paying Taxes report (Stewart 2014) while the European Commission (2018a) uses these ETRs as an additional indicator of the tax burden on corporations. Similar estimates of forward-looking ETRs compiled on the basis of stylized business models by ZEW (2016, 2017) have been used by the European Commission (2018a) 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 modeling rather than on the observed behavior 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 captures 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., 2020) and which are difficult to reflect when modeling forward-looking ETRs (see Hanappi and 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.

Backward-Looking ETRs

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, backward-looking ETRs can be further broken down according to the data used for estimating them. Table 1 provides a brief comparison of measures of corporate income tax rates with a focus on MNCs and covering

statutory rates, forward-looking rates and a variety of backward-looking ETRs according to the real-world data sources used, including company tax returns which are confidential in most countries. Table 1 includes key research contributions to the development and estimation of various ETRs. The various rates differ with respect to how much they take into account any tax provisions, with statutory rates not even attempting to do so and forward-looking ETRs doing so in hypothetical scenarios. In contrast, these provisions are taken into account by ETRs estimated using tax returns which more closely reflect reality.

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 (2003) and Dharmapala (2014). More recently, for example, Beer et al. (2020) argue that backward-looking ETRs are outcomes of past profit-shifting behavior 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, Landefeld, and Moore (2017: 5), who argue that both statutory and average tax rates suffer from endogeneity issues, as discussed by Huizinga and Laeven (2008) or by the IMF (2014), since tax policy—which can be represented by any of the tax rates discussed 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 U.S.-headquartered MNCs and includes foreign taxes paid in many countries worldwide. Desai, Foley, and 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, and 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 and Zucman (2018); Cobham and Janský (2019); Janský (2020a) and Tørsløv, Wier, and Zucman (2022). It is also possible to combine the BEA data with other sources—for example, Zucman

Table 1. A brief comparison of various measures of corporate income tax rates, focusing 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 (ETRs or often effective average tax rates; EATRs)	Law and hypothetical investment project	Devereux and 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 and Griffith (1999), Devereux and Griffith (2003), Hanappi (2018)
ETRs	National statistics	Slemrod (2004) estimates average corporate tax rate as the ratio of corporation income tax revenues to GDP using country-level data. Tørsløv, Wier, and Zucman (2022) estimate the ratio of corporate income tax payments to corporate profits in national accounts.	Slemrod (2004), Tørsløv, Wier, and Zucman (2022)
ETRs	Foreign affiliates statistics	Desai, Foley, and Hines (2004) use the BEA data to estimate ETR as the ratio of	Desai, Foley, and Hines (2004), Clausing (2016)

(continued)

Table 1. (continued)

Name	Basis or type of data	Selected methodology	Selected other references
		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.	
ETRs	Company balance-sheets	Garcia-Bernardo, Janský and Tørsløv (2020) estimate ETRs as the ratio of corporate income tax to gross income.	Markle and Shackelford (2012a), Garcia-Bernardo, Janský, and Tørsløv (2020)
ETRs	Country-by-country reporting	For large US MNCs, Garcia-Bernardo, Janský, and Tørsløv (2021) estimate ETRs as dividing corporate income tax by gross income.	OECD (2018a), Garcia-Bernardo, Janský and Tørsløv (2021)
ETRs	Confidential tax returns	Dowd, Landefeld, and Moore (2017) create country-year average tax rates as profit-weighted averages of company-specific rates within a country for a given year.	Dowd, Landefeld, and Moore (2017), Bilicka (2019), Koivisto et al. (2021)

Source: Author.

(2014) computes ETRs by dividing all corporate taxes paid to the U.S. and foreign governments by U.S. corporate profits, as recorded in national accounts. Another U.S.-centred data source, the U.S. Treasury on Form

5471 by U.S.-controlled foreign corporations in manufacturing, is used by Mutti and Grubert (2004) to estimate the country average effective corporate income tax rates. While the good quality and coverage of the BEA data facilitate interesting research findings, it is limited to U.S. MNCs.

Data sources on the foreign affiliates of MNCs are also published by countries other than the United States. 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, for example, corporate income tax. This is also the case with Germany's MiDi data, which has been used in research, for example, by Weichenrieder (2009); Hebous and Johannesen (2015); and Gumpert, Hines, and Schnitzer (2016). In addition to the frequently missing tax data, another drawback of foreign affiliates' statistics is that they often aggregate information from the company to country level and present the data publicly only in aggregate 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 United States and Japan using financial statements of companies and points out differences between statutory and effective taxation. Furthermore, official company reporting to the U.S. Securities and Exchange Commission (10-K filings) can be used to derive ETRs, as recently carried out, for example, for Apple (Clancy and 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, and Zucman, 2022). Likewise, data available from country-by-country reporting constitute another emerging alternative (Clausing, Saez, and Zucman 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 the creation of an 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

the year 2016 by the OECD in an aggregate and anonymized 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 U.S.-headquartered MNCs for years 2016 and 2017 (Garcia-Bernardo, Janský, and Mišák 2021) as well as for other MNCs (Garcia-Bernardo and Janský 2021; OECD 2020), with confidential MNC-level data used for Germany (Fuest et al. 2022; Fuest, Hugger, and Neumeier 2022) and Italy (Bratta, Santomartino, and Acciari 2021). 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, Landefeld, and Moore (2017) for the United States and by Habu (2017) for the United Kingdom. Using U.S. data from the Internal Revenue Service, the Government Accountability Office (2008) shows that ETRs on the foreign operations of U.S. MNCs vary considerably by country and that ETRs are correlated with where income is reported. Dowd, Landefeld, and Moore (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, for example, 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 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.

Backward Looking ETRs: Orbis and Compustat

Both leading global company balance sheet databases, that is, Orbis and Compustat, have been used to estimate backward-looking ETRs. They are comparable in a number of aspects and both are 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 United States, 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 and Riedel (2012), who compare Orbis and Compustat characteristic by characteristic and a recent empirical comparison is provided by Garcia-Bernardo, Janský, and Mišák (2021). 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, for example, Markle and 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-U.S. 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: for example, Joshi (2020) matches observations between Orbis and Compustat to estimate the impact of public CBCR on ETRs. 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 summarize 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.

Backward Looking ETRs: Orbis

The researchers have thus far preferred to use unconsolidated Orbis data to estimate ETRs. Egger et al. (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, and Winner (2010) who use Bureau van Dijk's Amadeus, that is, 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,

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 and 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 and 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, Janský, and Tørsløv (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 et al. (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 and Tørsløv (2022)	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 and 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

(continued)

Table 2. (continued)

Source	Data	Focus	Estimation of ETRs	Selected findings
Dyreng et al. (2017)	Compustat (consolidated)	ETRs	Cash ETR, ratio of cash taxes paid to pre-tax accounting income	U.S. and some cross-country results of ETRs over time
Overesch, Schenkelberg, and Wamser (2018)	Compustat (consolidated)	ETRs	ETR as tax expenses divided by pre-tax income	U.S. MNCs pay less foreign taxes but have higher total taxes than EU ones
Other, e.g., rates Dyreng, Hanlon, and Maydew (2008)	Compustat (consolidated)	ETRs	For example, 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.

Egger, Strecker, and 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 to 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 (despite tax playing a secondary role in location decisions more generally, Bergstrand and Egger 2007). Using French firm-level Orbis data and entropy balancing, Egger, Strecker, and 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 profit shift. Cobham and 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, de Mooij, and Keen (2016). Fuest and 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 articles to exploit consolidated Orbis data to estimate ETRs, Garcia-Bernardo, Janský, and Tørsløv (2022) 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, for example, a review of research in accounting for income taxes by Graham, Raedy, and 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 United States allows firms to simultaneously manage their taxable income downwards while managing their book income upwards. Hanlon and Maydew (2009) discuss the implications of book-tax conformity for MNCs. Using U.S. data, their simulations 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 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.

Backward Looking ETRs: Compustat

In existing literature, Compustat has been used more frequently than Orbis to estimate backward-looking ETRs. This is perhaps because of its U.S. focus as well as due to recent interest in these ETRs by U.S.-based finance and accounting academics. Kemsley (1998) uses Compustat to estimate the average foreign tax rates of U.S. 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 articles Graham (1996a, 1996b) develops a methodology to estimate the corporate marginal tax rate and other simulated tax rates and is 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 U.S. firms, Dyreng et al. (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 U.S. 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 article. Markle and 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 an MNC 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 and Shackelford 2012b).

Another article focuses on the differences between U.S. and European MNCs. Overesch, Schenkelberg, and Wamser (2018) suggest that U.S. 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.

In another more recent article, Dyreng et al. (2021) use ETRs estimated using Compustat as measures of tax avoidance to investigate the relationship between corporate tax incidence and tax avoidance. They find that as the corporate tax incidence increasingly falls on firms, because they operate in labor markets with highly elastic labor supply, firms avoid more tax. This is strongest when there are relatively few tax deductions for capital relative to labor and when capital is highly productive relative to labor, because

these conditions facilitate an investment mix that tilts more heavily toward capital and increases the marginal benefit of tax avoidance. In an even more recent article, Dyreng, Hills, and Markle (2022) use Compustat data to generate estimates of foreign ETRs as one of the four important measures of the overall tax avoidance of U.S. MNCs. As an excellent example of using the Compustat data to investigate the industry and other heterogeneity in the ETRs, they further show that the decline in the foreign ETRs is highly concentrated in three industries and in a small set of large, highly-profitable firms.

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 ETRs are not very good predictors of long-run cash ETRs (Dyreng, Hanlon, and Maydew 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, Li, and Zhang 2011), that equity risk incentives are a significant determinant of corporate tax aggressiveness (Rego and Wilson 2012), that tax avoidance increases in the separation of ownership and control (Badertscher, Katz, and Rego 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 and 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.

Backward-Looking ETRs: 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 three interrelated findings of this research agenda in detail below, that is, first, that MNCs often pay lower ETRs than local companies, second, that MNCs with links to tax havens pay lower ETRs than MNCs without links to tax havens and, third that MNCs sometimes have lower backward-looking ETRs than are the statutory or forward-looking ETRs. 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 and Miller 2014), which might have been the case in some U.S. states (Fox and Luna 2005).

First, most existing evidence points to ETRs being lower for MNCs than for local firms. Vandenbussche and 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, that is, Orbis for European companies only, Egger, Eggert, and 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 and Overesch (2019) 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, and 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 to 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, and 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 3.58% reduction. While MNCs usually have lower ETRs, this is not the only systemic difference reported in existing research. By contrast, Dyreng et al. (2017), use a sample of U.S. firms to suggest that domestic companies pay higher taxes than MNCs. Similarly, Fuest and 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 the information on European companies from Orbis, Egger, Eggert, and Winner (2010) show that the ETRs of MNCs are lower than domestic firms in high-tax countries but higher in low-tax countries.

Second, 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 and 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 articles on profit shifting discussed above reveal a similar pattern with MNCs having lower ETRs such as Clausing (2016) and Tørsløv, Wier, and Zucman (2022). 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, for example, Jog and Tang 2001; Buettner and Wamser 2009; Egger, Eggert, and Winner 2010; and Fuest and 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 an MNC affiliate, then both taxable and real profits fall and ETRs should thus be unaffected. Consequently, the research by Fuest and Riedel (2012) and others focus on the ETRs of the whole MNC group.

Third and finally, we address the question of how backward-looking ETRs compare to the statutory or forward-looking ETRs quantitatively. If there are systematic differences, this might have important implications for how to estimate profit shifting as well as for profit shifting itself. More generally, it is of interest to know whether methodological differences in measurement of corporate taxation can lead to material differences in the magnitude of the measures. However, among the existing literature, not many articles make explicit quantitative comparisons across these different measures of corporate taxation.

A rather rare example is an article by Garcia-Bernardo, Janský, and Tørsløv (2020), who estimate backward-looking ETRs and compare them with both the statutory rates and forward-looking ETRs. Garcia-Bernardo, Janský, and Tørsløv (2020) focus on estimating ETRs of MNCs with unconsolidated Orbis data for the 2011–2015 period for countries with at least 50 available companies, which results in a sample of 50, mostly European, countries. They estimate the ETR of a country as the ratio of corporate income tax to gross income for all affiliates of MNCs in that country, weighted by gross income. They propose four ETR estimations, including

lower and upper bounds, which differ by gross income calculation. In addition to estimating these ETRs, they compare them with statutory rates (Janský and Palanský 2019; KPMG 2018) and forward-looking ETRs (Hanappi 2018; OECD 2018c). They find that ETRs substantially differ from statutory rates and from forward-looking ETRs for some countries, for example, Luxembourg, as can be seen in Figure 1, reprinted from Garcia-Bernardo, Janský, and Tørsløv (2020). As these comparisons are from one study only (with related limitations such as the time period and country coverage), I do not want to draw from it any general conclusions, for which more research is needed.

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 ETRs, as reviewed recently by Johannesen, Tørsløv, and Wier (2020) and Beer, De Mooij, and Liu (2020). 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. (2020) argue that backward-looking ETRs are outcomes of past profit-shifting behavior and raise reverse causality concerns. Overall, good practice might be to report results using both statutory tax rates and ETRs as done by Crivelli, de Mooij, and Keen (2016), who use forward-looking ETRs, or Cobham and 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.

Discussion

In this section, I provide a more detailed discussion of the kinds of questions that can be answered with each measure of corporate tax rates, starting with summarizing their differences. In a nutshell, while statutory tax rates are clearly identifiable in legislation and have by far the best coverage across countries and years, 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, for example, tax deductions, which are more likely than not to decrease

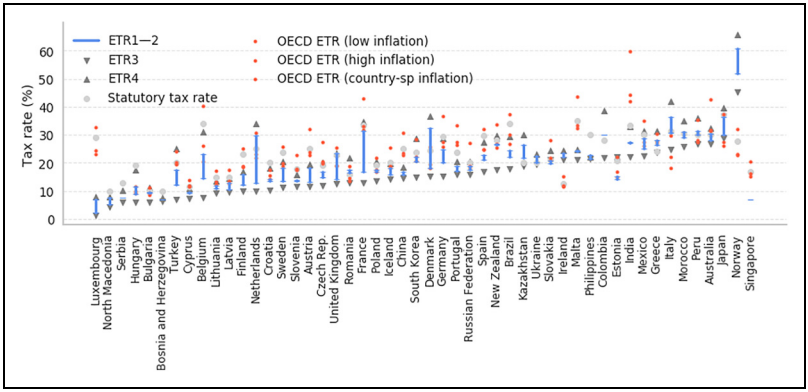

Figure 1. Corporate statutory, backward-looking and forward-looking effective tax rates.

Source: Garcia-Bernardo et al. (2020). *Notes: The figure compares corporate statutory, backward-looking and forward-looking effective tax rates. Country-level means of ETRs in four versions of backward-looking ETRs (ETR1–ETR4; defined in Garcia-Bernardo, Janský and Tørsløv 2020, for 2011–2015). Statutory rates (KPMG 2018; Janský and Palanský 2019). OECD forward-looking ETRs for three scenarios (Hanappi 2018,* OECD 2018c*): high inflation and interest rates, low inflation and interest rates, and country-specific inflation and interest rates.*

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 behavior of individual companies. The outcomes of these interactions may be tracked at the 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 considered a variety of corporate tax rates, deciding which one is most suitable depends on what is specifically expected of it. In a nutshell, each of them can be a useful tool. Let's consider backward-looking ETRs. Perhaps most importantly, backward-looking ETRs are a good measure of tax burden that can be used for comparisons across countries and years, as well as across different companies. These companies can in theory differ by size, sector, multinational status, headquarter country, and other characteristics, although in practice this heterogeneity of ETRs is underexplored in the current literature so far. Moreover, although they are far from identifying tax avoidance with certainty, backward-looking ETRs

can be used as proxies of profit shifting as well as indicators of other forms of corporate tax avoidance. And, indeed, they are used intensively for this purpose by the profit-shifting literature, as evidenced by much of the Orbis- and Compustat-based research covered in this article (Dyreng et al. 2017; Tørsløv, Wier, and Zucman 2022).

In contrast to the relatively broad use of backward-looking ETRs, the most often used version of forward-looking ETRs emerged as a response to a specific need, to evaluate taxation of discrete investment choices (Devereux and Griffith 1999). And, indeed, forward-looking ETRs are and should be mainly used when analyzing investment or capital structure decisions. But forward-looking ETRs are and likely should be also used more broadly. This partly happens when statutory are deemed not suitable for the purpose, but backward-looking ETRs are not able to simulate the parameter of interest due to detailed data not being available, as might be the case with an evaluation of corporate tax reform proposals (e.g., Hanappi and Cabral 2020). Or when backward-looking ETRs are not available for a sufficient number of countries or years, as might be explained in the case of their use in some of the profit-shifting literature (e.g., Crivelli, de Mooij, and Keen 2016). Naturally, the generally better coverage of respected estimates of forward-looking ETRs than of backward-looking ETRs likely contributed to their wider use among economists.

Statutory rates are much simpler than ETRs, which have their pros as well as cons. The interpretation of statutory rates as well as availability is much simpler than for ETRs. Indeed, when the best possible worldwide and time coverage is required, broadly available statutory tax rates in fact generally constitute the best option. On the other hand, they simplify corporate taxation too much and ignore the various complexities and tax provisions altogether. All in all, let's acknowledge the inconvenient truth. For most purposes either backward- or forward-looking ETRs are likely preferable to statutory rates. But as long as neither forward-looking nor backward-looking ETRs are available for a comparable range of countries or years, most researchers or policy makers will choose to—or will be forced to—use statutory rates. Consequently, the full range of various rates can play a useful role in either research or policy.

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 the 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 the Statutory Rates and Forward-Looking ETRs section of this article, the latter being reviewed at more length in recent articles focusing on forward-looking ETRs.

Reviewed information sources of corporate income tax rates differ in terms of, for example, 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 and 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 analyzing investment decisions. And, when the best possible coverage is required, statutory tax rates constitute the best option. Therefore, each of the measures of corporate taxation is a useful tool for researchers and policy makers.

The implications of ETRs for future research and policy are intertwined. Much of the future research on ETRs is likely to be driven by policy needs, at least in the short and medium terms. At the same time, how much ETRs will in fact influence policy likely depends on how much related research progresses. A common requirement across the 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 article. 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, for example, Pillar Two of the OECD reforms.

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