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Tax planning by multinational firms: Firm-level evidence from a cross-country database

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By Åsa Johansson, Øystein Bieltvedt Skeie, Stéphane Sorbe and Carlo Menon

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ABSTRACT/RÉSUMÉ

Tax planning by multinational firms: Firm-level evidence from a cross-country database

This paper exploits firm-level data from the ORBIS database to assess international tax planning by multinational enterprises (MNEs). Profit shifting to lower-tax rate countries is measured by comparing the profitability of MNE entities having different links to countries with different tax rates and thus different profit shifting opportunities. The paper also considers other aspects of tax planning that have been less documented in the empirical literature, such as the exploitation of mismatches between tax systems and preferential tax regimes, by comparing how profits reported by MNE entities are taxed relative to non-multinational entities with similar characteristics. The analysis builds on available unconsolidated financial account data, which, despite its limitations, is considered as the best existing cross-country firm-level data. Results are based on a very large sample of firms (1.2 million observations of MNE accounts) in 46 OECD and G20 countries and a sophisticated procedure to identify MNE groups. They provide robust evidence that MNEs shift profits to lower-tax rate countries and that large MNEs also exploit mismatches between tax systems and preferential tax treatment to reduce their tax burden. Overall, the estimated net tax revenue loss ranges from 4% to 10% of global corporate tax revenues. The empirical analysis also shows that strong "anti-avoidance" rules against tax planning are associated with reduced profit shifting, but also higher compliance costs for firms.

JEL classification: H25; H26; H32; F23

Key words: Multinational tax planning; base erosion; profit shifting; corporate income tax; firm-level data

Planification fiscale des entreprises multinationales: des preuves basées sur des données internationales d'entreprises

Ce document exploite les données d'entreprises de la base de données ORBIS pour évaluer la planification fiscale internationale des entreprises multinationales. Les transferts de bénéfices vers les pays à taux d'imposition inférieur sont mesurés en comparant la rentabilité des entités multinationales ayant des liens différents avec des pays ayant des taux d'imposition différents et donc différentes possibilités de transferts de bénéfices. Le document examine également d'autres aspects de la planification fiscale qui ont été moins documentés dans la littérature empirique, comme l'exploitation des disparités entre les systèmes fiscaux et les régimes fiscaux préférentiels, en comparant la façon dont les bénéfices déclarés par les entités multinationales sont imposés par rapport à des entités non-multinationales avec des caractéristiques similaires. L'analyse se fonde sur des données financières non consolidées, qui, malgré leurs limites, sont considérées comme le meilleur échantillon international de données d'entreprises existant. Les résultats sont basés sur un très grand échantillon d'entreprises (1,2 millions d'observations de comptes de multinationales) dans 46 pays de l'OCDE et du G20 et une procédure sophistiquée pour identifier les groupes multinationaux. Ils fournissent des preuves solides que les multinationales transfèrent leurs bénéfices vers les pays à taux d'imposition inférieur et que les grandes multinationales exploitent également les disparités entre les systèmes fiscaux et les traitements fiscaux préférentiels pour réduire leur fardeau fiscal. Au total, la perte de recettes fiscales nette estimée varie de 4% à 10% des recettes mondiales d'impôt sur les sociétés. L'analyse empirique montre également que des règles strictes « anti-évitement » contre la planification fiscale sont associés à des transferts de bénéfices réduits, mais aussi à des coûts de conformité plus élevés pour les entreprises.

Classification JEL: H25; H26; H32; F23

Mots clés: Planification fiscale internationale, impôts sur les sociétés, données au niveau de l'entreprise

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TAX PLANNING BY MULTINATIONAL FIRMS: FIRM-LEVEL EVIDENCE FROM A CROSS-COUNTRY DATABASE

By Åsa Johansson, Øystein Bieltvedt Skeie, Stéphane Sorbe and Carlo Menon[1]

KEY FINDINGS

This paper provides robust evidence of tax planning by multinational enterprises (MNEs). The analysis is based on a sample of data that are considered to be the best available cross-country firm-level information. Yet, the data have significant limitations in their representativeness in some countries, do not include all MNE entities and are based upon financial accounts rather than tax returns.

- Robust empirical evidence shows that MNEs engage in international tax planning. MNEs shift profit from higher to lower-tax rate countries. Large MNEs also exploit mismatches between tax systems (e.g. differences in the tax treatment of certain entities, instruments or transactions) and preferential tax treatment for certain activities or incomes to reduce their tax burden.
- Transfer price manipulation, strategic allocation of intangible assets and manipulation of internal and external debt levels are important profit shifting channels.
- Tax planning reduces the effective tax rate of large MNEs by 4-8½ percentage points on average. The reduction is even greater for very large firms and firms intensive in the use of intangible assets. Small MNEs also engage in tax planning, but to a lesser extent.
- The net tax revenue loss from tax planning is estimated at 4-10% of global corporate tax revenues. These estimates based on 2000-10 data are surrounded by uncertainty and should be interpreted with caution.
- Strong anti-avoidance rules reduce tax planning. Strong anti-avoidance rules, such as transfer pricing, interest deductibility, general anti-avoidance rules (GAARs) and controlled foreign-company (CFC) rules, are found to reduce profit shifting. However, complex rules generate compliance costs for all firms, hampering profitability, as well as administrative and enforcement costs for tax authorities.

1. Introduction and main findings

1. Multinational enterprises (MNEs) can take advantage of international differences in corporate tax systems to reduce their tax burden. A main avenue to exploit these differences is to shift profits from higher to lower-tax rate countries, disconnecting these profits from the generating economic activity. Such profit shifting can be achieved, for example, by manipulating "transfer prices" on intra-group transactions, strategically concentrating intangible assets (and the associated income) in low-tax countries or

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concentrating internal and external debts (and thus interest payments) in high-tax countries. In addition to profit shifting, MNEs can exploit mismatches between tax systems, for example to reach situations of double non-taxation (e.g. "hybrid" corporate entities that are considered as tax resident by no country) or double deduction (e.g. expenses that are tax deductible in two countries at the same time). They can also, more than domestic firms, exploit preferential tax treatment of certain activities or incomes, for example by locating their intellectual property in countries with preferential tax treatment (e.g. "patent box"). Tax planning by MNEs can undermine government revenues and raise economic efficiency issues.

2. Previous research based on firm-level data has found evidence of profit shifting of MNEs, although these studies often cover only one specific country or group of countries (for reviews, see OECD, 2013a; Heckemeyer and Overesch, 2013; Dharmapala, 2014; IMF, 2014). The issues of mismatches between tax systems and preferential tax treatment have received much less academic attention than profit-shifting. The two main contributions of this paper are: (i) to assess profit shifting over a large set of OECD and G20 countries, using a large sample of firms from the ORBIS database (1.2 million observations of MNE accounts). This database is considered to be the best currently available cross-country firm-level information. Still, the data have limitations in their representativeness in some countries (e.g. the United States), do not include all MNE entities and are based upon financial accounts rather than tax returns. The assessment of profit shifting improves upon earlier research by taking into account profit shifting between all members of multinational groups rather than only between a subsidiary and its parent and by trying to gauge the effectiveness of "anti-avoidance" policies aimed at preventing profit shifting; (ii) to assess, in a second step, the effect of mismatches between tax systems and preferential tax treatment, which are also found to significantly erode corporate tax revenues.

3. The empirical strategy to identify profit shifting, inspired by Huizinga and Laeven (2008), is to compare in a regression analysis the profitability of MNE entities that have similar characteristics (size, industry, etc.), but belong to different corporate groups. As they have different links to other countries, these entities have different opportunities to shift profits. Profit shifting opportunities are proxied by the differential between the statutory tax rate in the country of an entity and the average rate among the countries where its MNE group is present. On average, MNE entities with links to lower tax rate countries are found to report lower profits than comparable entities without such links, supporting the profit shifting hypothesis. The magnitude of profit shifting is broadly in line with previous estimates. For instance, a one percentage point higher statutory corporate tax rate than the average in the MNE group is associated with a reduction in reported profits by about 1%. The empirical analysis suggests that transfer price manipulation, strategic allocation of intangible assets and manipulation of the location of internal and external debt are important profit shifting channels.

4. The effect of mismatches between tax systems and preferential tax treatment is estimated jointly. The strategy is to compare the effective tax rate (ETR) of an entity of a multinational group to the ETR of a non-multinational entity on its reported profit (i.e. profit reported in financial accounts, which may differ from taxable profit). The hypothesis is that in the absence of mismatches, the profit reported in a given country by a MNE entity would be taxed at the same rate as the profit of a non-MNE entity after controlling for other factors (e.g. industry, size, profitability). However, if MNEs can exploit mismatches between tax systems to reach situations of double non-taxation of profit, or double deduction of expenses, this would reduce their taxable profit and they would have a lower ETR on their reported profit. This ETR differential would also be increased if MNEs exploit country-specific preferential tax regimes for certain activities or incomes to a greater extent than comparable domestic firms, for example by locating all their patents in countries with preferential tax treatment for patent revenues. The empirical analysis suggests that large MNEs exploit mismatches between tax systems and preferential tax treatment. In contrast, small MNEs do not appear to exploit them, possibly because of the large fixed costs (and information costs) of the schemes involved.

5. The empirical analysis also shows that MNEs operating in many countries engage more intensively in tax planning than other MNEs. This may reflect their access to a wider range of (potentially mismatching) tax systems and bilateral tax treaties. Intangible assets are also found to facilitate tax planning. Patenting MNEs have a higher profit shifting intensity than non-patenting MNEs and they also benefit more from mismatches and preferential tax treatment, possibly reflecting patent shifting behaviours.

6. All OECD and G20 countries have "anti-avoidance" rules against tax planning. For example, rules generally require that intra-group trade takes place at market price ("arm's length" principle), but documentation and disclosure requirements on transfer prices differ a lot between countries. Rules can also include restrictions on interest deductibility based on debt-to-equity ("thin capitalisation" rules) or interest-to-earnings ratios to limit the scope for strategic allocation of debt. Other existing rules include general anti-avoidance rules (GAARs) and controlled foreign-company (CFC) rules. Withholding taxes on interest, dividends and royalties, although they are not strictly speaking anti-avoidance rules, can also influence tax planning incentives. Based on a new classification of the strength of anti-avoidance rules and withholding taxes (Johansson et al., 2016), the empirical analysis suggests that strong anti-avoidance rules can reduce profit shifting. However, these rules are also associated with lower firm profitability, which may reflect compliance costs.

7. Overall, international tax planning reduces the effective tax rate of large MNEs by an average 4-8½ percentage points relative to comparable non-multinational firms. This difference is lower (1½-3½ percentage points) for smaller MNEs. The tax revenue effects of profit shifting and mismatches between tax systems (including preferential tax treatment) are cumulative. Profit shifting redistributes corporate tax bases between countries. It leads to an overall tax revenue loss since profit is taxed at a lower rate (or not taxed at all) in the destination country. Mismatches between tax systems imply revenue losses for all countries, since they result in some profit not being taxed in any country or some deductions being used in two countries at the same time. The estimated net tax revenue loss for the countries included in this study (all OECD and G20 countries, accounting for about 90% of world GDP) ranges from 4% to 10% of CIT revenues. Globally, this corresponds to about USD 100-240 billion in 2014, or about USD 0.9-2.1 trillion accumulated over the last ten years (2005-14).

2. Tax planning channels and the BEPS Action Plan

8. In this study, tax planning refers to situations in which there is a disconnection between the location of profits and the real activity generating them. It also includes situations where the effective tax rate (ETR) of MNEs is artificially reduced – compared to that of similar domestic firms – due to exploitation of tax planning schemes involving loopholes in tax systems and preferential tax treatment. The main tax planning channels covered in the empirical analysis are presented in Box 1. In practice, tax planning schemes are often complex and can involve several of these channels in combination.

9. The tax planning channels covered in this paper broadly overlap with the base erosion and profit shifting (BEPS) behaviours identified in the OECD-G20 BEPS Action Plan (OECD, 2013b; Table A1.1).[2] The BEPS project focuses on "*instances where the interaction of different tax rules leads to double non-taxation or less than single taxation"* and it also relates to *"arrangements that achieve no or low taxation by shifting profits away from the jurisdictions where the activities creating those profits take plac*e*"* (OECD, 2013b). Tax planning defined in this paper is broader than BEPS. Some tax planning activities are included in the empirical analysis but are not BEPS behaviours, such as the decision to carry out

2. One part of this paper examines the impact of tax rate differentials on global tax revenues. On the other hand, the OECD - G20 BEPS Action Plan deals with aggressive tax planning of multinational enterprises that artificially shift profits to minimise their global tax burden, while respecting the sovereign decisions on levels of taxation.

substantial activity in a country to benefit from certain preferential tax treatments (e.g. R&D tax subsidies). This reflects the limitations of the available data, which make it difficult to disentangle certain BEPS from non-BEPS behaviours. Still, most tax planning channels covered by the analysis in this study overlap with BEPS behaviours and represent artificial financial flows that are not related to the location of real activity.

Box 1. Tax planning channels covered in the analysis

Profit shifting channels: MNEs have different ways to reduce their corporate tax burden by locating in lower-tax rate countries their profit generated in higher-tax rate countries.

- **Transfer price optimisation:** Optimising the price of transactions between related entities within the range of possible market-based so-called "arm's-length" prices to achieve tax advantages. For example, by selecting a low price in the range for rights, products and services transferred from high to low-tax entities or vice versa.*

- **Allocation of intangibles, assets and risks:** Allocating through intra-group arrangements the ownership of income producing intangibles, assets and risks in low-tax countries to divert profit from high-tax countries. Operational functions are more difficult to re-locate and the main value-creating activities which manage and exploit those intangibles, assets and risks may be performed in higher-tax locations under contract to the legal owner.

- **Manipulation of the location of debt:** Interest payments on debt are generally deductible from taxable income. Locating MNE external and internal debt (and the associated interest payments) in an entity in a higher-tax rate country allows offsetting profits and reducing tax payments of this entity.

Mismatches between tax systems, including preferential tax treatment and negotiated tax rates: MNEs may exploit differences in the tax treatment of entities, instruments, or transfers between countries to reduce their corporate tax burden (OECD, 2014a). This is possible even in the absence of a difference between statutory tax rates. MNEs may also be able to reduce their tax burden via preferential tax treatment and negotiated firm-specific reduced tax rates.

- **Hybrid instruments and transfers:** Instruments which are treated differently in two countries, for example as debt in one country and as equity in another country. This can result in an interest deduction in the first country and non-taxable income in the second country (as the income is treated as a tax-exempt dividend).

- **Hybrid entities:** The same entity can be treated differently in two countries for tax purpose. For instance, an entity may be considered as tax resident by no country (so called "stateless entities") and in this way achieve double non-taxation of profit. Alternatively, an entity can be treated as a non-taxable entity such as a partnership (where the partners are taxed instead of the entity itself) in one country and a taxable entity in another. This can result in a deduction in the first country and non-inclusion of the income in the second country.

- **Preferential tax treatment:** MNEs may shift certain incomes to benefit from special tax treatment offered by some countries (or areas within them), such as for intellectual property (e.g. patent boxes) or financial services. Domestic firms can also benefit from preferential tax treatment, but to a lesser extent than MNEs since they cannot shift incomes across borders to enjoy these treatments on a larger scale.

- **Negotiated tax rates:** Firm-specific reduced tax rates for individual MNEs through negotiation between the MNE and the tax authority.

* The empirical approach cannot disentangle "legal" transfer pricing optimisation, i.e. optimisation within the range of permitted arm's length prices, from illegal transfer pricing manipulation, i.e. the choice of a price outside the range of permitted arm's length prices. As a result, both situations are covered in the empirical analysis.

3. Empirical strategy

10. The strategy is to first identify profit shifting, and in a second step the effect of mismatches between tax systems and preferential tax treatment jointly. The analysis on profit shifting focuses on where profits of MNEs are reported in financial accounts, while the analysis on mismatches (including preferential tax treatment) focuses on how the reported profits are taxed in each country. This systematic top-down approach (as opposed to a channel by channel approach) ensures that there is no double-counting between the two steps and that complex tax planning schemes are covered in a consistent way.

11. The approach also takes into account potential interactions between profit shifting and mismatches between tax systems. For instance, if profits are shifted to a country to enjoy a preferential tax treatment, the ETR differential resulting from this treatment is applied to the complete tax base (i.e. including the shifted profits) when assessing the fiscal implications of tax planning.

3.1 Profit shifting

12. The empirical framework follows the idea introduced by Grubert and Mutti (1991) and Hines and Rice (1994) that the observed pre-tax profit of a multinational entity is a sum of the "true" profit and the profit shifted for tax reasons (equation 1). This (unobserved) shifted profit would be positive in low-tax countries and negative in high-tax countries. The strategy to estimate the shifted profit is similar to Huizinga and Laeven (2008) and Beer and Loeprick (2014). The idea is to compare the profitability of multinational entities that have similar characteristics (e.g. size, industry, etc.) and are thus likely to have the same "true" profitability, but have different opportunities to shift profits. These opportunities are assessed using the available information on the location of the other firms in the group and the statutory tax rate in these locations. The assumption is that MNE entities with links to lower-tax rate countries are more likely to shift profits, while MNE entities with links to higher-tax rate countries are more likely to receive profits.

$$Observed\ profit = \underbrace{"true"\ profit}_{f(size,industry,country,year,etc.)} + \underbrace{shifted\ profit}_{f(tax\ differential)} \quad (1)$$

Baseline specification

13. Following these lines, the baseline equation estimated to identify profit shifting is:

$$Profitability_{f,g,c,i,t} = \alpha X_{f,g,c,i,t} + \beta\left(STAT_{c,t} - STAT_group_avg_{g,c,i,t}\right) + \delta_t + \delta_i + \varepsilon_{f,g,c,i,t}, \quad (2)$$

where $Profitability_{f,g,c,i,t}$ is the profitability of multinational entity *f*, which belongs to MNE group *g* and operates in country *c*[3] and industry *i*, in year *t*. In the baseline specification, profitability is defined as the ratio of pre-tax profit over total assets, based on unconsolidated firm accounts. $X_{f,g,c,i,t}$ is a vector of determinants of true profitability, which includes firm or group-specific characteristics, such as size, position in the group (group headquarters, other parent company or entity without affiliate) and a dummy for entities belonging to patenting groups. It also includes a number of macroeconomic variables, such as GDP growth, exchange rate, inflation and GDP per capita. $\left(STAT_{c,t} - STAT_group_avg_{g,c,i,t}\right)$ is the

3. There can be ambiguity about what is the country of certain hybrid entities. For example, an entity can be incorporated in a country but tax resident in another (or even tax resident in no country). The approach in this paper is to define the country of an entity as the country where it reports its financial accounts, to the extent that these accounts are reported in the ORBIS database. If this country is different from the tax residence of the entity and that this results in a lower effective tax rate on its profit, the low effective tax rate should be captured in the second half of the empirical analysis (mismatches between tax systems).

difference between the statutory tax rate in country c and year t and the unweighted average of the statutory tax rates in the countries where the multinational group g is represented. The tax sensitivity of profit is measured by the coefficient β, which is expected to be negative if profits are shifted to lower-tax countries. Finally, δ_t, δ_i are respectively time and industry fixed-effects and $\varepsilon_{f,g,c,i,t}$ is the residual term.

14. The preferred measure of profitability in this paper is the ratio of pre-tax profit to total assets, which offers the benefit of good data availability and comparability between countries. The ratio of pre-tax profit to employment (for which data are less widely available) is used as an alternative measure and yields similar results. Ideally, the denominator of the profitability measure should reflect the "true" activity of the firm and not be affected by profit shifting.[4] Otherwise, this would "cancel" the effect of profit shifting seen in the numerator. Against this background, total assets and employment can be considered as relevant proxies for true activity, although in certain cases (e.g. digital services) there can be ambiguity about where a MNE group generates value. Total assets and employment can also be considered as largely independent from profit shifting in the short term, even though there is evidence that tax planning can distort real investment behaviour to some extent (Grubert, 2003; Sorbe and Johansson, 2016b).[5] By contrast, a firm's turnover may not be a good benchmark of true economic activity, because it can be influenced by transfer price manipulation.

15. Profit refers to total pre-tax profit reported in a firm's profit and loss account, at an unconsolidated level (i.e. for each entity of the multinational group). It can differ from taxable profit for a number of reasons, such as differences in the timing of recognition of income and expenses (e.g. different capital depreciation rules), in the definition of income (see e.g. Hanlon, 2003)[6] or because taxable profit may reflect past losses being carried forward.[7] Nevertheless, profit reported in financial accounts and taxable profit should generally be affected in the same direction by profit shifting, making reported profit a relevant proxy for taxable profit in this context. In some cases, reported and taxable profit differ because a firm exploits mismatches between tax systems to reduce its taxable profit (e.g. by deducting some expenses in two countries at the same time) and thus its tax burden (Lisowsky, 2010). Such tax planning situations cannot be identified by analysing the location of profits using financial account data (as in the first part of

4. In the case of e-commerce or the sale of online services, there can be ambiguity over where the "true" activity of a firm is located. For example, a firm may conduct substantial sales of goods and services into a market from a remote location and with minimal use of personnel (OECD, 2014b). No separate analysis was conducted of profit shifting associated with the digital economy in this paper. The assumption underlying the empirical analysis is that the location of assets (including purchased intangible assets reported in financial accounts) or employees represents a proxy for "true" activity.

5. Admittedly, intangible assets (which are included in total assets) can be located strategically for tax purposes, but they only represent a very small share of total assets (about 4% on average in the sample). This is because they are not always reported in financial accounts unless they are acquired rather than self-developed. Another limitation is that financial assets can be inflated by profit shifting strategies involving intra-group debt.

6. In the United States, for example, tax-exempt municipal bond interest income is considered as profit in financial accounts but not in tax returns.

7. Another potential source of difference is that in a number of countries (e.g. Germany, France), corporate entities belonging to the same group and operating in the same country may under certain conditions consolidate their accounts for tax purposes. In these cases, each entity reports in its financial accounts a tax payment that is a fraction of the consolidated tax payment. This may create noise in the data but seems unlikely to bias the results in any direction.

this paper),[8] but they are captured in the second part on the empirical analysis (mismatches between tax systems), which focuses on how reported profits are taxed.[9]

16. The determinants of "true" profitability included in the analysis are firm size, industry, country, year, presence of patents in the group, and macroeconomic variables (GDP growth, exchange rate, inflation and GDP per capita). True profitability is expected to increase with firm size due to economies of scale and with the presence of patents (Andrews et al., 2014). It also varies across industries and countries, for instance, because of differences in capital intensity, the intensity of competition or labour market settings. True profitability might also be affected by corporate taxation. For example, Loretz and Mokkas (2011) argue that high-tax countries may attract only investments generating high expected pre-tax profits in order to offset the higher taxes.[10] Country fixed-effects and country-interacted-with-time fixed-effects control for such effects. However, these fixed-effects may also capture some profit shifting (for example because most MNEs in high-tax countries would be linked to lower-tax countries), which would result in under estimating profit shifting (Clausing, 2009; Buettner and Wamser, 2013).[11] Thus, results are presented for three specifications: (i) without country fixed-effects (the preferred specification, equation 2); (ii) with country fixed-effects and (iii) with country fixed-effects interacted with time fixed-effects.[12]

17. The statutory tax rate is generally considered as the most relevant for profit shifting (see e.g. Gravelle, 2014).[13] The tax variable is the difference between the statutory tax rate in the home country and the unweighted average of the statutory tax rates in the countries where the multinational group is present. This variable, similar to the one used by Beer and Loeprick (2014), is positive when the company has links to lower-tax countries (and thus incentives to shift profits) and negative when it has links to higher-tax countries (and thus can be expected to receive profit).[14] This tax variable is unlikely to be correlated with "true" profitability, which would otherwise bias the estimation – such correlation may have been an issue in earlier studies using macroeconomic data and the home country statutory tax rate as a tax variable (e.g. Hines and Rice, 1994).

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8. Profit shifting analyses in the literature rely either on financial account data (e.g. the ORBIS database or its regional subsamples) or tax returns (e.g. Grubert, 2012 for the United States), the latter being only available at the country level and on a non-harmonised and confidential basis (Dharmapala, 2014).

9. In a case where taxable profit (and thus tax expense) is low relative to reported profit, the effective tax rate (as defined in the mismatches section) will appear abnormally low relative to a comparable domestic firm, which will be identified by the regression in the mismatches section.

10. In contrast, Becker and Fuest (2007) argue that MNEs would allocate their most profitable investment projects to lower-tax rate countries.

11. Another potential issue is that in specification with country interacted with time fixed-effects, the identification of the coefficient β only comes from variations in $STAT_group_avg_{g,c,i,t}$, since $STAT_{c,t}$ does not vary at the country-time level. In the specification with country fixed-effects, identification comes from variations in $STAT_group_avg_{g,c,i,t}$ and from time variations in $STAT_{c,t}$.

12. Results are robust to the addition of more fixed effects, such as country interacted with industry, industry interacted with time, or industry interacted with firm size.

13. This is because most corporate tax deductions or exemptions are based on the "real" activity of a firm and are not affected by the shifting of profit. As a robustness check, the forward-looking effective average tax rate (sourced from the Oxford Centre for Business Taxation) was also used, with similar results. Profit shifting to countries with a high statutory tax rate but preferential tax treatment for certain activities or incomes is covered in the second half of the empirical analysis.

14. An alternative would be to use the difference to the lowest tax rate in the group. The drawback would be that this variable would be equal to zero for all companies having the lowest tax rate in their group, regardless of whether the difference with the rest of the group is high (resulting in high probability of receiving profit) or low (resulting in a lower probability).

18. The tax variable takes into account the tax rate in all countries where the group is identified as operating, including countries outside the sample of OECD and G20 countries and including links to entities with no available financial information (still, some links may be missing).[15] This allows to capture profit shifting taking place even between distant group members. This is an improvement over studies considering only the tax rate differential between a subsidiary and its parent, such as Dischinger (2007). Relying on an unweighted average of tax rates, as done in this paper, does not reflect the "weight" of the different countries in the group structure. However, there is no appropriate weighting strategy, since weights based on activity levels (e.g. sales or employment) may not reflect profit shifting possibilities (profit can be shifted even to locations where the group has little activity)[16] and weights based on profits, as used by Huizinga and Laeven (2008), can pose endogeneity issues.[17] These issues exist even in the case of lagged profits as there is a high correlation between past and current profits.

19. One limitation of the approach is that the group structure of a MNE may not be fully exogenous to its profitability. For example, a highly productive and profitable group has more to gain from tax planning than a less profitable group. Therefore, highly profitable groups may be more likely to set up affiliates in a lower-tax rate country in order to shift profits there (Grubert, 2003; Desai et al., 2005; Sorbe and Johansson, 2016a).[18] Despite shifting part of their profits, these groups may still report relatively high profits in high-tax rate countries because of high "true" profitability. Based on the comparison with an average (less profitable) firm, the profits shifted by these groups may be underestimated. However, a symmetric effect exists in lower-tax rate countries, where these high-profitability groups may report relatively high profits not only because of profit shifting, but also because of higher "true" profitability. Therefore, the overall effect of this issue on the estimated tax sensitivity is ambiguous. Another potential issue is that tax-planning MNEs devote a share of their resources to the tax and legal advice needed to set up tax-planning schemes, which can reduce their overall pre-tax profitability.

20. The identification of multinational groups is more refined than in existing studies on profit shifting, because it takes into account – and iterates – the information on direct ownership in cases where information on ultimate ownership is not available in ORBIS (see details in Appendix 2). Two entities are assumed to be linked if one owns the other, directly or indirectly, with an ownership share of at least 50%. All entities that are linked together are considered to belong to the same corporate group and thus to be susceptible to shift profits among each other. This allows considering complex group structures involving long ownership chains and multiple holding or shell companies. Such complex structures can notably arise if MNE groups engage in "treaty abuse", i.e. routing income through a third country to exploit favourable bilateral tax treaties. A 50% ownership threshold is the most common choice in the literature. A 90% threshold is used in a few recent papers and tested as a robustness check. The rationale for the 50% threshold is that profit shifting would generally take place between two companies that are under the same

15. A sizeable number of links to no-corporate-tax countries are taken into account (Figure 2) even though the financial accounts of entities in these countries are generally not available. The coverage of links is discussed in the data section. Bilateral withholding taxes are not taken into account due to data limitations and as it would require a much more complex identification strategy. Still, their importance for tax planning is assessed along with anti-avoidance rules in the following section.

16. In addition, a number of entities appear in the ORBIS database but do not report financial information at an unconsolidated level (e.g. most entities in the United States) or at all (e.g. in certain low-tax countries). Links to such companies could not be used in a weight-based tax variable. The resulting incomplete tax variable could potentially lead to biased results.

17. If profits are systematically shifted to lower-tax countries, weights based on observed profits would exaggerate the importance of these countries in the group structure, which could bias profit shifting estimates.

18. On the other hand, non-tax-planning firms may need to be ex ante more profitable than tax-planning firms to survive in a competitive environment with them.

control. For example, an affiliate that is not fully controlled would likely refuse to shift its profits, as it would generally harm the shareholders not part of the MNE group.

21. The position of an entity in its corporate group can influence its profitability. For example, the profit of a parent company includes dividends from affiliates, while its assets include participations in affiliates. In addition, the financial and intangible assets of the group may be centralised at the top of the corporate structure. Overall, the effect of the position in the group structure on the ratio of profit to total assets is *a priori* ambiguous. A number of studies drop parent companies altogether to avoid potential biases (e.g. Huizinga and Laeven, 2008; Beer and Loeprick, 2014). This paper follows a more parsimonious way to control for the position in the group. It includes control dummies identifying group headquarters (defined as entities with at least one subsidiary but no parent), other parent entities (i.e. entities having at least one subsidiary and one parent) and non-parent entities (i.e. entities without any identified subsidiary). Results are robust to excluding group headquarters and other parent companies from the sample.

22. In turn, the location of group headquarters may be influenced by tax considerations. There is some evidence that multinationals are reluctant to shift profit away from their headquarters location, even if headquarters are in a high-tax country, possibly because group managers and shareholders value having funds under direct control (Dischinger et al., 2014). This may contribute to explain cases of headquarters relocating to lower-tax countries, a phenomenon known as "inversion" which has been empirically documented (Voget, 2011). Nevertheless, headquarters of multinational groups often remain located in their origin country, which are predominantly richer and higher-tax rate countries. Overall, these two phenomena seem to offset each other, as the data suggest that there is no clear pattern on headquarters being located predominantly in higher-tax or lower-tax rate countries.

Profit shifting channels and refinements

23. Data availability issues make it difficult to identify profit shifting channels. For example, financial account data do not include details of related-party transactions. Still, a number of refinements to the baseline regression can give indication on the size of certain channels. One common approach to isolate the debt shifting channel is to compare the tax sensitivity of total profit (baseline specification) to the sensitivity of operating profit (also called EBIT, i.e. earnings before interest and taxes) (e.g. Loretz and Mokkas, 2011; Heckemeyer and Overesch, 2013). Operating profit excludes net financial income including net interest payments and thus is not affected by profit shifting through manipulation of debt location. It only reflects profit shifting through other channels, such as transfer price manipulation. In contrast, total profit reflects profit shifting by all channels. Thus the difference between the two elasticities is one way of measuring the magnitude of debt manipulation.[19] A more direct measure of external debt manipulation based on identifying the location of external debt is presented in Sorbe et al. (2016).

24. Intangible assets (patents, copyrights, trademarks, etc.) can facilitate profit shifting because they are highly mobile and their price is difficult to benchmark to market prices (Grubert, 2003). For example, the value of using a patent, a brand or group-specific know-how can be hard to assess. As a result, transfer prices of intangible assets and the associated services are easier to manipulate than the price of tangible assets. This can enable MNE groups to locate intangible assets in lower-tax rate countries (or in countries with preferential tax treatment for certain intangible assets) to benefit from lower taxation of the associated revenue streams (e.g. royalties). Intangible assets are often poorly reported in financial accounts (since

19. Another difference between operating profit and total profit is that total profit includes financial income, i.e. interest income and dividends received. Dividend income does not appear to bias the results, since results are robust to excluding from the sample all companies having at least one identified subsidiary (i.e. keeping only the lowest tier in the corporate structure).

only acquired assets have to be reported), which makes it difficult to measure empirically their importance for profit shifting. To circumvent this issue, this paper focuses on patents, which are a type of intangible assets for which information is widely available in the PATSTAT database. The idea is to test if MNE groups having patents have a higher profit shifting elasticity than other MNEs. A different approach, focusing directly on the location of the legal ownership of patents is presented in Skeie et al. (2016).

25. Another question is whether profit shifting takes place predominantly in the direction of no-corporate-tax countries[20] or between countries with positive (but different) tax rates. This can be assessed by breaking down the tax variable used in the analysis into two parts: (i) the difference between the statutory tax rate in the country of an entity and the tax rate of a no-tax country (i.e. zero) if the entity has a link to such a country; (ii) the difference between the statutory tax rate in the country of the entity and the average tax rate in the group, excluding no-tax countries from the average.

26. A further refinement, which is relevant in the assessment of fiscal implications of profit shifting, is to restrict the sample to profitable firms. Profitable firms have obviously more incentives to shift profits than loss-making firms, since the latter generally do not pay taxes. However, loss-making firms should not necessarily be discarded from the analysis. Indeed, some initially profitable entities may end in a loss-making position after profit shifting, for example if the shifted profit slightly exceeds the true profit. Loss-making multinational groups may also have an interest in using profit shifting channels to allocate their losses to high-tax countries. The idea is to carry these losses forward to offset future profits and thereby lower future tax payments.

Impact of anti-avoidance rules

27. All OECD and G20 countries have "anti-avoidance" rules restricting the tax planning possibilities of MNEs, but their strength vary across countries. For example, all countries require that intra-group transactions take place at market prices (the so-called arm's length principle) but documentation and disclosure requirements on intra-group trade vary across countries (Lohse et al., 2012). Some countries also restrict interest deductibility above certain debt-to-equity or interest-to-earnings ratios to reduce the scope for debt manipulation. In addition, a number of countries have special "controlled foreign company" (CFC) rules applying to MNE subsidiaries and general anti-avoidance rules (GAARs) allowing tax authorities to question tax-motivated transactions or arrangements (OECD, 2013a). Withholding taxes on interest payments, royalties and dividends (i.e. taxes levied on these payments to non-resident entities) can also influence firms' incentives to shift profits. For instance, high withholding taxes on interest payments can discourage manipulation of debt location, and high withholding taxes on royalties can discourage strategic allocation of intangible assets.

28. This paper relies on the classification of the strength of anti-avoidance rules in OECD (2015) and Johansson et al. (2016), which builds upon earlier classification efforts in the literature (Lohse et al., 2012; Lohse and Riedel, 2012; Blouin et al., 2014). The classification covers five dimensions of the rules: (i) the comprehensiveness of documentation and disclosure requirements on transfer prices; (ii) the existence and strictness of rules limiting interest deductibility (thin capitalisation and interest-to-earnings rules); (iii) the existence of a GAAR; (iv) the existence of a CFC rule; and (v) withholding tax rates on interest payments, royalties and dividends, taking into account the existence of tax treaties that may reduce these rates.[21]

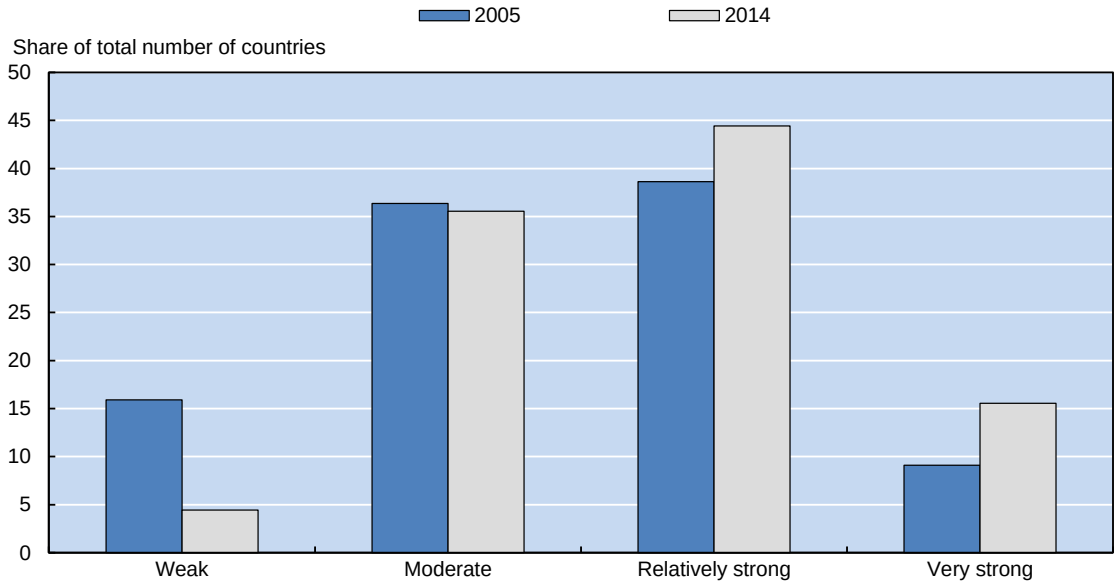
20. These countries are sometimes referred to as "tax havens". This expression is not used in this paper since there is no internationally accepted definition of tax havens.

21. On transfer pricing, interest deductibility and withholding taxes, the classification is based on a 0-1-2 scale, which captures the broad strength of rules but may miss some important country-specific details. On GAAR and CFC rules, a simpler 0-1 scale based on the existence of a rule is used, reflecting the difficulty

29. As rules are complex and country-specific, the classification inevitably relies on simplifying assumptions (see Johansson et al., 2016 for details). For example, enforcement practices (e.g. frequency of tax audits, penalties in case of non-compliance) are not captured. As the design of GAARs and CFC rules is very country-specific, the classification only reflects the existence or non-existence of a rule. As a robustness check, the effect of anti-avoidance rules is tested based on a classification excluding GAARs and CFC rules. Overall, the classification suggests that countries have moved towards stronger anti-avoidance rules over 2005-14 (Figure 1).

Figure 1. Strength of anti-avoidance rules and withholding taxes

Distribution of countries by degree of strength of anti-avoidance rules and withholding taxes[1]



1. About 15% of countries in the sample (which includes all OECD and G20 countries) had "very strong" anti-avoidance rules in 2014. A "very strong" anti-avoidance rule corresponds to a score of 7-8 on the 0-8 classification of anti-avoidance and withholding taxes described in Johansson et al., (2016). A score of 8 is defined as the combination of strict documentation requirements on transfer pricing, a strict rule against debt manipulation, existence of a GAAR and a CFC rule as well as relatively high withholding taxes on interest, dividends and royalties. A "relatively strong" rule corresponds to a score of 5-6, a "moderate" to 3-4 and "weak" to 0-2. The classification does not reflect the enforcement of existing rules.

Source: Johansson et al., (2016)

30. The empirical framework needs to be slightly adapted to test whether anti-avoidance rules effectively reduce profit shifting. Indeed, the effect of these rules is not symmetric. They are designed to prevent profit from flowing away from a country, but do not necessarily prevent profit from flowing into the country. For example, a country introducing a thin capitalisation rule restricting interest deductibility may stop receiving debts from lower-tax rate countries, but may still shift debts to higher-tax rate countries having no such rule. To account for this asymmetry, the sample is split into two parts: firms facing a higher statutory tax rate than the average in their group (which have incentives to shift profits) and firms facing a lower tax rate than this average (which are more likely to receive profit). The effectiveness of anti-avoidance rules is tested only on the first group. The hypothesis is that the tax sensitivity of firms in this group would be lower in countries with strong anti-avoidance rules, as the possibility to shift profits would be reduced.

to classify these country-specific rules in a harmonised way. The overall classification sums the five components. As a result, the classification ranges from 0 to 8.

31. More specifically, the estimated equation is the following, with the same notations as in equation (2):

$$Profitability_{f,g,c,i,t} = \alpha X_{f,g,c,i,t} + \beta_1 \left(STAT_{c,t} - STAT_group_avg_{g,c,i,t}\right)_{when\ negative} + \beta_2 \left(STAT_{c,t} - STAT_group_avg_{g,c,i,t}\right)_{when\ positive} + \beta_3 AS_{c,2005} + \beta_4 \left(STAT_{c,t} - STAT_group_avg_{g,c,i,t}\right)_{when\ positive} \times AS_{c,2005} + \delta_t + \delta_i + \varepsilon_{f,g,c,i,t}, \quad (3)$$

where $AS_{c,2005}$ is the anti-avoidance strength classification in country *c* and year 2005.[22] β_1 and β_2 are expected to be negative and of the same magnitude as the coefficient β in equation (2). The coefficient β_3 reflects the direct effect of strong anti-avoidance rules on firm profitability (e.g. in terms of compliance costs), regardless of tax considerations. The coefficient β_4 is expected to be positive if strong anti-avoidance rules mitigate profit shifting. The overall profit shifting elasticity, taking into account anti-avoidance strength, corresponds to $(\beta_2 + \beta_4 AS)$.

3.2 Mismatches between tax systems and preferential tax treatment

32. In addition to profit shifting, MNEs may exploit mismatches created by international differences in corporate tax systems to reduce their tax burden (OECD, 2014a). This can occur even in the absence of differences in corporate tax rates. Tax systems and tax treaties are generally designed to avoid taxing the same profit in two countries at the same time (double taxation). However, MNEs can in some cases reach situations of double non-taxation (i.e. revenues that are taxable in no country), double deduction of an expense (i.e. expense that is tax deductible in two countries at the same time) or asymmetric treatment of a transaction (e.g. expense that is deductible in one country, but for which the associated related-party income is not taxable in another country). These situations arise for example because of "hybrid" instruments or entities, which are treated differently in different countries. For example, convertible bonds may be treated as debt in one country and as equity in another. Certain types of foreign-owned entities may be considered as tax resident neither by their home or their host country (OECD, 2013a; Levin and McCain, 2013).

33. In addition, MNEs can sometimes exploit preferential tax treatment for certain types of revenues or activities to a greater extent than domestic firms. For example, they may locate their patents in countries where intellectual property income from patents is taxed at a lower rate ("patent boxes"). They can also in some cases benefit from lower tax rates negotiated in advance with tax authorities in exchange for locating operations in a country.

34. There is significant anecdotal evidence that some MNEs take advantage of mismatches between tax systems and preferential tax treatment to reduce their tax burden (e.g. Levin and McCain, 2013). However, little is known about the magnitude of this phenomenon, which has not received as much academic attention as profit shifting. A few studies focusing on the effective tax rate of multinationals (e.g. Collins and Shackelford, 2003; Markle and Shackelford, 2011) may include the effects of mismatches and preferential tax regimes, but without disentangling them from profit shifting.

22. The classification was only compiled for 2005 and 2014. The classification for year 2005 is assumed to be broadly representative of the strength of anti-avoidance rules over the sample period (2000-2010). Some countries have changed their rules over this period, which may blur the estimation results and lead to underestimating the effect of anti-avoidance rules.

Baseline specification

35. The strategy to identify (jointly) the effect of mismatches between tax systems and preferential tax treatment is to compare the effective tax rate of a multinational entity in a given country and year to the ETR of a domestic (i.e. not member of a multinational group) entity. The comparison is based on a regression analysis controlling for other firm characteristics that may influence the ETR. The ETR considered is the ratio of tax expense to the profit reported in the financial statements of the firm, at an unconsolidated level (i.e. for each entity in the group).[23]

36. The hypothesis is that if a MNE entity exploits mismatches to reduce its tax burden, this will reduce its ETR relative to a non-MNE entity. Indeed, it may report a high profit in its financial statements, but its taxable profit would be lower, for example because of the use of a hybrid entity or instrument. For example, a hybrid entity can report profits in a higher-tax country while paying the tax rate of a lower-tax (or no-tax) country, resulting in a low ETR as compared to a non-MNE entity. A hybrid instrument can result in an interest deduction in one country where it is treated as debt and a non-taxable income in another country where it is treated as equity. As compared to a standard debt instrument, this would lead to a lower ETR (measured with financial account data) in the receiving country. However, there would be no visible difference in financial accounts as compared to a standard equity instrument.[24] Another example is the so-called "dual resident" MNE entity, which may claim more than one tax deduction for the same interest expense, which would also reduce its ETR (OECD, 2014a).

37. ETR differences between MNE and non-MNE entities can also result from MNEs exploiting preferential tax treatment for certain activities or incomes more than non-MNE firms. For example, the ETR of domestic firms can be lowered by the existence of a reduced tax rate on certain intangible assets, but the ETR of MNEs will be reduced to a greater extent if they locate their intangible assets in countries with preferential treatment.

38. One caveat is that tax expenses reported in financial accounts can differ from actual tax liabilities or cash taxes paid. Financial tax expenses include both current and deferred tax expenses, and can be affected by changes in countries' tax rates on deferred tax assets and liabilities. In contrast, tax accounting does not include deferred tax expenses.

39. MNEs and domestic firms differ in many respects. For example, MNEs tend to be larger and more productive. To ensure a fair comparison, the analysis controls for as many firm characteristics as possible, including size, industry, position in the corporate group, profitability and presence of patents. In addition, the comparison is made more relevant by the fact that in most countries, MNE and domestic firm entities are taxed according to the same rules. Indeed, in many countries, the tax administration does not identify whether a firm is multinational or not. Still, unobserved inherent differences between MNEs and

23. In this respect, the approach is different from Markle and Shackelford (2011), which focus on the ETR at the consolidated (group-wide) level and compare MNE groups on the basis of their headquarter location. In territorial tax systems, ETRs at the unconsolidated level should be more comparable (within each country) than consolidated ones. This is because consolidated ETRs reflect the tax rates of all the countries where the group is present, making it difficult to compare two MNE groups present in different sets of countries.

24. As a result, the identification of the effect of hybrid instruments depends if the counterfactual is a standard debt or equity instrument. An alternative specification avoiding this issue, which is presented as a robustness check, is to use the ratio of tax expense to operating profit (instead of total profit) as a dependent variable. The idea is that the exploitation of a hybrid instrument reduces this ratio as compared to both a standard equity and debt instrument. However, this ratio does not capture certain other mismatch situations (e.g. hybrid entities with a large share of financial income).

domestic firms (e.g. capital intensity, management practices, propensity to engage in domestic tax minimisation strategies) could affect the results.

40. Exploiting mismatches between tax systems can involve sizeable fixed costs for companies. These costs can include the setting up of ad-hoc companies, the use of sophisticated financial instruments and tax and legal advice. As a result, multinational companies may need to be sufficiently large to engage in such schemes. Similarly, negotiated tax rates are likely to be available only to large MNE groups. To account for these elements, the empirical approach compares the ETR of MNE and non-MNE entities among different size classes.

41. The estimated equation to identify mismatches between tax systems and preferential tax treatment is as follows:

$$ETR_{f,c,i,t} = \gamma_1 Large_firm_{f,c,i,t} + \gamma_2 Small_firm_{f,c,i,t} \times MNE_{f,c,i} + \gamma_3 Large_firm_{f,c,i,t} \times MNE_{f,c,i} + \gamma_4 X_{f,c,i,t} + \delta_i + \delta_{c,t} + \varepsilon_{f,c,i,t}, \quad (4)$$

42. $ETR_{f,c,i,t}$ is the effective tax rate of entity *f* (operating in country *c* and industry *i* and member of a MNE or non-MNE corporate group) in year *t*, measured as the corporate tax expense[25] over reported profit. $Large_firm_{f,c,i,t}$ and $Small_firm_{f,c,i,t}$ are respectively dummies for large and small firms, equal to one when firm *f* has more (respectively less) than 250 employees. In an alternative specification, more size categories are included. $MNE_{f,c,i}$ is a dummy equal to one when a company is part of a multinational group and zero otherwise. $X_{f,c,i,t}$ is a vector of firm-level control variables, including the position of the firm in the group (with the same categories as in the profit shifting section), a dummy for patenting groups and (in a robustness check) firm profitability.

43. The coefficients γ_2 and γ_3 measure the ETR differential between small (respectively large) MNE and non-MNE entities. The hypothesis is that these coefficients should be negative if MNEs exploit mismatches between tax systems and preferential tax treatment to reduce their tax burden. δ_i and $\delta_{c,t}$ are fixed-effects for industry and for country interacted with time. These fixed-effects ensure that the ETR comparison takes place between firms of the same country observed in the same year and thus facing the same tax rate and rules. $\varepsilon_{i,t}$ is the residual term. The sample is restricted to firms with a positive pre-tax profit in the year considered. Micro-firms (below 10 employees) are excluded as they often enjoy special tax treatment, which may otherwise bias the results.

44. The position of a firm in its corporate group matters for its ETR, similarly to the profit shifting analysis. The profit of parent entities consists at least to some extent of dividends from affiliates, which are often taxed differently from other profits. For example, dividends are generally tax exempt if the corresponding profit has already been taxed at the affiliate level. The regression includes dummies for the position in the group (group headquarters, other parent companies and non-parent firms) to control for these differences.

Refinements and anti-avoidance rules

45. The information in financial accounts is insufficient to disentangle the effects of mismatches between tax systems from those of preferential tax treatment. Nevertheless, it is interesting to test if certain types of firms have a greater ETR differential than others. For example, MNEs present in a large set of countries have a priori greater scope to exploit mismatches between tax systems, as they have access to a wider range of loopholes between systems. In addition, patenting MNEs may be able to exploit preferential regimes more than other MNEs since income from patents benefits from a preferential treatment in a number of countries (Griffith et al., 2014; Skeie et al., 2016).

46. As in the profit shifting analysis, the effectiveness of anti-avoidance rules can be tested. This is done by testing if ETR differentials are lower in countries with strong rules, based on the classification presented above. Some aspects of the classification are relevant to mismatches between tax systems, such as CFC rules or withholding taxes. For example, high withholding taxes on dividends may prevent the

25. Tax expenses correspond to taxes reported in the financial accounts (source: ORBIS database). They include current and deferred taxes and are generally reported on an accrual basis, although some smaller firms may report on a cash basis. Cash taxes also include payments associated with prior year liabilities such as audit adjustments.

repatriation of dividends paid by hybrid entities. Nevertheless, the classification predominantly focuses on rules against profit shifting (e.g. transfer pricing rules, thin capitalisation rules). It does not take into account the degree of consistency of a tax system with its peers or the existence of preferential regimes.

4. The data

47. The source of firm-level financial and ownership data is the ORBIS database compiled by Bureau Van Dijk and processed by the OECD Statistics Directorate (Pinto Ribeiro et al., 2010). The time period covered in the final sample is 2000-10, with coverage generally increasing over time.[26] The final sample comprises unconsolidated financial accounts of firms in 46 countries: all OECD and G20 countries, Colombia, Latvia, Malaysia and Singapore. Together, these countries account for about 90% of world GDP over the period, although the coverage in the sample varies meaningfully across countries as discussed below.

48. Links to countries outside the sample are also taken into account to compute the tax variable as long as these links can be identified in ORBIS. Some of them are links to countries with low or no taxation of corporate income and they are taken into account even in cases of missing financial information of the particular entity. About 10% of MNEs (and 20% of large MNEs) are found to have links to countries with no corporate tax (Figure 2). Nevertheless, some links may be missing, which would blur the estimation and could lead to an underestimation of profit shifting. It is difficult to assess the magnitude and importance of the missing links due to general lack of data on actual links. One source of comparison is a study by Citizens for Tax Justice (CTJ, 2014). Among the top-500 US firms (Fortune 500 list for 2013), Citizens for Tax Justice identifies 362 firms having links to "tax havens". Of these 362 firms, 266 (i.e. 72%) are in the ORBIS sample. Among these 266 firms, at least one tax haven link is identified in ORBIS in 184 cases, i.e. 69% of the times (this represents just over half of top US firms with tax haven links).

49. ORBIS data covers all kinds of business forms (corporations, limited liability partnerships, etc.) and is compiled from different sources across countries, such as chambers of commerce, local public authorities or credit institutions. For these reasons, and also because accounting standards may slightly vary across and within countries (for example, small firms can have different standards), the data on financial information is not fully homogenous. As a robustness check, results are also presented for the subsample constituted by EU countries, where data are likely to be more homogeneous.

50. ORBIS data is not originally collected for statistical purposes and is known to be subject to reporting errors. A first cleaning was undertaken by Ragoussis and Gonnard (2012) to identify implausible values and violation of basic accounting identities. The dataset was cleaned further for this paper, mainly by dropping all observations at the top and bottom 2.5% on several ratios of interest, such as the profit-to-total-asset ratio (see details in Appendix 3). This treatment eliminates the noise created by reporting errors and extraordinary events (e.g. mergers, court rulings, etc.). However, it may also eliminate some observations of profit shifting behaviour, for example because profit shifting to low-activity entities can lead to very high values of the profit-to-asset ratio. This does not seem to be a major issue, since results are robust to dropping less outliers (top and bottom 1% instead of 2.5%).[27] After cleaning, the profit shifting sample consists of 1.2 million MNE entities, considerably higher than in all previous studies on the subject.

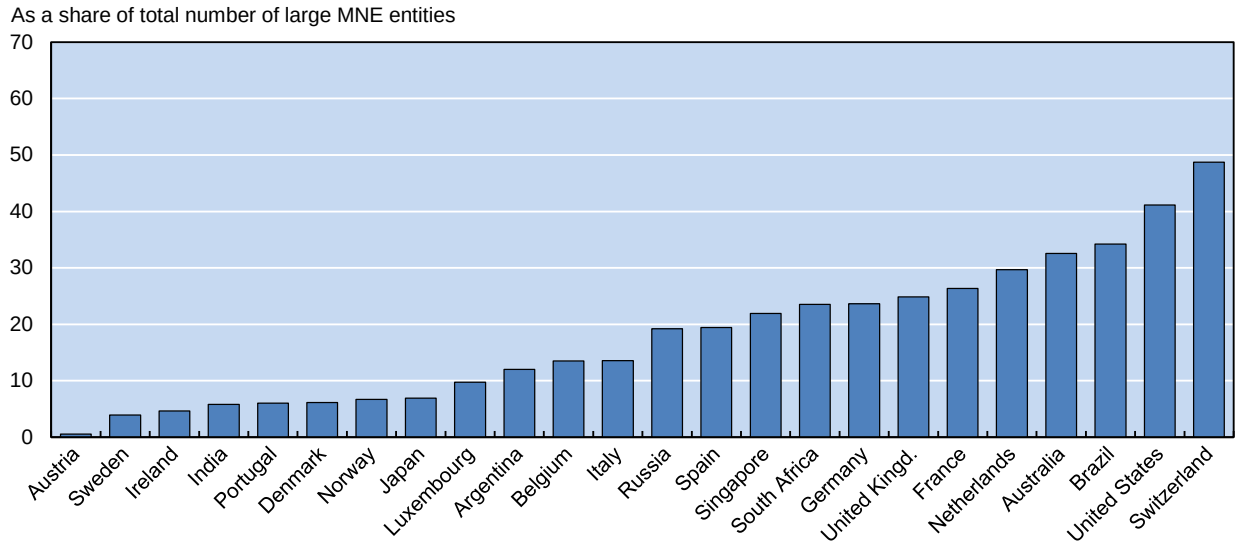
26. The varying sample over time is due to changes in coverage and firms being created or going out of business, whichis not likely to be systematically related to tax planning intensity. The results are robust to estimating over sub-periods (2000-05 and 2005-10).

27. An alternative option is to winsorise the data, i.e. to replace outliers by a fixed threshold value (e.g. the value at the 2.5% threshold). This allows keeping more observations in the sample (1.4 million instead of 1.2 million in the profit shifting sample), but the resulting sample is noisier and the estimated tax sensitivity of profit is lower than in the baseline and only significant at the 10% threshold.

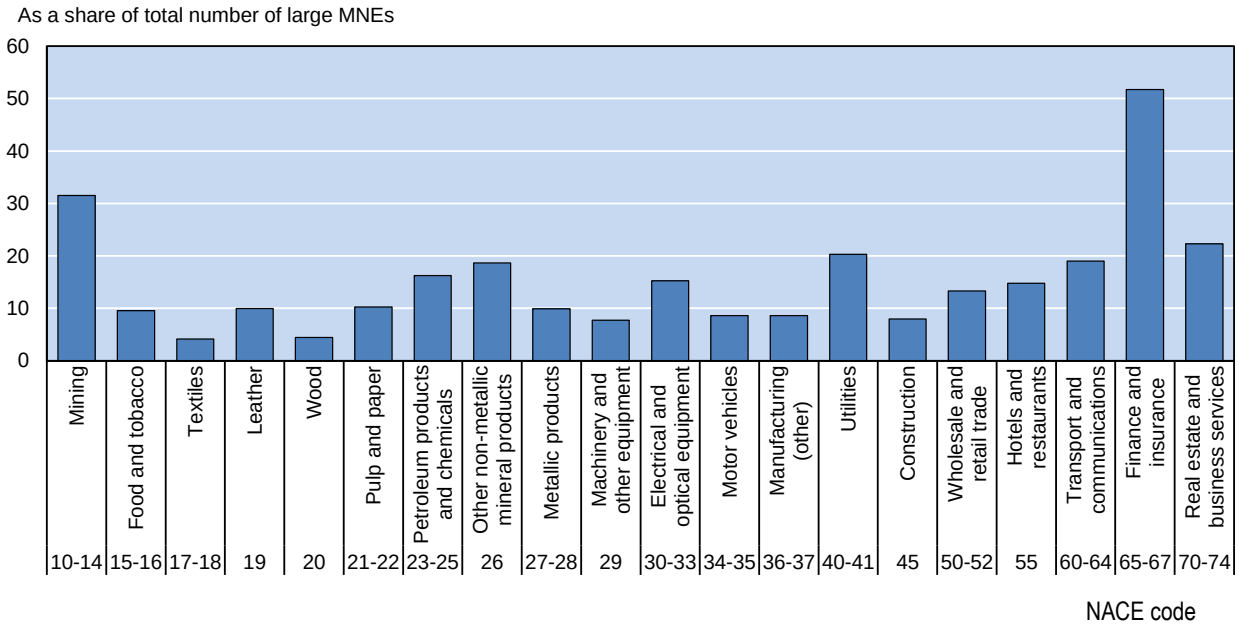
Figure 2. Identified links to no-corporate-tax countries of entities in the sample

Share of large MNE entities in the sample having links to countries not taxing corporate income[1,2]

Panel A: by country of headquarters



Panel B: by industry



1. A MNE entity is considered as having a link to a given country if at least one entity in its corporate group (identified with the procedure described in Appendix 2) is present in this country. A MNE entity is considered as large if it has more than 250 employees. The figures presented are computed based on all observations in the ORBIS sample used in this study over the period 2000-2010 (see Appendices 3 and 4 for details on the sample). Countries with less than 1,200 observations of large MNE entities are not presented.
2. The data are based on the ORBIS sample used in the analysis and may not be representative of the underlying population, particularly for specific countries.

Source: OECD calculations based on the ORBIS database.

51. Details of final sample coverage and basic statistics are presented in Appendix 4. A comparison with the OECD STAN Business Demography Statistics suggests that coverage of large firms is above 50% in most European countries and less than 10% in most non-European countries (Figure 3). [28] Moreover, the effect of poor coverage in a specific country is mitigated by the fact that the elasticities used to derive tax revenue effects are estimated over the full sample of countries rather than country by country, which can be expected to be less influenced by outliers and missing data than country-specific propensities would be. The estimation would only be biased if profit shifting patterns (relative to tax rate differentials) were different from average in countries with low data coverage. However, results are robust to weighting observations to correct for the under-sampling of certain countries.[29]

52. The share of MNEs and domestic (i.e. non-multinational) groups by country appears plausible, with a few exceptions where it is implausibly low, such as the Netherlands, probably reflecting missing ownership links in the ORBIS database (Figure A2.2). The number of large domestic entities, which is the control group in the estimation of equation (3) appears reasonably high in most countries (Table A4.2).

53. A bias could also appear if, in a given country, firms outside the ORBIS sample have a different propensity to engage in tax planning than in-sample firms of the same country. By definition, this is difficult to assess, but the data collection process of the ORBIS database does not suggest such a bias. Indeed, data collection is based on administrative records and thus determined by administrative reporting requirements, which are likely to be independent from tax planning intensity. However, it is possible that MNEs heavily involved in tax planning or using complex schemes (e.g. "stateless" entities for tax purposes) opt not to disclose their financial accounts to business registers if the repercussion of not complying with reporting is limited. This may result in under-sampling of such firms, an issue addressed in the sensitivity analysis in this paper.

54. Coverage appears roughly well-balanced across industries. Coverage tends to be better for larger firms, which have stricter data reporting requirements, a well-known fact about the ORBIS database. The better coverage of large firms suggests that the coverage of MNE entities is also better than average, as they tend to be relatively large (still, entities in large MNE groups can be small).

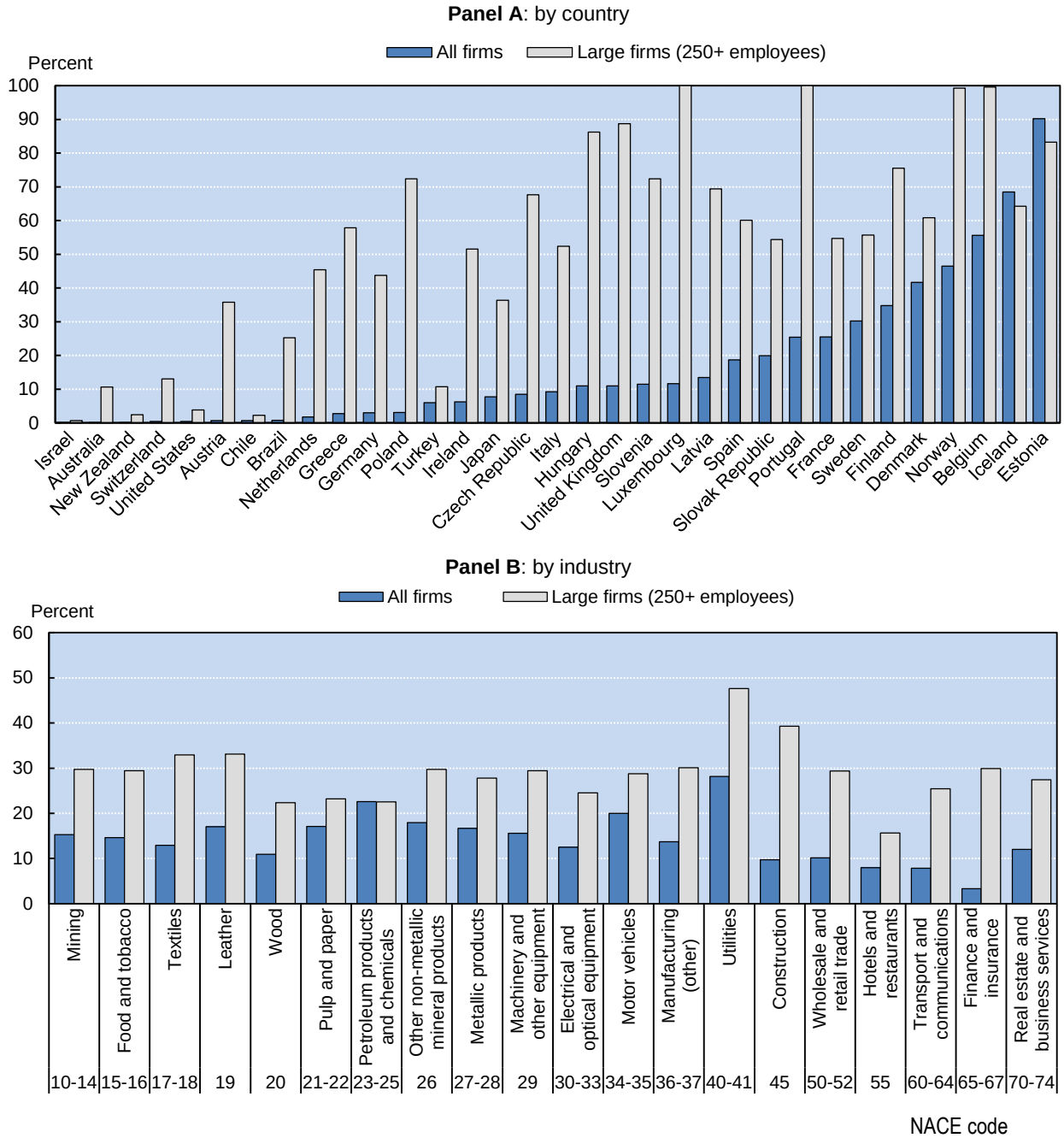
55. Coverage can also be considered in terms of the share of entities of a given MNE group that are identified and covered in the sample. One can assess this by reconciling the unconsolidated accounts of the group members identified by the algorithm described in Appendix 2 with the consolidated group accounts (when these accounts are available in ORBIS). The coverage is generally not exhaustive, since some group members are absent from the ORBIS database, or are not identified as part of the considered group because of missing ownership links, or do not have unconsolidated financial information reported in ORBIS (e.g. in the United States or in certain low tax rate countries). Despite this, the average coverage rate ranges between 50% and 65%, depending of the variable of interest (see Table A2.1). This is higher than in Huizinga and Laeven (2008), where about two thirds of observations had less than 50% group coverage. In addition, the empirical approach does not require perfect coverage of the financial accounts of a group, but only the list of countries where it operates. Coverage in this respect is probably better, since in many cases the location of group members can be identified even when the corresponding unconsolidated financial information is not available.

28. Potential alternative data sources for the United States, such as Compustat or Worldscope, lack detailed ownership information and contain only consolidated firm accounts, making it impossible to merge them consistently into the ORBIS sample of unconsolidated firm accounts.

29. The weights are computed based on the representativeness of the ORBIS sample for large firms (as a proxy for MNEs) relatively to the OECD STAN business demography statistics, as presented in Figure 3A. These weights are used to estimate a weighted OLS regression, which amounts to re-sampling the data to adjust for under-sampling of certain countries. The resulting estimate of the tax sensitivity of profit is not statistically different from the baseline regression.

Figure 3. Representativeness of the final sample

Number of firms in the final ORBIS sample, as a share of the total in STAN business demography statistics, 2006[1]



1. Only countries covered in the OECD STAN business demography statistics database are presented. Large firms are firms with more than 250 employees. When the number of employees is not available in ORBIS, turnover or total assets are used as alternative size measures (with respective thresholds of EUR 50 million and EUR 43 million, in line with the EU definition). Brazil and Iceland refers to manufacturing, Japan is 2012 in STAN as compared to 2009 in ORBIS (large firms is 50+ employees), Iceland 2005, Brazil 2008 and Switzerland 2009.

Source: OECD calculations based on the ORBIS database and OECD STAN business demography statistics.

56. Another issue is whether there is sufficient variability in the tax variable, especially within countries, to identify the effect of tax differentials on profitability. For the average country-year pair in the sample, the standard deviation of the tax variable across MNE entities is about 3.4 percentage points, suggesting that there is indeed substantial variability.

57. The main source of data on statutory tax rates is the OECD tax database. For federal countries, the tax rates are the sum of national and average sub-national rates. By construction, these rates do not take into account tax holidays or regional differences in tax rates. Information from the OECD tax database is complemented with data from the Centre for European Economic Research (ZEW) and KPMG. Macroeconomic data is sourced from World Bank databases. The source of data on patents is the PATSTAT database, which has been merged with the ORBIS database (for details, see Andrews et al., 2014). A patenting group is defined as a corporate group having a depreciated patent stock of at least 10 patents at one point in the sample period, with a depreciation rate conventionally set at 15% per year.

5. Results

5.1 Profit shifting

Baseline results

58. The baseline regression results corresponding to equation (2) are presented in Table 1. The sensitivity of profitability to the tax rate differential between home and partner countries is negative. This supports the hypothesis that MNEs shift profits to lower-tax countries.[30] The estimated coefficient is about -0.0690 in the specification without country fixed-effects (column 1). This implies that a tax rate above the group average by 1 percentage point is associated to a lower reported profit by about 1% for the average MNE entity.[31] This estimate is slightly higher than the recent meta-study estimate of a 0.8% reduction in profits (Heckemeyer and Overesch, 2013).

59. The estimated tax sensitivity of profit is about 30% smaller when fixed-effects for country or country interacted with time are introduced (columns 2 and 3). This result suggests that, as anticipated, these fixed-effects absorb some of the profit shifting behaviour. Coefficients on the determinants of "true" profitability appear plausible: profitability is found to increase with company size,[32] the presence of patents,[33] GDP growth and GDP per capita. The coefficient on the headquarters dummy is negative, which may reflect the centralisation of certain common assets (e.g. financial, intangibles) at the headquarters level, which reduces the profit-to-asset ratio for headquarters entities. The dummy for other parent entities also has a negative coefficient, but of smaller magnitude, which may reflect the same centralising tendency on a smaller scale.

30. The low R-squared is common among cross-sectional regressions such as firm and household-level studies (see e.g. Beer and Loeprick, 2014). It reflects the very large number of observations and the intrinsic volatility of the profit rate, which is largely driven by unobserved firm-specific factors. Since the objective is to explore the association between the independent variables and the outcome, the R-squared is not crucial in evaluating the estimation, in contrast to forecasting models. More importantly, the explanatory variables of interest are highly statistically significant, suggesting that they are estimated with precision.

31. A 1 percentage point tax difference is associated with a profit-to-total-assets ratio lower by 0.0690 percentage point (Table 1, column 1). The average MNE entity in the sample has a profit-to-assets ratio of 6.2%. At this level, a lower profit-to-assets ratio by 0.0690 percentage point corresponds to lower profit by 0.0690/6.2%, i.e. about 1%.

32. The size variable is the logarithm of total assets, but results are robust to the use of the logarithm of sales (for which data coverage is inferior) or of a discrete size variable based on employment (or when unavailable: turnover or total assets).

33. This may partly reflect the value of intangible assets being underreported in financial accounts (e.g. self-created intellectual property is often not reported), which increases the observed profit-to-assets ratio of firms with intangible assets.

Table 1. Profit shifting: baseline regression results

	(1) No country fixed-effects	(2) Country fixed-effects	(3) Country×year fixed-effects
Dependent variable	Pretax profit / Total assets		
Year fixed-effects	yes	yes	yes
Industry fixed-effects	yes	yes	yes
Country fixed-effects	no	yes	yes
Country×year fixed-effects	no	no	yes
Difference to average statutory tax rate in the group	**-0.0690*** **	**-0.0453*** **	**-0.0504*** **
	[0.0191]	[0.0131]	[0.0099]
Log(Total assets)	0.0029***	0.0039***	0.0039***
	[0.0005]	[0.0006]	[0.0006]
Dummy for group headquarters	-0.0087***	-0.0115***	-0.0114***
	[0.0020]	[0.0016]	[0.0016]
Dummy for other parent entities	-0.0032***	-0.0072***	-0.0071***
	[0.0011]	[0.0007]	[0.0007]
Patenting group dummy	0.0063***	0.0041**	0.0044**
	[0.0019]	[0.0019]	[0.0018]
GDP growth rate	0.0029***	0.0027***	
	[0.0008]	[0.0005]	
Exchange rate (USD per local currency unit)	-0.0196*	-0.0155*	
	[0.0118]	[0.0080]	
Inflation	0.0554*	-0.0948**	
	[0.0325]	[0.0453]	
Log(GDP per capita)	0.0185***		
	[0.0045]		
Observations	1,210,651	1,210,651	1,210,651
R-squared	0.015	0.024	0.027
AdjR2	0.015	0.024	0.027

All regressions are ordinary least squares (OLS). *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level. Robust standard errors corrected for clustering at the country-year level are presented under brackets. The sample consists of entities in multinational groups (unconsolidated financial accounts) in 46 countries over 2000-10 (see Appendices 3 and 4 for details).

60. Results are robust to a number of variants (see Tables A5.1 and A5.2). The estimated tax sensitivity of profit is broadly unchanged when the ratio of profit to employment is used instead of profit to total assets, which suggests that both total assets and employment are good benchmarks to measure the "true" economic activity of a firm.[34] The profit shifting elasticity is also robust to restricting the sample to EU countries or to manufacturing firms and to using a 90% ownership threshold in the definition of multinational groups (instead of a 50% threshold). Results are also robust to dropping the dummies

34. An alternative specification with the logarithm of profit as dependent variable and the logarithms of both total assets and employment included as explanatory variables, in the manner of Huizinga and Laeven (2008), also yields similar results. A drawback of this approach is that loss-making firms cannot be included in the sample.

identifying the entities' position in the group (headquarters, other parent company or other), or to excluding all parent companies (i.e. all entities having at least one identified subsidiary) from the sample. The profit shifting elasticity is also unchanged when restricting the sample to 2000-05 or 2005-10, suggesting no significant change in profit shifting intensity over the sample period.

Profit shifting channels and refinements

61. The empirical analysis suggests that the tax sensitivity of operating profit is not statistically different from the sensitivity of total pre-tax profit (see Table A5.3).[35] This means that the debt manipulation channel could not be isolated with this approach. However, a separate in-depth analysis of MNEs' allocation of third-party debt (i.e. debt to credit institutions) provides evidence of debt manipulation. It suggests that debt manipulation accounts for at least 20% of profit shifting and potentially more as the analysis excludes internal debt, which has been shown by other studies to contribute significantly to debt manipulation (see Sorbe et al. 2016 for details). The consensus among firm-level estimates is that debt manipulation accounts for about 30% of profit shifting (Heckemeyer and Overesch, 2013).

62. The tax sensitivity of profit is almost twice as high among patenting MNEs than other MNEs (see Table A5.4). This underlines the importance of intangible assets as a profit shifting channel. The sensitivity is also significantly higher for multinational groups present in at least five countries. Among other factors, this higher sensitivity may reflect increased profit shifting opportunities from exploiting simultaneously differences between many tax systems, for example through access to a wider range of bilateral tax treaties ("treaty abuse"). The splitting of the tax variable between links to no-corporate-tax countries and other links suggests that an important part of profit shifting takes place between countries with a strictly positive corporate tax rate. Finally, the profit shifting elasticity is also significantly higher among profit-making firms, suggesting that potential "loss-shifting" behaviours are less frequent than profit shifting.

Effectiveness of anti-avoidance rules

63. Results show that strong anti-avoidance rules are associated with a reduction in profit shifting (Table 2). This holds for both versions of the classification: including or excluding GAARs and CFC rules. The coefficients estimated in column 3 imply that a country having anti-avoidance rules of moderate strength (3-4 on the 0-8 classification of Figure 1) and moving to a relatively strong stance (5-6) could reduce profit shifting by about one half.[36]

35. In the baseline specification without country fixed effects, the tax sensitivity of operating profit is about 25% lower than the tax sensitivity of total profit, but this difference is not statistically significant at a 5% threshold.

36. More specifically, the estimation results imply that a country scored X on the 0-8 anti-avoidance strength classification in Figure 1, has an average tax sensitivity of (with notations from equation 3): $\beta_2 + \beta_4 X = -0.2305 + 0.0380 \times X$. This coefficient is generally negative, as expected. It is slightly positive for very high anti-avoidance strength (7-8), which would counter-intuitively suggest profit shifting to higher-tax countries, but this positive sign is not statistically significant. After rescaling the coefficient to zero for maximal anti-avoidance strength, moving from $X = 3.5$ to $X = 5.5$ reduces the profit shifting coefficient (in absolute value) by about one half. Without rescaling, the effect is larger, but likely to be exaggerated.

Table 2. Profit shifting: effectiveness of anti-avoidance rules

	(1) Baseline	(2) With anti-avoidance strength, excluding GAARs and CFC rules (0-6 classification)	(3) With anti-avoidance strength, including GAARs and CFC rules (0-8 classification)
Dependent variable		Pretax profit / Total assets	
Year fixed-effects	yes	yes	yes
Industry fixed-effects	yes	yes	yes
Difference to average statutory tax rate in the group (when negative)	-0.0713** [0.0306]	-0.0630* [0.0341]	-0.0445 [0.0327]
Difference to average statutory tax rate in the group (when positive)	-0.0676** [0.0281]	-0.2460*** [0.0657]	-0.2305*** [0.0829]
Anti-avoidance strength		-0.0057*** [0.0011]	-0.0044*** [0.0011]
Anti-avoidance strength × difference to average tax rate in the group (when positive)		**0.0591*** [0.0187]	**0.0380** [0.0166]
Log(Total assets)	0.0029*** [0.0005]	0.0031*** [0.0005]	0.0030*** [0.0005]
Dummy for group headquarters	-0.0086*** [0.0019]	-0.0098*** [0.0021]	-0.0097*** [0.0021]
Dummy for other parent entities	-0.0032*** [0.0011]	-0.0032*** [0.0011]	-0.0034*** [0.0011]
Patenting group dummy	0.0063*** [0.0019]	0.0065*** [0.0019]	0.0062*** [0.0019]
GDP growth rate	0.0029*** [0.0008]	0.0021*** [0.0007]	0.0022*** [0.0007]
Exchange rate (USD per local currency unit)	-0.0197* [0.0118]	-0.0147 [0.0100]	-0.0136 [0.0099]
Inflation	0.0556* [0.0326]	0.0256 [0.0312]	0.0227 [0.0326]
Log(GDP per capita)	0.0185*** [0.0044]	0.0136*** [0.0038]	0.0172*** [0.0036]
Observations	1,210,651	1,210,651	1,210,651
R-squared	0.015	0.017	0.016
AdjR2	0.015	0.017	0.016

All regressions are ordinary least squares (OLS). *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level. Robust standard errors corrected for clustering at the country-year level are presented under brackets. The sample consists of entities in multinational groups (unconsolidated financial accounts) in 46 countries over 2000-10 (see Appendices 3 and 4 for details).

64. However, strong anti-avoidance rules can also generate compliance costs for firms. For example, complying with transfer pricing documentation requirements can be time-consuming and require costly legal advice, which may dent profitability. Indeed, the regression results suggest that, independently of tax considerations, strong anti-avoidance rules are associated with lower profitability. This might also reflect other factors, for example if countries with strong anti-avoidance rules also tend to have other policies

generating high compliance costs for firms. However, the result that strong anti-avoidance rules are associated to lower profitability is robust to controlling for development level (measured by the GDP per capita), regulatory quality (measured with the World Bank index) or statutory corporate tax rates (which have a positive correlation with anti-avoidance strength).[37] Moreover, the correlation between the measure of anti-avoidance and overall product market regulation (or its "barriers to entrepreneurship" subcomponent) is slightly negative.

5.2 Mismatches between tax systems and preferential tax treatment

Baseline results

65. The results suggest that large MNE entities have a lower ETR than entities in non-MNE groups after controlling for other drivers of ETR (Table 3). The estimated difference is on average 3.3 percentage points among large firms (more than 250 employees).[38] This difference is even higher (4.0 percentage points) among very large firms (more than 1,000 employees). In contrast, there is no significant difference between the ETR of small MNE entities and comparable small entities in non-MNE groups. These results support the hypothesis that MNEs exploit mismatches between tax systems and preferential regimes to reduce their tax burden and that larger MNEs are more likely to do so because of the fixed costs involved.

66. Independently of MNE or domestic status, large firms tend to have a higher ETR than smaller ones, which may reflect elements of progressivity in certain corporate tax systems. Also independently of MNE status, patenting firms tend to have a lower ETR than non-patenting firms, possibly because of preferential tax treatment for R&D activities and the associated income. Finally, the ETR of group headquarters is lower than other group members, which may reflect that dividends received from affiliates are often tax-exempt. When estimated separately for MNEs and domestic firms, the coefficient before the headquarters dummy is not significantly different between MNEs and domestic firms. This suggests no systematically different treatment of foreign-source dividends.

67. These results are robust to a number of variants, presented in Table A6.1. The estimated ETR differential between large MNEs and large domestic groups is not statistically different from the baseline: (i) when controlling for firm profitability, (ii) when restricting the sample to manufacturing firms, (iii) when dropping the headquarters and other parent company dummies or (iv) when using the ratio of tax expense to operating (rather than total) profit as a dependent variable.[39] When restricting the sample to EU countries, the ETR differential is lower (2.2 percentage points instead of 3.3 percentage points), but still strongly significant. When MNE groups are identified using a 90% ownership threshold (instead of 50%), the ETR differential is higher (4.3 percentage points instead of 3.3 percentage points) and also strongly significant.

Refinements and effectiveness of anti-avoidance rules

68. The ETR differential between large MNE and non-MNE entities is significantly higher among patenting firms, which may reflect that MNEs exploit preferential tax treatment for R&D activities and associated income more than comparable domestic firms. This is corroborated by the findings in Skeie et al., (2016) that MNEs shift patents from higher to lower-tax rate countries. The ETR differential is also

37. The result is also robust to dropping the interacted term (anti-avoidance interacted with the tax variable) in the regression.

38. When the number of employees is not available in ORBIS, firm size is defined using turnover (with a EUR 50 million threshold), or total assets (EUR 43 million threshold).

39. As discussed above, this ratio may better capture the effect of hybrid securities than the ratio of tax expense to total profit. However, it may leave aside some other tax planning schemes based on financial operations that do not affect operating profit.

higher for MNEs present in at least five countries, suggesting that they exploit the possibilities offered by their access to more (potentially "inconsistent") pairs of tax systems (see Table A6.2).

Table 3. Mismatches between tax systems: baseline results

	(1) Baseline	(2) Large firms divided into subcategories
Dependent variable	ETR (tax expense over reported profit)	
Year fixed-effects	yes	yes
Industry fixed-effects	yes	yes
Country fixed-effects	yes	yes
Country×year fixed-effects	yes	yes
Dummy for group headquarters	-0.0151***	-0.0151***
	[0.0031]	[0.0031]
Dummy for other parent entities	0.0020	0.0021
	[0.0014]	[0.0014]
Patenting group dummy	-0.0106***	-0.0104***
	[0.0037]	[0.0038]
Firm size:		
Small/medium (below 250 employees) - base level	0	0
Large (over 250 employees)	0.0340***	0.0333***
	[0.0040]	[0.0039]
Very large (over 1,000 employees)		0.0374***
		[0.0054]
MNE dummy:		
Among SMEs	0.0020	0.0020
	[0.0027]	[0.0027]
Among large firms	-0.0325***	-0.0302***
	[0.0026]	[0.0028]
Among very large firms		-0.0397***
		[0.0032]
Observations	2,046,838	2,046,838
R-squared	0.187	0.187
AdjR2	0.186	0.186

All regressions are ordinary least squares (OLS). *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level. Robust standard errors corrected for clustering at the country-year level are presented under brackets. The sample consists of entities in both multinational and non-multinational groups (unconsolidated financial accounts) in 46 countries over 2000-10. Micro-firms (less than 10 employees), loss-making firms and standalone firms (i.e. firms that are not part of a corporate group) are excluded (see Appendices 3 and 4 for details).

69. The results suggest no significant effect of strong anti-avoidance rules and withholding taxes – as measured with the classification presented in Figure 1 – on the ETR differential between large MNE and non-MNE entities (column 5 of Table A6.2). This is because the classification mainly measures the strength of rules designed to prevent profit shifting rather than the exploitation of mismatches between tax

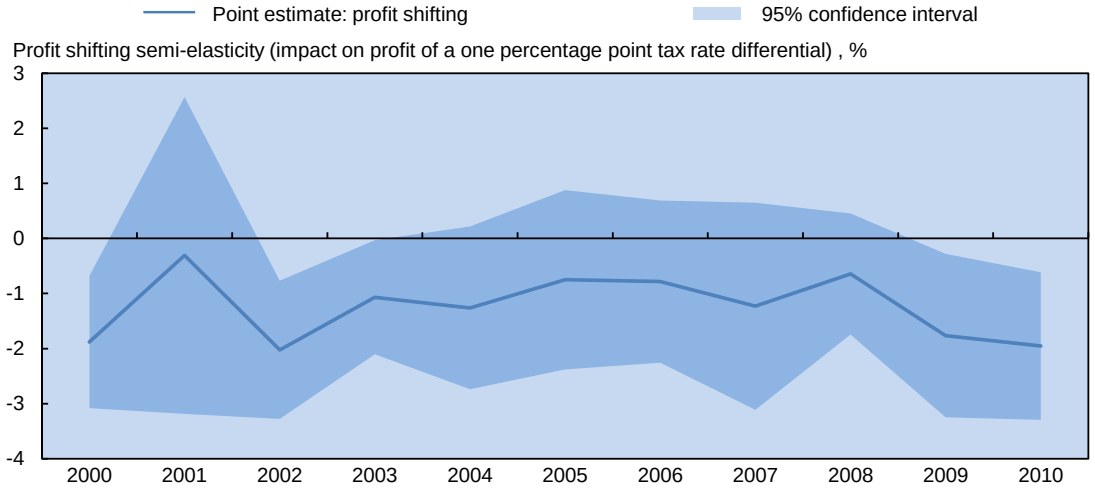
systems. The possibility to exploit mismatches is likely to depend on the "consistency" of a tax system with its international counterparts (more differences in the treatment of certain entities, instruments or operations create scope for tax planning) and on the strength of other anti-avoidance rules (not integrated in the classification presented in Figure 1), such as anti-hybrid rules.

5.3 Trends in international tax planning

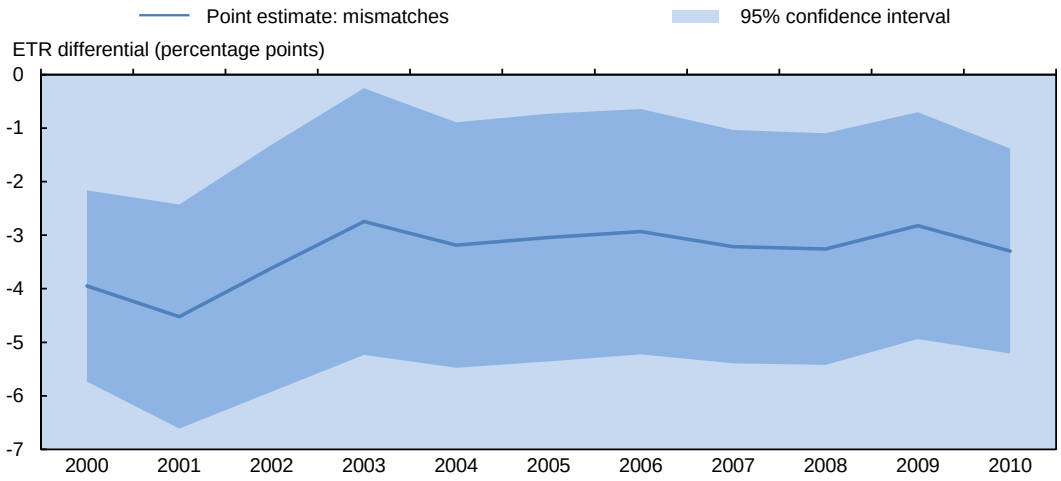
70. Changes in tax planning intensity can only be assessed over 2000-10 with the available sample of firm-level data. The empirical analysis suggests no clear trend over this period (Figure 4). One possible explanation is that a potential increase in the tax planning intensity due to increasing globalisation and greater reliance on intangible assets has been offset by stronger anti-avoidance rules.

Figure 4. Trends in international tax planning, 2000-10

Panel A: Profit shifting



Panel B: Mismatches between tax systems including preferential tax treatment



Note: Panel A shows that in 2000 a one percentage point higher statutory corporate tax rate than the average in the corporate group is associated with a reduction in reported profits of about 1.9%. Panel B shows that in 2000 the ETR of large MNE entities is on average close to 4 percentage points lower than that of comparable large domestic groups. The year estimates are obtained by refining equation (2) by interacting the tax rate differential with a year dummy.

6. Corporate tax revenue implications

71. The elasticities estimated in the previous section combined with a number of assumptions can be used to estimate the effect of international tax planning on corporate tax revenues. Profit shifting redistributes corporate tax bases across countries and results in global tax revenue losses as shifted profits are taxed at a lower average rate than they would have been in the absence of profit shifting. While profit shifting entails gains or losses at the country level depending on the characteristics of tax systems, in the case of mismatches between tax systems (including preferential tax treatment) there are generally no gains in terms of tax revenues, but there can be ambiguity as to who has lost revenue. For example, both parties concerned by a scheme involving a hybrid security may (or may not) claim that they lost revenues. Another difficulty is to identify the most frequent schemes and countries involved in these mismatches.

72. Given the data limitations, the revenue effects presented in this paper should be seen as illustrative and ranges reflecting the many uncertainties of the analysis are provided. The revenue estimates are based on the average tax planning propensity (both for profit shifting and mismatches) estimated over the full sample of countries, in combination with the average tax rate differential in each country. This makes the results less sensitive to outliers or low data coverage in one country, but it also leaves aside certain country-specific differences in tax planning intensity.

Illustrative revenue estimates for hypothetical cases

73. The revenue estimates depend on a number of assumptions, presented in Box 2. One assumption is the share of MNEs in taxable profit, which in most OECD-G20 countries appears to range between 40% and 80% (second Figure in Box 2). Reflecting this distribution, results are presented for two hypothetical cases: a MNE share of 50% and a share of 75%. Another input in the revenue estimates is the average tax rate differential between MNE entities in a country and the average in their MNE group (first Figure in Box 2). Another key assumption is that firms outside the firm-level sample have similar structures and behave in a similar way as firms in the sample. Sensitivity analysis to this assumption is presented below.

Box 2. Assumptions underlying tax revenue effects

Profit shifting

The estimated profit shifting elasticity is translated into revenue effects by assuming that MNEs outside the ORBIS sample shift profits in the same way as the MNEs in the sample. This relies on the assumption that the ORBIS sample is representative of the population of firms, at least in terms of profit shifting propensity.

The starting point is equation (a), which is derived from equation (2) by assuming that the tax differential variable fully captures profit shifting (i.e. the difference between observed and "true" profit).

$$\left(\frac{\text{Shifted profit}}{\text{Total assets}}\right)_{f,c,i,t} = \beta\left(\text{STAT}_{c,t} - \text{STAT_avg_group}_{g,c,i,t}\right) \quad \text{(a)}$$

Multiplying by $\left(\frac{\text{Total assets}}{\text{Observed profit}}\right)_{f,c,i,t}$ on both sides, equation (a) can be rewritten as:

$$\left(\frac{\text{Shifted profit}}{\text{Observed profit}}\right)_{f,c,i,t} = \beta\left(\text{STAT}_{c,t} - \text{STAT_avg_group}_{g,c,i,t}\right)\left(\frac{\text{Total assets}}{\text{Observed profit}}\right)_{f,c,i,t} \quad \text{(b)}$$

Another important assumption is that the tax expense (before tax credits) of a firm in a given country is assumed to change proportionally to the amount of profit shifted from this country. For example, if a firm shifts 10% of its profit out of a country, it is assumed to pay 10% less corporate tax (before tax credits) in this country. This is a simplifying assumption, because there may be some progressivity in the tax schedule and differences between profit in financial account and tax data. The calculations are based on tax expense before tax credits, since tax credits are generally unaffected by profit shifting (although it may not be the case for tax credits arising from taxes paid abroad). Book/tax differences and tax credits are discussed in more detail in Box 3.

Only MNEs (as opposed to non-multinational firms) can shift profits across countries. Thus, tax revenue losses (as a share of total tax revenues) are equal, in the first order, to the share of MNEs in total corporate profits multiplied by the average profit shifting propensity of MNEs:

$$\left(\frac{\text{Revenue gains/losses}}{\text{CIT revenues before tax credits}}\right)_{c,t} \approx \left(\frac{\text{Profits of MNEs}}{\text{Observed profits}}\right)_{c,t} \times \underset{\text{(MNEs)}}{\text{Average}}\left[\left(\frac{\text{Shifted profit}}{\text{Observed profit}}\right)_{f,c,i,t}\right] \quad \text{(c)}$$

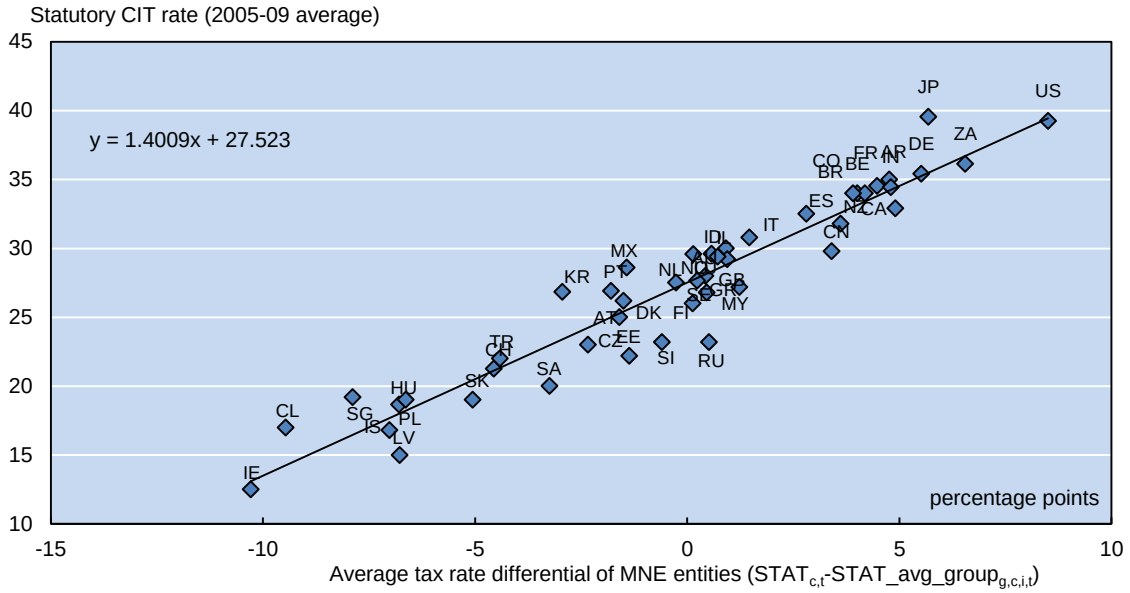
Average revenue effects by country and year are obtained by combining equations (b) and (c) and multiplying by $\left(\frac{\text{CIT revenues before tax credits}}{\text{Observed CIT revenues}}\right)_{c,t}$ on both sides of the equation to express revenue effects in terms of observed tax revenues (i.e. after tax credits):

$$\left(\frac{\text{Revenue gains/losses}}{\text{Observed CIT revenues}}\right)_{c,t} \approx \left(\frac{\text{Profits of MNEs}}{\text{Observed profits}}\right)_{c,t} \times \beta \times \underset{\text{c,t (MNEs)}}{\text{Average}}\left(\text{STAT}_{c,t} - \text{STAT_avg_group}_{g,c,i,t}\right) \times \underset{\text{(MNEs)}}{\text{Average}}\left(\frac{\text{Total assets}}{\text{Observed profit}}\right) \times \left(\frac{\text{CIT revenues before tax credits}}{\text{Observed CIT revenues}}\right)_{c,t} \quad \text{(d)}$$

where $\beta \approx -0.1000$ is the profit shifting sensitivity estimated for the subsample of profit-making firms (column 5 of Table A5.4). This is the relevant sample to assess revenue effects since in general only profit-making firms pay taxes. $\underset{\text{c,t (MNEs)}}{\text{Average}}\left(\text{STAT}_{c,t} - \text{STAT_avg_group}_{g,c,i,t}\right)$ is the average of the tax differential variable for MNEs in country c and year t (see first Figure below). $\left(\frac{\text{Profits of MNEs}}{\text{Observed profits}}\right)_{c,t}$ is the share of the profits of MNEs in total corporate profits in country c. Estimates computed from ORBIS as well as (confidential) tax data in a number of countries suggest that this share ranges from 40% to 80% in most OECD-G20 countries (see second Figure below). $\underset{\text{(MNEs)}}{\text{Average}}\left(\frac{\text{Total assets}}{\text{Observed profit}}\right)$ is the inverse of the average profit-to-assets ratio in the sample, which is about 6.2%. Cross-country differences in this ratio are not taken into account, as they may be driven by reporting differences between countries. $\left(\frac{\text{CIT revenues before tax credits}}{\text{Observed CIT revenues}}\right)_{c,t}$ is the ratio of tax revenues before tax credits to tax revenues after tax credits (i.e. observed tax revenues) (see third Figure below).

Average tax rate differential in the ORBIS sample[1] and statutory tax rate

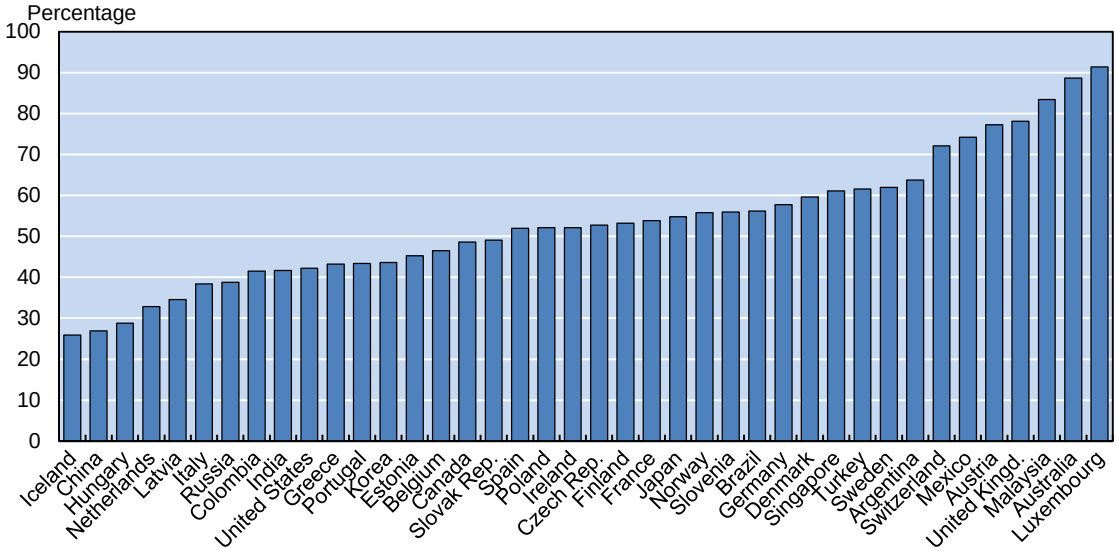
Average 2005-09



1. The tax variable is defined as the difference between the statutory tax rate faced by a MNE entity and the average statutory tax rates in countries where its corporate group is present.
2. The data on average tax rate differentials are based on the ORBIS sample used in the analysis and may not be representative of the underlying population, particularly for specific countries.

Share of multinational entities in total pre-tax profits in the ORBIS sample

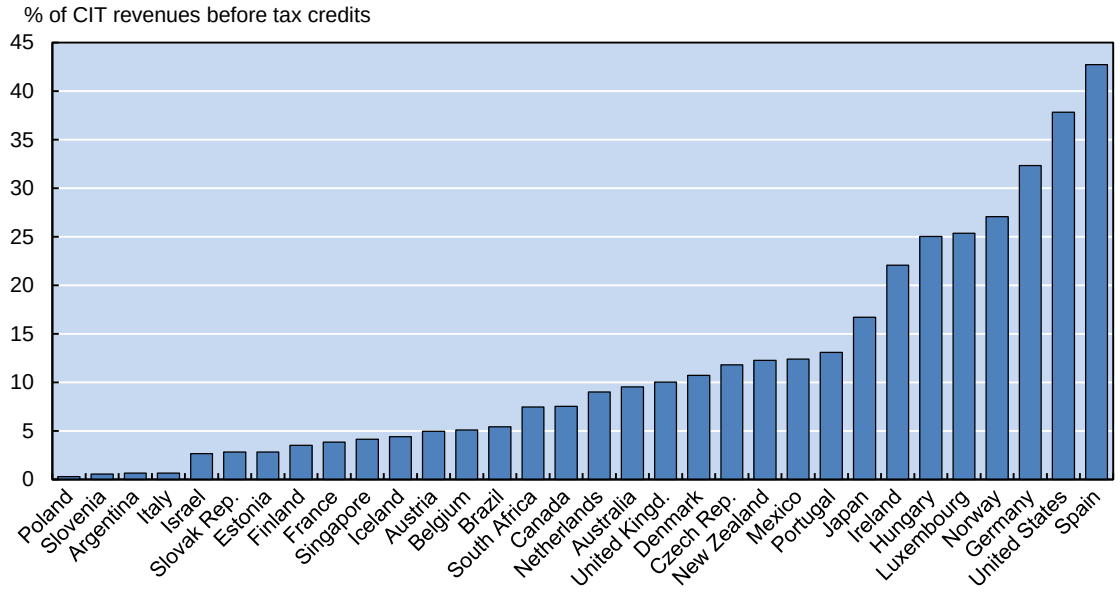
Average 2005-09[1,2]



1. Data for Chile, Indonesia, Israel, New Zealand, Saudi Arabia and South Africa may not be reliable due to a low number of observations in ORBIS and are not presented.
2. The data are based on the ORBIS sample used in the analysis and may not be representative of the underlying population, particularly for specific countries.

Corporate income tax credits

Selected year, 2009-12[1]



1. Data for Austria and Luxembourg is 2009; Estonia and Germany is 2010; Canada and Italy is 2011; Belgium, Brazil, Denmark, Finland, Ireland, Israel, Japan, Netherlands, Norway, Poland, Portugal, Singapore, Slovak Republic and Spain is 2012; Argentina, Australia, Czech Republic, France, Hungary, Iceland, Mexico, New Zealand, Slovenia, South Africa and United Kingdom is 2013. United States is the 2005-09 average.

Source: Data provided to the OECD by national tax authorities

Mismatches between tax systems and preferential tax treatment

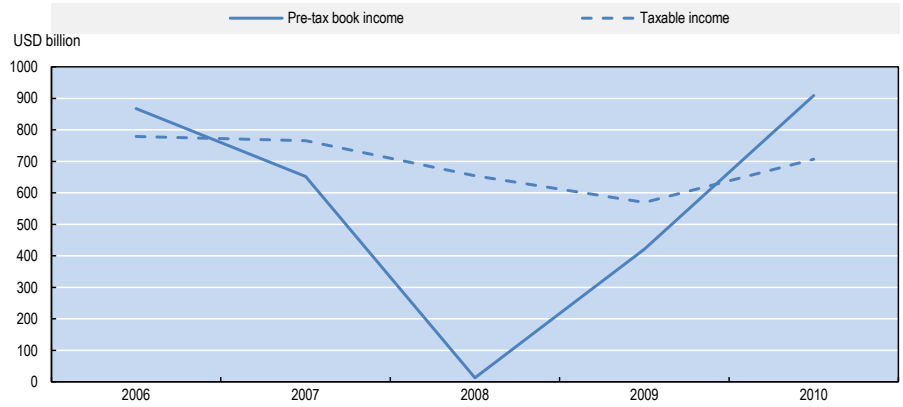
The revenue effects of mismatches between tax systems are based on the assumption that in the absence of these mismatches, a large MNE entity would have the same effective tax rate as a large comparable non-multinational entity. The estimated effective tax rate differential is 3.3 percentage points (Table 3). This differential is multiplied by the share of large MNEs in the total profits of firms in each country (estimated from the ORBIS sample) to derive revenue losses as a share of corporate income tax (CIT) revenues. The underlying assumption is that firms outside the ORBIS sample have the same ETR differential (and thus the same propensity to exploit mismatches) as firms observed in the sample.

74. The estimates are also based on the assumption that corporate tax revenues (before tax credits) change in proportion with reported financial profits. This is an approximation because of potential differences between reported and taxable profits, for instance due to book/tax differences. The effect of book/tax differences on the estimated revenue effects is ambiguous (Box 3). By contrast, taking into account tax credits increases the revenue effects where such tax credits are significant. Information on tax credits is limited and the available data suggest that they can vary substantially across countries and over time. The assumption in this hypothetical example is that tax credits represent 15% of CIT revenues before tax credits.

Box 3. The impact of book/tax differences and tax credits on tax revenue estimates

There exist few estimates of the difference between book and taxable profits. In the United States, the difference was volatile over 2006-10. Excluding the crisis-year 2008, the difference was relatively small on average over the period (Boynton et al., 2014; see Figure below). This pattern would suggest that differences in the timing of recognition of income and expenses are an important driver of book/tax differences (see Section 2.2 above on the sources of book/tax differences). In Germany, financial profits were 10% lower than taxable profits in 2009, with the difference being largest among firms engaged in corporate restructuring, but the corresponding information is not available for other years (Zinn and Spengel, 2012).

Book/tax differences in the United States[1]



Source: Boynton et al. (2014). Data is for SEC 10-K corporations.

Book/tax differences can affect the estimation of the average tax planning propensity, which is based on financial account rather than tax data. Book/tax differences that are independent of tax planning (e.g. timing differences) likely create noise in the estimation, but are unlikely to bias the estimated tax sensitivity in any direction. In contrast, certain book/tax differences result from tax planning schemes (e.g. a dual residence scheme leading to the same interest expense being deducted in more than one country). These schemes would reduce taxable income relatively to book income (Lisowsky, 2010). Such schemes are not identified in the profit shifting analysis, but they are captured in the empirical analysis of mismatches between tax systems, which focuses on how reported profits are taxed.

Book/tax differences can also affect tax revenue estimates for a given tax-sensitivity of reported profits. Indeed, these differences imply that corporate tax revenues may not change proportionately with profits reported in financial accounts. For example, if taxable profit is systematically lower (respectively higher) than book profit, shifting 5% of book profit would amount to shifting more (respectively less) than 5% of taxable profit and thus lead to a revenue loss greater (respectively smaller) than 5% of revenues.

Similarly, the existence of tax credits, if they are unaffected by profit shifting, can influence revenue estimates. Taking tax credits into account would increase estimated revenue effects (see Table below).

Illustrative example of the effect of book/tax differences and tax credits

	No tax planning	Tax planning	Share of tax planning
(1) Financial account profit	105.0	100.0	5.0%
(2) Taxable profit (assuming 10% lower tax than book profits)	94.5	89.5	5.6%
Tax rate	*30%*	*30%*	
(3) Tax before credits	28.4	26.9	5.6%
(4) Tax credits (assuming 15% of tax before credit)	4.0	4.0	
(5) Tax after credits	24.3	22.8	6.6%

Note: Profit shifting is assumed to reduce financial account (i.e. reported) profit by 5% (line 1). Assuming that taxable profits are 10% lower than financial profits, then profit shifting represents 5.6% of taxable profit (line 2). Assuming that tax credits represent 15% of tax before credits and are unaffected by profit shifting, revenue losses from profit shifting, revenue losses would represent 6.2% of tax revenues rather than 5% (line 5).

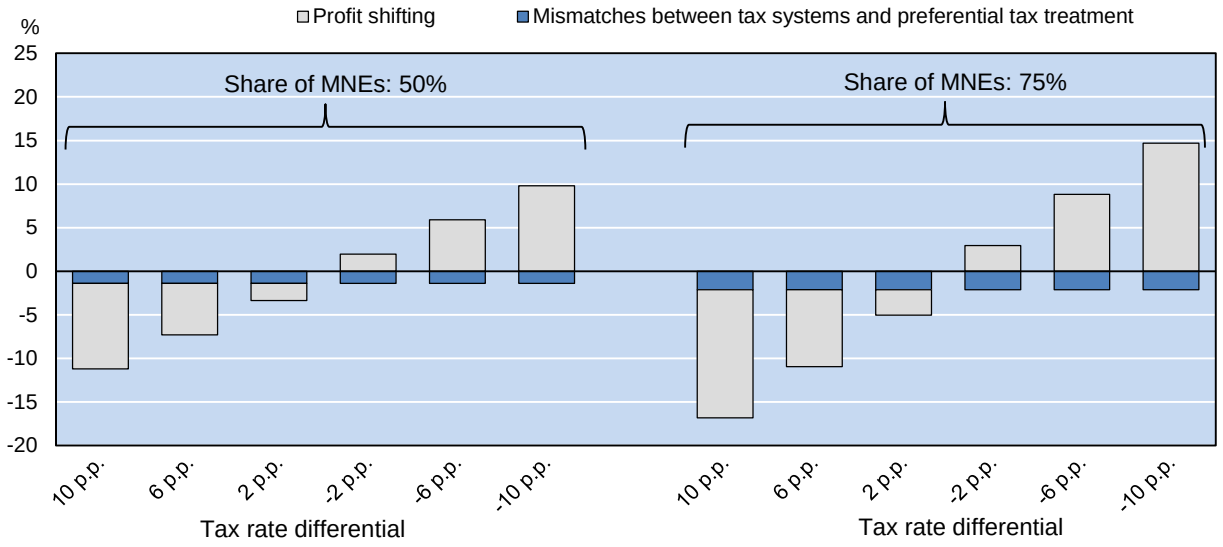
75. Based on these assumptions, illustrative tax revenue effects of tax planning in hypothetical cases are presented in Figure 5. These estimates represent average effects for different combinations of corporate tax bases subject to profit shifting (i.e. shares of MNEs profits in total corporate profits) and statutory tax rate differentials between MNE entities in a country and the average in their MNE group.

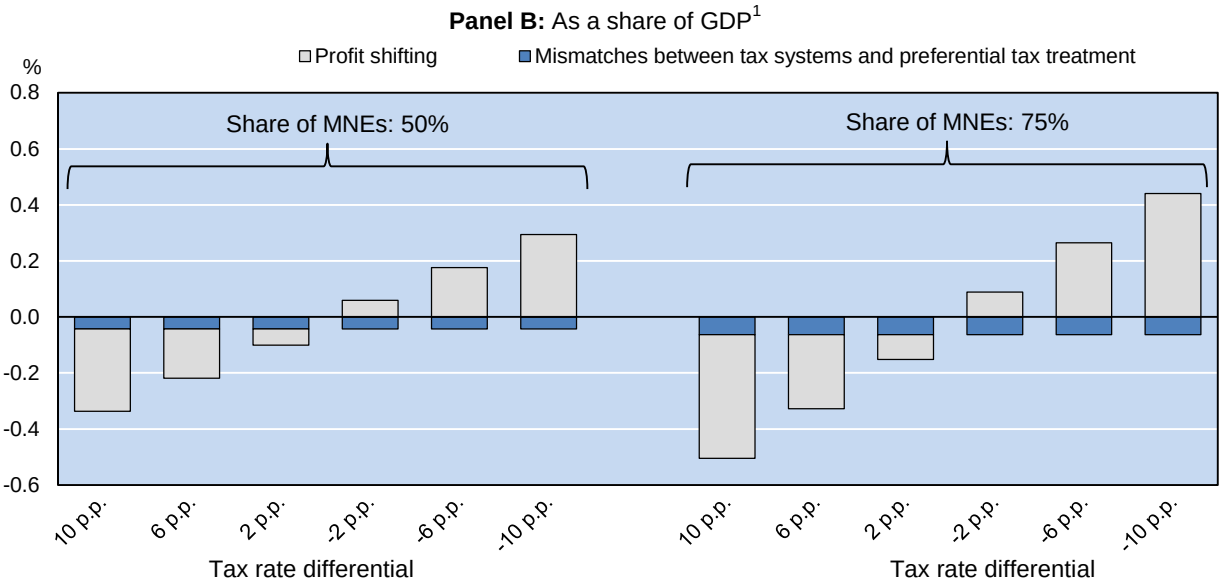
76. Actual tax revenue effects in a given country can deviate significantly from the hypothetical estimates presented in Figure 5. An important source of deviation is the strength of anti-avoidance rules against tax planning, as strong rules have been shown to reduce tax planning (Figure 6). The enforcement of these rules (e.g. frequency of audits, penalties, etc.), which is not captured by the estimates of Figure 6, is also likely to have impact of the fiscal outcomes, as are other country-specific characteristics (e.g. preferential tax treatment, degree of mismatch with other tax systems). Thus, countries with higher statutory tax rates do not necessarily have higher revenue losses from tax planning.

Figure 5. Illustrative tax revenue effects of international tax planning in hypothetical cases

Assuming average anti-avoidance strength

Panel A: As a share of corporate income tax revenues





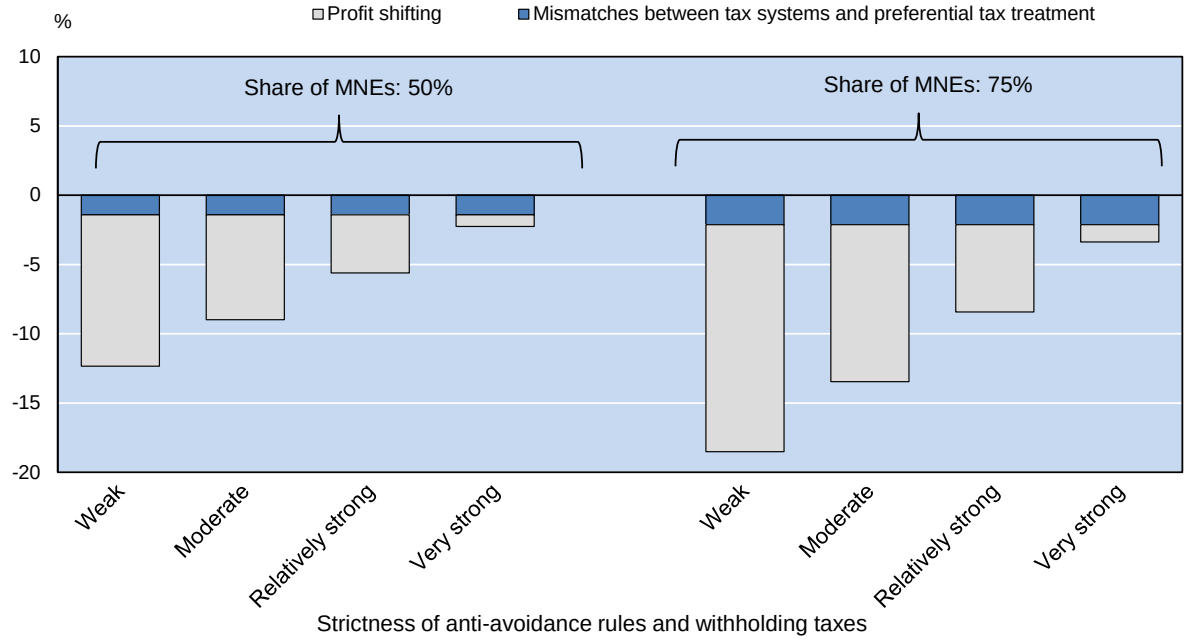
Note: For a country in which the average resident MNE would face a 10 percentage point higher tax rate than the average tax rate in the other countries where this MNE group operates and with a 50% share of MNEs in total corporate profits, the tax revenue loss from tax planning would represent on average about 11% of CIT revenues (or about 0.3% of GDP), most of which from profit shifting. These averages are presented as an illustration of the magnitude of tax planning and are computed for an average strength of the anti-avoidance stance. Actual country-specific tax revenue effects can vary around these averages for many reasons, including cross-country differences in the strength of anti-avoidance rules against tax planning and other country-specific tax rules.

1. Figures as a share of GDP assume that CIT revenues represent 3% of GDP, which is close to the OECD average.

Figure 6. Illustrative tax revenue effects depending on the strength of anti-avoidance rules

Example assuming a 6 percentage point tax rate differential between the resident rate and the average rate in the countries where the MNE groups operate

As a share of corporate income tax revenues



Note: For an average country with a 6 percentage point tax rate differential, a 50% share of MNEs in total corporate profits and weak anti-avoidance rules, the tax revenue loss from tax planning would represent on average about 11% of CIT revenues. The effect of anti-avoidance rules on the profit shifting intensity is derived from the regression results presented in Table 2, column 3.

Sensitivity analysis of revenue estimates

77. The revenue effects are surrounded by a number of uncertainties (Box 4). Some factors may lead to an underestimation of revenue effects, such as the potential lack of financial or ownership information on certain entities involved in the most complex tax schemes. More generally, "unknown" tax planning schemes of MNEs may not be captured, although the empirical approach (based on the location of activity, profits and tax expenses) does not require knowing the details of schemes to estimate tax planning. On the other hand, certain assumptions may lead to an overestimation, such as not controlling for country fixed-effects in the estimation of the profit shifting sensitivity.

Box 4. Main uncertainties surrounding the tax revenue estimates

Factors potentially leading to underestimating the revenue effects:

- Lack of financial or ownership information on some firms involved in complex tax schemes (e.g. specific case of "stateless" entities for tax purposes, which may be less likely to report financial accounts than "normal" entities), thereby leading to their under-representation in the sample.
- The cleaning of the data (e.g. dropping outliers) may have led to certain observations of extreme tax planning behaviour being excluded.

Factors potentially leading to overestimating the revenue effects:

- The empirical specification does not include country-specific fixed-effects and some not-controlled-for country-specific factors may be captured by the tax sensitivity. With country fixed-effects, the estimated profit shifting elasticity is about 30% lower (Table 1).
- Inclusion of legislated tax incentives such as R&D tax credits or negotiated tax preferences, if MNEs exploit these incentives to a greater extent than similar domestic firms. These are not considered as BEPS behaviours.

Factors with ambiguous impact on the revenue effects:

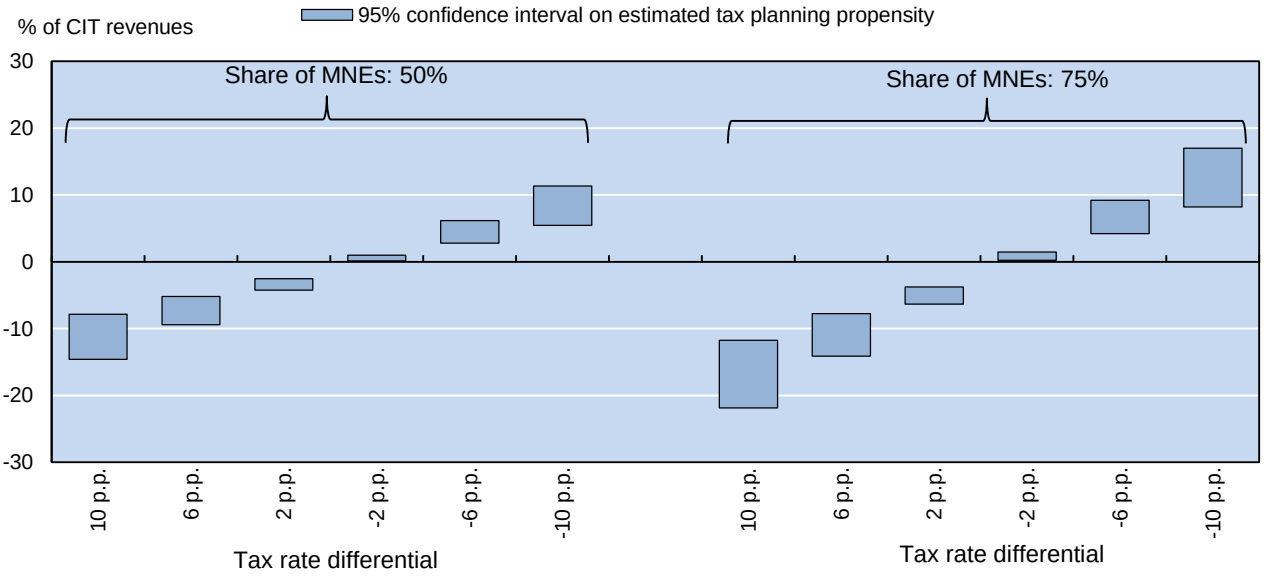
- Corporate group structure is not exogenous to profitability. High-profitability MNE groups are more likely to set up affiliates in lower-tax countries, so as to shift profits there. Despite shifting part of their profits, these groups still report relatively high profits in higher-tax rate countries because of high "true" profitability. Based on the comparison with an average (less profitable) firm, the profits shifted by these groups may be underestimated. However, a symmetric effect exists in lower-tax rate countries, where these high-profitability groups may report relatively high profits not only because of profit shifting, but also because of higher "true" profitability. Thus, the overall effect on the tax sensitivity is ambiguous.
- Corporate tax revenues are assumed to change proportionately with financial reported profits. This may not always be the case because of differences between financial and taxable profits as well as tax credits (see Box 3).

78. Reflecting these uncertainties, the revenue effects incorporate sensitivity to the following two sources of variation: (i) taking a 95% confidence interval around the tax sensitivity estimate; and (ii) assuming that firms outside the sample have a 50% higher tax sensitivity than firms in the sample. The sample coverage is assessed against the population of firms from the OECD Business Demography Statistics database (see Figure 3; the weighted average of coverage is about 40%).[40] The resulting ranges are presented in Figure 7.

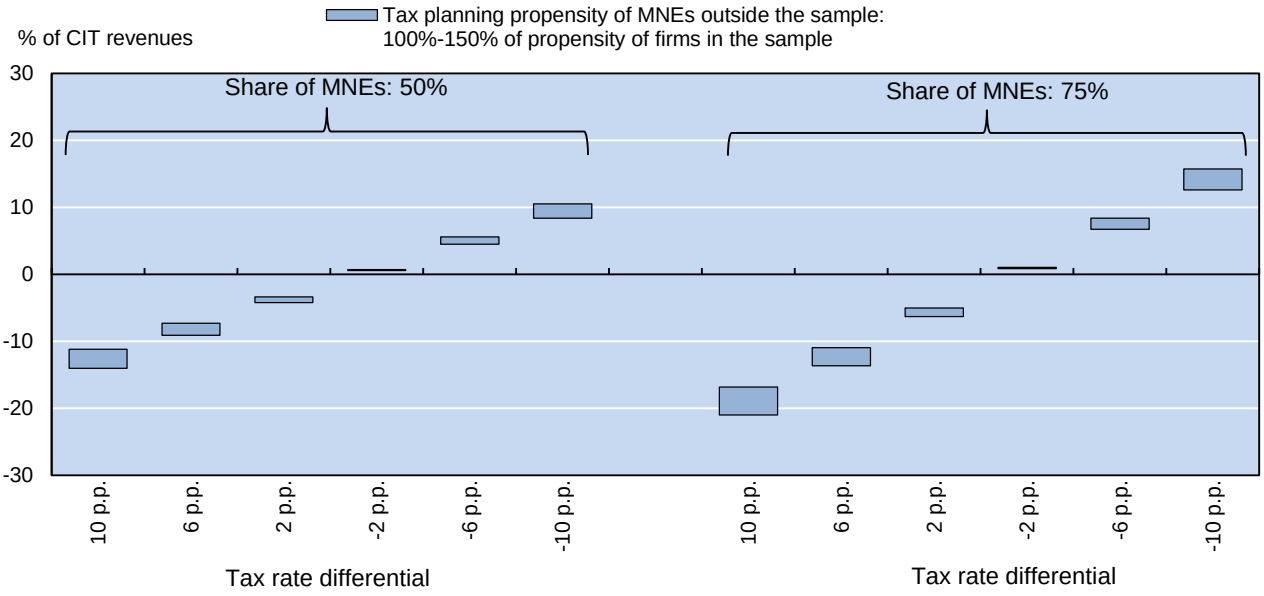
40. The comparison is based on large firms only, as a proxy for MNE entities. For Russia, where no data is available in the OECD Business Demography Statistics database, a coverage rate of 70% is assumed. This corresponds to the average across European countries where comparison is possible. For non-European countries where no data is available in the OECD Business Demography Statistics database, a coverage rate of 5% is assumed.

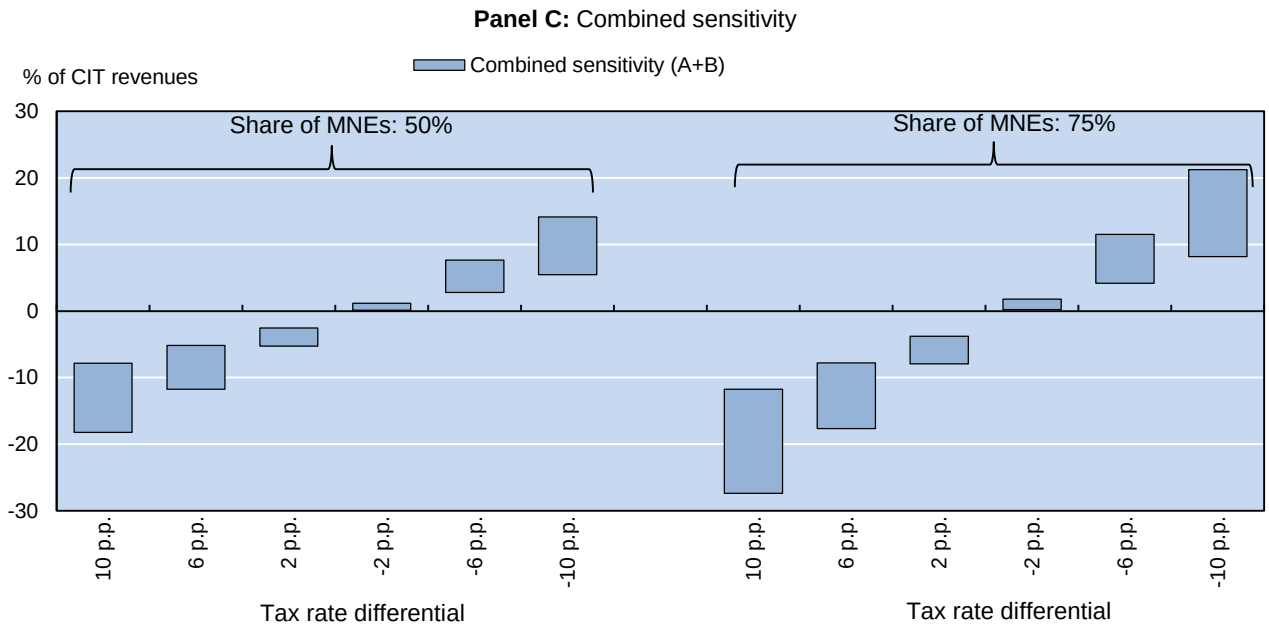
Figure 7. Revenue effects of tax planning in hypothetical cases: accounting for uncertainties

Panel A: Sensitivity to the estimated tax planning intensity[1]



Panel B: Sensitivity to the tax planning intensity of firms outside the sample[2]





1. The range is based on sensitivity around the point estimate of the tax planning sensitivity. The sensitivity analysis assumes a 95% confidence interval (i.e. about two standard errors on each side) around the point estimate of the profit shifting and mismatch estimates.

2. The revenue effect is based on the assumption that firms outside the sample have the same tax elasticity (i.e. profit shifting elasticity and ETR differential) as firms in the sample. The sensitivity analysis assumes a 50% higher tax elasticity of firms outside the sample relative to in-sample firms. The assumption is that 50% of firms are covered in the hypothetical country.

Global tax revenue loss

79. An estimate of the global revenue loss from tax planning is calculated based on the methodology of Box 2 and the weighted average of the relevant parameters for the countries covered in this study. More precisely, the parameters underlying the global revenue loss are based on: (i) the share of MNEs in profits in financial account data complemented with tax data collected as part of the work on Action 11 (the weighted average is 59%); (ii) the average tax rate differential based on the actual links of MNE entities to other countries with different tax rates (the weighted average differential is 3.6 percentage points[41]); and (iii) tax credits as a share of pre-tax profits (the weighted average is 17%).

80. Factoring in the uncertainties described above, the estimated total net revenue loss for the countries included in this study is in the interval of 4% to 10% of corporate tax revenues. Globally, this corresponds to an accumulated revenue loss of about USD 0.9-2.1 trillion over the last ten years (2005-14) or about USD 100-240 billion in 2014.[42] Of these, about two-thirds are due to profit shifting and one-third to mismatches between tax systems and preferential tax treatment.

81. A recent report by the IMF gives an estimate in the estimated range for the overall revenue loss, with an analysis based on macroeconomic data and comparing gross operating surplus with actual

41. In the hypothetical example, the average tax rate differential corresponds to a statutory tax rate of 33%, which broadly corresponds to the weighted average of statutory tax rates over 2005-09 in OECD and G20 countries (see first Figure in Box 2).

42. The underlying assumption is that non-OECD and non-G20 countries lose on average 4-10% of corporate tax revenues, which is the same as the countries in the sample. On average in non-OECD non-G20 countries, corporate tax revenues as a share of GDP is about 50% higher than in countries in the sample (data on corporate tax revenues for these countries is sourced from available national sources and the IMF).

corporate income tax revenues (IMF, 2014).[43] Based on FDI data, a preliminary report by UNCTAD estimates to around USD 100 billion the annual tax revenue loss from international tax planning through offshore investment for developing countries, a number of which are OECD or G20 members (UNCTAD, 2015).

Effective tax rates

82. As a result of tax planning, the effective tax rate of MNE groups is lower than that of non-MNE groups with similar characteristics. Mismatches between tax systems and preferential tax treatment have been found in the previous section to lower the ETR of large MNE entities by an average 3.3 percentage points relative to large non-MNE entities. Profit shifting also reduces the ETR of MNE groups on their "true" profit, by an amount corresponding to the net tax revenue loss of governments, since what is lost by governments is a tax saving for MNEs. On average, the tax revenue effects computed above imply that profit shifting is equivalent to an ETR reduction of an average 2.0 percentage points for MNE groups relative to non-MNE groups (Table 4).[44]

83. Summing up, taking into account the sensitivity assumptions presented above, tax planning would reduce the ETR of large MNE groups by 4-8½ percentage points on average relative to non-MNE groups with similar characteristics. This differential is higher among very large firms (more than 1,000 employees), which exploit mismatches more than other firms (Table 3, column 2). The differential is also higher among patenting MNEs, which have a higher profit shifting intensity than other MNEs and take greater advantage of tax incentives for R&D than non-MNE firms (by locating R&D and patents strategically). In contrast, the ETR differential is lower for smaller (non-patenting) MNE entities, as small MNEs appear to exploit profit shifting opportunities but not mismatches between tax systems.

Table 4. Effect of tax planning on the effective tax rate of MNEs

Estimated average ETR differential between MNE entities and non-MNE entities with similar characteristics induced by tax planning[1]

Percentage point

	Induced by:		
	Profit shifting	Mismatches between tax systems and preferential tax treatment	**Total**
Small MNE entity (<250 employees) as compared to a small non-MNE entity	-2.0 [-1½ to -3½]	0.0	**-2.0 [-1½ to -3½]**
Large MNE entity (250+ employees) as compared to a large non-MNE entity	-2.0 [-1½ to -3½]	-3.3 [-2½ to -5]	**-5.3 [-4 to -8½]**

1. The ranges provided under bracket take into account a 95% confidence interval around the estimated tax sensitivities. The top point of the range also assumes that firms outside the ORBIS sample have a 50% higher tax sensitivity of profit than in-sample firms.

43. The field covered by the IMF study only partly overlaps with this study. For example, profit shifting through transfer price manipulation is not included in IMF estimates, but tax credits and deductions unrelated to tax planning are included.

44. The detailed calculation is as follows: (i) overall net tax revenue losses from profit shifting have been found to amount to about 4% of CIT revenues; (ii) on average (weighted) in the countries included in the study, 59% of profits are generated by MNEs (second Figure of Box 2); (iii) assuming that this would approximately be the share of MNEs in CIT payments in the absence of tax planning, net revenue losses represent about $4\%/59\% = 6.6\%$ of the CIT that would be paid by MNEs in the absence of tax planning; (iv) given an average (weighted) effective tax rate of 30% in the countries covered by this survey, this represents an ETR differential of $6.6\% \times 30\% = 2.0$ percentage point.

7. Conclusion

84. This study covers in a consistent way a wide range of tax planning channels, which correspond to the scope of BEPS, as defined in the OECD-G20 BEPS Action Plan. The profit shifting analysis covers transfer price manipulation, strategic location of intangible assets and manipulation of the location of debt. It also covers cases of headquarters relocating in lower-tax countries, to the extent that the relocation involves a transfer of profits. The analysis on mismatches between tax systems covers issues of hybridity (hybrid entities, instruments and operations), treaty abuse and preferential tax regimes. One important aspect of tax planning for which no separate analysis was conducted in this paper is the issue of defining where the taxable economic activity takes place in the context of the digital economy (see OECD, 2014b). Indeed, the study focuses on where profits are located relative to the assets (or employees) of MNE groups, but not on the location of their customer base.

85. The analysis is based on a large cross-country sample of firms from a database which has limitations but is generally considered as the best available cross-country firm-level information. The results provide robust empirical evidence of international tax planning by MNEs. Both profit shifting and mismatches between tax systems (including preferential tax treatment) are found to reduce significantly the tax burden of MNEs. On average, they translate into a lower ETR by 4-8½ percentage points (respectively 1½-3½ percentage points) for large (respectively small) MNE groups relative to non-MNE firms with similar characteristics. Differences are even larger for very large and patenting firms. This results in a redistribution of tax bases among countries and a total net tax revenue loss ranging from 4% to 10% of corporate tax revenues for the OECD and G20 countries. Globally, this corresponds to about USD 100-240 billion in 2014, or a cumulated 0.9-2.1 USD trillion over the last ten years (2005-14).

86. One interpretation of the results is that there are two categories of tax planning MNEs. A first category is large MNE groups engaged in complex schemes involving the exploitation of preferential regimes and mismatches between tax systems, abuse of bilateral tax treaties and manipulation of intangible assets location. These schemes enable such MNEs them to greatly reduce their corporate tax burden. The other category consists of smaller MNEs shifting profit via marginal manipulation of the price of intra-group transactions and the location of debt, but not engaging in more complex tax schemes. This reduces their tax burden, but to a lesser extent than that of the first category.

87. Strong anti-avoidance rules are associated with reduced profit shifting. For example, increasing anti-avoidance from a moderate regulatory stance to a relatively strong stance could about halve the amount of profit shifting activity. However, strong anti-avoidance rules are also associated with lower firm profitability, which may reflect compliance costs. These results suggest that the implementation of the BEPS Action Plan from 2015 onwards will likely reduce tax planning, albeit at the cost of additional compliance burdens for firms. The benefits of the Action Plan may also be partly undone by the strategic adaptation of MNEs, which may turn to different tax loopholes. Such loopholes could arise especially if the Action Plan is not implemented uniformly across countries.

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APPENDIX 1: THE OECD-G20 BEPS ACTION PLAN

Table A1.1 Action Plan on Base Erosion and Profit Shifting (BEPS)

1	Address the tax challenges of the digital economy
2	Neutralise the effects of hybrid mismatch arrangements
3	Strengthen CFC rules
4	Limit base erosion via interest deductions and other financial payments
5	Counter harmful tax practices more effectively, taking into account transparency and substance
6	Prevent treaty abuse
7	Prevent the artificial avoidance of permanent establishment status
8-10	Assure that transfer pricing outcomes are in line with value creation (Action 8: Intangibles, Action 9: Risks and capital, Action 10: Other high-risk transactions)
11	Establish methodologies to collect and analyse data on BEPS and the actions to address it
12	Require taxpayers to disclose their aggressive tax planning arrangements
13	Re-examine transfer pricing documentation
14	Make dispute resolution mechanisms more effective
15	Develop a multilateral instrument

Source: OECD (2013b)

APPENDIX 2: IDENTIFICATION OF MULTINATIONAL GROUPS

1. This appendix describes the algorithm using the information on firms' ownership structure in ORBIS to identify all firms belonging to the same corporate group (for details see Menon, forthcoming). This allows distinguishing MNE entities from entities in domestic groups (i.e. corporate groups present in only one country) and standalone firms. In addition, it allows identifying broadly the position of a firm in the group (group headquarters, other parent company or non-parent entity) and calculating additional indicators at group level, such as the tax variable used in this study.

2. The ORBIS dataset contains ownership information compiled by Bureau Van Dijk (BvD). However, the information on the ultimate owner of a firm is sometimes missing. For instance, the dataset may report that firm A controls 100% of firm B, and that firm B controls 100% of firm C. This implies that A also controls 100% of firm C, but this link may not always be reported in the original ownership tables. In this example, only one step is needed to find the ultimate owner of company A. However, in the real dataset several iterations may be needed. Furthermore, each company can have more than one intermediate shareholder. As a result, different alternative ownership routes may lead to different global ultimate owners (GUOs) and complex group structures may lead to different identifications depending on the choices made. To address these issues, an ad-hoc algorithm (elaborating on Andrews et al., 2014, Appendix A) was developed to extract the available information in ORBIS and identify corporate groups in a consistent manner across the sample.

1. The algorithm

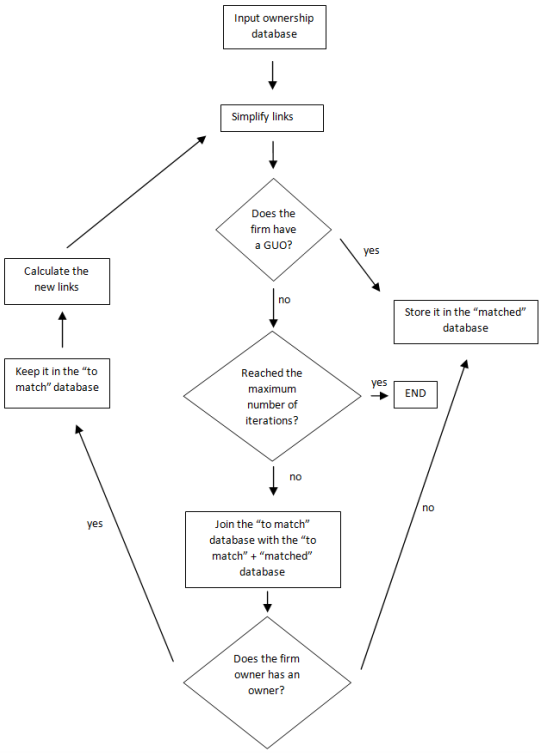
3. The algorithm first simplifies the link structure by dropping non-informative or duplicate links in the ORBIS database. The simplification of the ownership structure is based on three main assumptions:

- direct and total ownership convey the same message;
- all the ownership links below a set threshold (e.g. 50%) of ownership rate, or with missing information, are considered to be irrelevant and are therefore dropped;[45]
- in the case of multiple ownership links defined as "ultimate" (i.e. where the owner is either a domestic ultimate owner (DUO) or a GUO), only the one with the highest share (direct or total) is kept.

4. Once the ownership structure has been simplified, the algorithm stores the companies which already have a reported GUO in the "matched" database (see Figure A2.1). Next it looks for the owner of the owner of all remaining companies in the "to match" database. If none is found, the non-owned owner becomes the ultimate owner, and all the companies it owns are stored in the "matched" database. For those companies for which the final owner has not yet been found, the loop continues. The process continues until all companies are matched to a final owner (or until the maximum number of iterations is reached). A specific procedure identifies circular structures (e.g., A owns B that owns C that owns A), which can be considered as belonging to the same group even though the head of the group cannot be identified for them.

45. One consequence is that if firms A and B are linked by two different ownership routes (going through third companies), each corresponding to an ownership share below 50%, then firms A and B are not considered as linked by the algorithm (even though the overall ownership share may be above 50%).

Figure A2.1 MNE identification algorithm: flowchart



2. Main assumptions

5. The ownership threshold selected in this study is 50%. This means that a firm is considered as belonging to a group if the ultimate owner of the group (i.e. the group headquarters) has an ownership share of at least 50% (directly or indirectly) in the firm. As a robustness check, a 90% threshold is also used (with essentially the same results for the regressions reported in this paper).

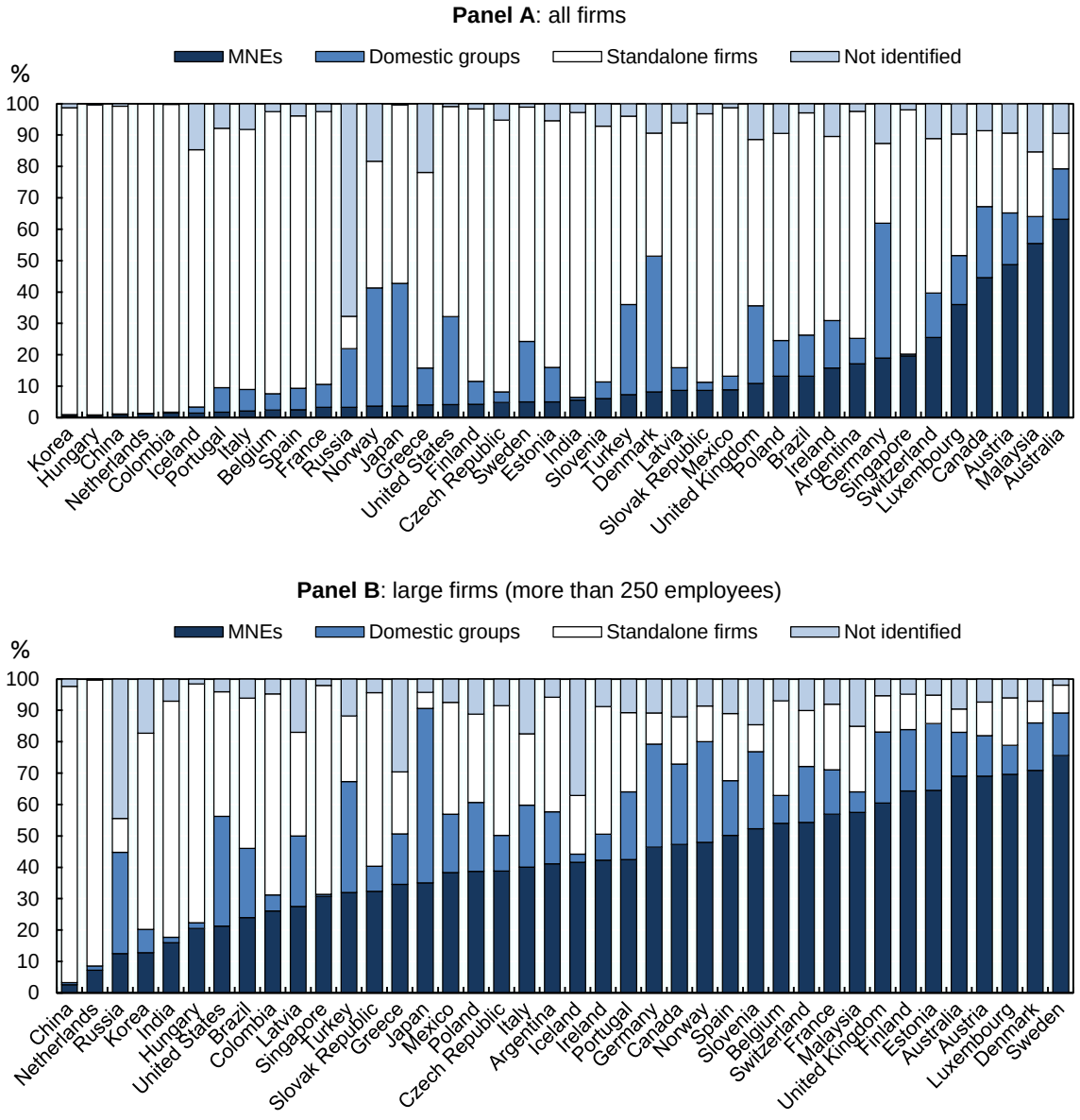
6. To enhance the robustness of the identification, firm category (MNE, domestic group or standalone) is also identified with a "weaker" version of the algorithm adopting a wider definition of corporate groups by assuming a lower ownership threshold (10%) and by allowing companies to belong to multiple groups. Firms or groups classified in different categories in the normal and the "weak" version (e.g. MNE in the weak version and domestic group in the strong version, which would reflect a link to a foreign company with an ownership share between 10% and 50%) are considered as non-identified and are excluded from the sample for the empirical analysis. The idea is that comparison between MNEs and domestic groups will be based only on firms that can be firmly classified into one category.

7. Ownership information is available in ORBIS for each year since 2005. However, since the coverage of ownership information has improved over time, new links appearing over the sample period are likely to reflect in many cases improving data coverage rather than actual changes in ownership structure. Therefore, the corporate group identification relies only on the latest available year (2009), so as to avoid potential noise created by the increasing data coverage. The drawback is that the group identification may lack timeliness in the earlier years of the sample. This does not appear to be too problematic, since restricting the sample period to 2005-10 (or even 2008-10) does not alter the regression results.

3. Results

8. In most cases, the weak and strong version of the algorithm point to the same result in terms of the distribution of different types of firms (MNEs, domestic groups, standalone firms). The distribution is presented in Figure A2.2, where "not identified" firms are those for which the weak and strong version of the algorithm gives different results. In most countries, the distribution of firms by category appears plausible, with a few exceptions where the share of MNEs or domestic groups is unrealistically low (China, Korea, Netherlands and Hungary), probably reflecting missing ownership links in ORBIS. The distribution of large firms (panel B) is more comparable across countries than the distribution of all firms (panel A), since the coverage of small firms (of which few are multinationals) in ORBIS differs widely between countries.

Figure A2.2 Distribution of observations by firm type[1]



1. The data are based on the ORBIS sample used in the analysis and may not be representative of the underlying population, particularly for specific countries.

Source: OECD calculations based on the ORBIS database

9. Another interesting test is to reconcile the unconsolidated accounts of the identified members of a MNE group with the consolidated accounts of the group (when these accounts are reported in ORBIS, i.e. for about 60% of MNE groups). Accounting rules for consolidation are generally based on a 50% ownership threshold for the inclusion of a firm in the group, which is consistent with the strong version of the algorithm, making the comparison relevant in terms of group members. The average coverage rate for MNE groups ranges between 50% and 65%, depending on the variable of interest (Table A2.1). It is lower than 100%, which reflects: (i) that some group members are absent from the ORBIS database; (ii) that some group members are not identified as part of the considered group because of missing ownership links or different consolidation rules (e.g. ownership threshold different from 50%); and (iii) that for some group members, unconsolidated financial information is not reported in ORBIS (e.g. in the United States, where most often only consolidated information is reported, or in certain low tax or no tax countries). Taking these elements into account, the fact that the coverage ratio exceeds 50% on average suggests that the algorithm performs rather well in terms of exploiting the information available in ORBIS to identify MNE groups.

Table A2.1 Reconciling consolidated and unconsolidated group accounts

	Average coverage rate (average ratio between the sum of unconsolidated figures and the corresponding consolidated figure)	Number of observations (one observation per MNE group and per year)
Total assets	61.6%	45,026
Employment	52.9%	32,145
Debt to credit institutions	55.0%	26,262
Total (pre-tax) profit	63.5%	35,104
Operational profit	59.6%	34,215

Explanatory note: The coverage rate for total assets (the calculation is identical for the other variables) is computed as the ratio between the sum of the total assets of all entities in the MNE group (as identified with the strong version of the algorithm presented in this Appendix) and the total assets of the group (as reported in the consolidated accounts of the group headquarters in the ORBIS database). For certain variables (total assets, total profit), the sum of unconsolidated figures can be higher than consolidated figures because of intra-group operations (e.g. the profit of an affiliate can also appear as a dividend received in the unconsolidated accounts of its parent). However, such "double counting" seems to be limited, since the average coverage rate of total assets and total profit is only slightly higher than the rate for the other variables (which are not affected by the issue).

Source: OECD calculations based on the ORBIS database

10. The average MNE group in the sample comprises 18 entities and is present in 3 countries (Table A2.2).

Table A2.2 Basic statistics on MNE groups

Variable	Number of groups observed	Mean	Standard deviation	Minimum	Maximum
Number of entities in the group	76,251	17.8	130.0	2	11,695
Number of countries where the group operates	76,251	3.0	4.0	2	136

Source: OECD calculations based on the ORBIS database

APPENDIX 3: DETAILS OF DATA CLEANING

1. A first cleaning of the dataset was applied by Ragoussis and Gonnard (2012). It consisted of: (i) dropping observations violating basic accounting identities (e.g. total assets should equal total liabilities plus equity), with a 10% error margin; (ii) dropping observations with implausible values (e.g. negative values for total assets); (iii) dropping observations with very large shifts over short periods of time (e.g. average wage per employee increasing by a factor ten); (iv) dropping observations not corresponding to full year accounts (e.g. quarterly results); (v) dropping observations with inconsistent dates (e.g. firm incorporated after becoming inactive).

2. An additional cleaning has been applied for this paper, which consisted of: (i) dropping observations violating other basic accounting identities (e.g. if pre-tax profit differs from post-tax profit plus tax expenses), with an identical 10% error margin; (ii) dropping further observations with implausible or suspect values (negative tax expenses[46], negative interest expenses, effective tax rate over 100%); (iii) dropping observations considered as outliers, which are identified as the top and bottom 2.5% of the distribution of the following ratios: profit to total assets, profit to number of employees, operating profit to total assets, operating profit to number of employees. The distribution of outliers appears roughly even across countries, industries and firm size categories (with a slight overrepresentation of small firms among the outliers). Results are robust to using a 1% threshold instead of 2.5%.

3. The main steps of the data cleaning procedure are summarised in Table A3.1. Only unconsolidated accounts are kept, using the consolidation codes (U1 and U2) provided in the ORBIS database. The final sample for the profit shifting regressions (only accounts of MNE entities) comprises 1.2 million observations. The final sample for the regressions on mismatches between tax systems (both accounts of MNEs and domestic groups, excluding micro-firms and loss-making firms) comprises 2.0 million observations.

46. Negative tax expenses can correspond to actual situations of tax credit (possibly to be carried forward for future years). However, they may also correspond to sign errors and therefore are dropped.

Table A3.1 Main steps of the database cleaning

Step	Number of observations	As a share of step N-1	As a share of step 1
Initial sample from ORBIS database	152,176,543	-	100.0%
Dropping years outside 2000-10	146,237,555	96.1%	96.1%
Dropping missing/incomplete financial information	61,782,156	42.2%	40.6%
Dropping missing sector information	58,815,864	95.2%	38.6%
Selecting the 46 countries in the sample (mainly OECD+G20)	50,692,083	86.2%	33.3%
Dropping implausible/suspect values	41,715,380	82.3%	27.4%
Dropping outliers (top and bottom 2.5% of main ratios)	36,674,290	87.9%	24.1%
Dropping consolidated accounts	36,053,521	98.3%	23.7%
Dropping public sector and agriculture	32,893,652	91.2%	21.6%
Keeping only MNEs and domestic groups (dropping standalone firms)	5,237,955	15.9%	3.4%

Sample for profit shifting regressions

	Nb. obs.	As a share of step N-1	As a share of step 1
Only MNEs	1,210,651	23.1%	0.8%

Sample for mismatches regressions

	Nb. obs.	As a share of step N-1	As a share of step 1
Dropping missing tax data	4,934,467	94.2%	3.2%
Dropping loss-making firms	3,674,554	74.5%	2.4%
Dropping micro-firms	2,046,838	55.7%	1.3%

APPENDIX 4: DATA COVERAGE AND BASIC STATISTICS

Table A4.1 Number of observations by country

	MNE entities (by operating country)	MNE entities (by headquarters country)	Domestic group entities	All entities (including standalone firms)
Argentina	2,152	407	1,015	12,561
Australia	2,124	6,769	540	3,363
Austria	5,184	15,589	1,755	10,650
Belgium	54,145	50,682	117,721	2,249,315
Brazil	3,250	1,234	3,211	24,612
Canada	323	5,063	164	724
Chile	458	263	124	2,460
China (People's Republic of)	12,343	2,619	2,966	1,399,494
Colombia	1,233	373	287	88,108
Czech Republic	24,809	5,237	17,303	517,547
Denmark	43,208	52,043	229,477	530,782
Estonia	16,282	3,012	35,380	323,901
Finland	33,203	32,716	56,495	779,585
France	177,496	151,379	404,920	5,516,292
Germany	69,533	94,721	156,974	365,838
Greece	8,295	3,833	23,802	203,879
Hungary	6,207	1,064	2,552	987,641
Iceland	1,589	1,996	2,065	109,087
India	3,040	4,630	502	54,799
Indonesia	260	114	24	565
Ireland	8,945	8,822	8,550	56,577
Israel	75	1,665	14	123
Italy	66,782	58,192	219,682	3,208,894
Japan	46,561	58,899	505,402	1,289,727
Korea	4,741	3,842	5,298	1,110,519
Latvia	4,715	2,001	3,969	54,719
Luxembourg	5,607	19,568	2,421	15,563
Malaysia	409	918	63	737
Mexico	1,647	1,054	814	18,614
Netherlands	1,036	22,466	110	87,413
New Zealand	410	852	33	1,064
Norway	36,951	21,807	387,699	1,027,161
Poland	39,856	13,345	34,436	303,112
Portugal	22,422	10,851	101,008	1,297,935
Russia	106,774	26,283	603,456	3,235,059
Saudi Arabia	2	278	20	54
Singapore	3,080	3,429	94	15,707
Slovak Republic	5,177	1,286	1,600	59,986
Slovenia	4,179	2,153	3,641	68,609
South Africa	255	1,498	41	480
Spain	107,150	75,670	295,925	4,305,340
Sweden	80,910	96,619	312,875	1,626,486
Switzerland	1,695	32,529	936	6,638
Turkey	1,826	1,895	7,228	25,114
United Kingdom	187,361	105,071	426,894	1,726,601
United States	6,951	73,037	47,818	170,217
Other	-	132,877	-	-
Total	1,210,651	1,210,651	4,027,304	32,893,652

Note: "MNE entities" are firms belonging to corporate groups present in at least two countries. "Domestic group entities" are firms in corporate groups present in only one country. "All entities" also include standalone firms (i.e. with no affiliate and no parent company) and firms that cannot be assigned to one category with certainty (see Appendix 2). Differences between the number of MNE entities by operating country and by headquarters country can reflect patterns in headquarters location, but also differences in data coverage between countries. Each observation is a firm-year pair.

Table A4.2 Number of observations by country of operation – large entities

	Large MNE entities	Large domestic group entities
Argentina	968	392
Australia	1,598	324
Austria	1,763	329
Belgium	4,541	745
Brazil	1,873	1,716
Canada	199	108
Chile	247	49
China (People's Republic of)	8,720	2,030
Colombia	624	122
Czech Republic	3,640	1,062
Denmark	1,955	418
Estonia	796	263
Finland	2,789	851
France	16,217	4,014
Germany	15,699	11,114
Greece	899	418
Hungary	1,399	126
Iceland	111	7
India	1,313	147
Indonesia	204	23
Ireland	1,686	329
Israel	61	10
Italy	7,114	3,503
Japan	17,408	27,551
Korea	1,890	1,095
Latvia	431	353
Luxembourg	1,102	147
Malaysia	302	34
Mexico	833	405
Netherlands	489	92
New Zealand	156	12
Norway	2,259	1,509
Poland	7,385	4,195
Portugal	2,897	1,467
Russia	12,760	32,842
Saudi Arabia	1	19
Singapore	1,834	40
Slovak Republic	739	184
Slovenia	859	404
South Africa	180	20
Spain	9,979	3,468
Sweden	4,012	719
Switzerland	721	237
Turkey	890	982
United Kingdom	36,960	13,839
United States	4,217	6,936
Total	182,720	124,650

Note: "MNE entities" are firms belonging to corporate groups present in at least two countries. "Domestic group entities" are firms in corporate groups present in only one country. Large entities are defined as having more than 250 employees.

Table A4.3 Number of observations by industry

NACE REV1 classification		MNE entities	Dom. group entities	All entities
10	Mining of coal and lignite	499	1,403	26,701
11	Extraction of crude petroleum and natural gas	4,140	2,862	16,956
12	Mining of uranium and thorium ores	36	13	331
13	Mining of metal ores	556	1,173	16,608
14	Other mining and quarrying	5,103	13,063	80,016
15	Manufacture of food products and beverages	25,332	75,841	685,427
16	Manufacture of tobacco products	333	306	2,652
17	Manufacture of textiles	7,823	21,627	306,397
18	Manufacture of wearing apparel	4,829	14,277	240,392
19	Tanning and dressing of leather	2,161	5,611	114,338
20	Manufacture of wood	7,046	26,828	253,809
21	Manufacture of pulp, paper and paper products	7,605	12,501	118,387
22	Publishing, printing and reproduction of recorded media	18,848	63,859	506,806
23	Manufacture of refined petroleum products	1,577	2,008	25,528
24	Manufacture of chemicals and chemical products	24,922	25,408	295,532
25	Manufacture of rubber and plastic products	19,271	31,701	297,162
26	Manufacture of other non-metallic mineral products	14,623	36,449	330,749
27	Manufacture of basic metals	9,171	12,930	144,921
28	Manufacture of fabricated metal products	30,807	95,009	867,306
29	Manufacture of machinery and equipment	39,917	73,340	687,918
30	Manufacture of office machinery and computers	2,765	3,373	35,625
31	Manufacture of electrical machinery and apparatus	15,015	23,296	233,513
32	Manufacture of radio, television and communication equipment	9,959	10,609	149,313
33	Manufacture of medical, precision and optical instruments	10,691	15,247	161,861
34	Manufacture of motor vehicles, trailers and semi-trailers	11,026	11,017	125,992
35	Manufacture of other transport equipment	5,655	10,998	101,500
36	Manufacture of furniture	10,579	33,059	368,904
37	Recycling	2,894	13,289	63,376
40	Electricity, gas, steam and hot water supply	13,763	34,000	148,338
41	Collection, purification and distribution of water	1,611	9,208	42,537
45	Construction	55,498	550,159	4,629,712
50	Sale, maintenance and repair of motor vehicles and motorcycles	21,432	139,634	1,235,591
51	Wholesale trade and commission trade	209,422	551,884	4,402,921
52	Retail trade	45,083	319,729	3,239,509
55	Hotels and restaurants	21,706	118,883	1,572,495
60	Land transport	20,265	91,634	843,837
61	Water transport	5,600	10,545	47,681
62	Air transport	1,875	2,562	13,241
63	Supporting and auxiliary transport activities	37,575	68,159	471,462
64	Post and telecommunications	9,325	17,351	109,215
65	Financial intermediation	48,893	118,345	520,940
66	Insurance and pension funding	18,597	17,855	76,645
67	Activities auxiliary to financial intermediation	16,497	32,495	306,038
70	Real estate activities	112,559	534,572	3,386,481
71	Renting of machinery and equipment	10,975	33,757	228,120
72	Computer and related activities	42,733	90,485	822,959
73	Research and development	9,072	19,558	115,113
74	Other business activities	214,987	629,392	4,422,797
	Total	1,210,651	4,027,304	32,893,652

Note: "MNE entities" are firms belonging to corporate groups present in at least two countries. "Domestic group entities" are firms in corporate groups present in only one country. "All entities" also include standalone firms (i.e. with no affiliate and no parent company) and firms that cannot be assigned to one category with certainty (see Appendix 2). Each observation is a firm-year pair.

Table A4.4 Number of observations by year

	MNE entities	Domestic group entities	All entities
2000	49,674	136,292	1,127,626
2001	94,157	295,170	2,329,237
2002	99,216	320,268	2,631,266
2003	106,080	346,440	2,815,606
2004	118,502	393,179	3,366,240
2005	138,206	449,318	3,728,112
2006	149,791	502,538	3,905,379
2007	156,141	524,631	4,239,802
2008	148,433	503,451	4,193,661
2009	128,406	446,291	3,870,188
2010	22,045	109,726	686,535
Total	1,210,651	4,027,304	32,893,652

Note: "MNE entities" are firms belonging to corporate groups present in at least two countries. "Domestic group entities" are firms in corporate groups present in only one country. "All entities" also include standalone firms (i.e. with no affiliate and no parent company) and firms that cannot be assigned to one category with certainty (see Appendix 2).

Table A4.5 Number of observations by firm size

	MNE entities	Domestic group entities	All entities
Micro (<10 employees)	436,120	2,234,954	23,471,776
Small (10-49 employees)	321,118	1,170,370	6,214,227
Medium-sized (50-249 employees)	270,693	497,359	2,396,825
Large (250-999 employees)	119,095	102,199	635,096
Very large (1,000-9,999 employees)	55,606	21,272	162,692
Huge (10,000+ employees)	8,019	1,150	13,036
Total	1,210,651	4,027,304	32,893,652

Note: when the number of employees is not available, firm size is defined based on total assets (thresholds: EUR 2m for small firms, EUR 10m for medium-sized firms, EUR 43m for large firms, EUR 172m for very large firms and EUR 1,720m for huge firms) or turnover (thresholds: respectively EUR 2m, EUR 10m, EUR 50m, EUR 200m and EUR 2,000m)

Table A4.6 Basic statistics on MNE entities

Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
Total profit (USD PPP of 2005, thousand)	1,210,651	5,405	120,159	-2.33E+07	2.97E+07
Operating profit (USD PPP of 2005, thousand)	1,154,946	2,381	75,742	-2.66E+07	2.97E+07
Tax expenses (USD PPP of 2005, thousand)	1,109,720	925	24,325	0	1.01E+07
Total assets (USD PPP of 2005, thousand)	1,210,651	365,063	9.21E+06	0	1.62E+09
Number of employees	732,099	287	2538	0	5.00E+05
Total profit over total assets	1,210,651	0.062	0.155	-0.688	0.762
Operating profit over total assets	1,154,946	0.064	0.150	-0.750	0.750
Total profit over number of employees	696,206	14.4	22.5	-37.6	99.2
Operating profit over number of employees	687,121	14.7	21.9	-38.0	101.3

APPENDIX 5: PROFIT SHIFTING: VARIANT REGRESSION RESULTS

Table A5.1 Profit shifting: profit to number of employees

	(1) No country fixed-effects	(2) Country fixed-effects	(3) Country×year fixed-effects
Dependent variable	Pretax profit / Employment		
Year fixed-effects	yes	yes	yes
Industry fixed-effects	yes	yes	yes
Country fixed-effects	no	yes	yes
Country×year fixed-effects	no	no	yes
Difference to average statutory tax rate in the group	**-0.0975*** **	**-0.0599*** **	**-0.0483*** **
	[0.0092]	[0.0082]	[0.0076]
Log(Total assets)	0.0133***	0.0131***	0.0132***
	[0.0003]	[0.0004]	[0.0004]
Dummy for group headquarters	0.0031**	0.0030**	0.0032**
	[0.0014]	[0.0014]	[0.0014]
Dummy for other parent entities	-0.0059***	-0.0047***	-0.0047***
	[0.0013]	[0.0011]	[0.0011]
Patenting group dummy	0.0084***	0.0125***	0.0127***
	[0.0016]	[0.0015]	[0.0015]
GDP growth rate	0.0027***	0.0018***	
	[0.0004]	[0.0003]	
Exchange rate (USD per local currency unit)	-0.0422***	-0.0431***	
	[0.0110]	[0.0072]	
Inflation	-0.1593***	-0.0639***	
	[0.0268]	[0.0241]	
Log(GDP per capita)	0.0378***		
	[0.0024]		
Observations	696,206	696,206	696,206
R-squared	0.105	0.110	0.113
AdjR2	0.105	0.110	0.112

All regressions are ordinary least squares (OLS). *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level. Robust standard errors corrected for clustering at the country-year level are presented under brackets. The sample consists of entities in multinational groups (unconsolidated financial accounts) in 46 countries over 2000-10 (see Appendices 3 and 4 for details).

Note: to obtain coefficients directly comparable with the baseline regression, the ratio of profit to the number of employees has been rescaled by a constant factor, so that its average is equal to the average profit to total assets ratio.

Table A5.2 Profit shifting: robustness checks

	(1) Baseline	(2) Only manufact. firms	(3) Only EU countries	(4) 90% ownership threshold
Dependent variable	Pretax profit / Total assets			
Year fixed-effects	yes	yes	yes	yes
Industry fixed-effects	yes	yes	yes	yes
Diff. to avg. statutory tax rate in the group	**-0.0690*** **	**-0.0642*** **	**-0.0761*** **	**-0.0704*** **
	[0.0191]	[0.0223]	[0.0213]	[0.0181]
Log(Total assets)	0.0029***	0.0046***	0.0026***	0.0027***
	[0.0005]	[0.0005]	[0.0006]	[0.0005]
Dummy for group headquarters	-0.0087***	-0.0132***	-0.0056***	-0.0113***
	[0.0020]	[0.0016]	[0.0021]	[0.0017]
Dummy for other parent entities	-0.0032***	-0.0009	-0.0013	-0.0039***
	[0.0011]	[0.0011]	[0.0012]	[0.0011]
Patenting group dummy	0.0063***	0.0056***	0.0117***	0.0090***
	[0.0019]	[0.0018]	[0.0017]	[0.0017]
GDP growth rate	0.0029***	0.0031***	0.0037***	0.0026***
	[0.0008]	[0.0009]	[0.0008]	[0.0008]
Exchange rate (USD per local currency unit)	-0.0196*	-0.0266**	-0.0197	-0.0185
	[0.0118]	[0.0111]	[0.0134]	[0.0126]
Inflation	0.0554*	0.0534	-0.1274	0.0460
	[0.0325]	[0.0392]	[0.0792]	[0.0336]
Log(GDP per capita)	0.0185***	0.0203***	0.0245***	0.0193***
	[0.0045]	[0.0039]	[0.0061]	[0.0043]
Observations	1,210,651	282,849	972,960	895,431
R-squared	0.015	0.017	0.017	0.015
AdjR2	0.015	0.017	0.017	0.015

All regressions are ordinary least squares (OLS). *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level. Robust standard errors corrected for clustering at the country-year level are presented under brackets. The sample consists of entities in multinational groups (unconsolidated financial accounts) in 46 countries over 2000-10 (see Appendices 3 and 4 for details).

Table A5.3 Profit shifting: operating profit to total assets

	(1) No country fixed-effects	(2) Country fixed-effects	(3) Country×year fixed-effects
Dependent variable	Operating profit (EBIT) / Total assets		
Year fixed-effects	yes	yes	yes
Industry fixed-effects	yes	yes	yes
Country fixed-effects	no	yes	yes
Country×year fixed-effects	no	no	yes
Difference to average statutory tax rate in the group	**-0.0522*** **	**-0.0426*** **	**-0.0504*** **
	[0.0173]	[0.0126]	[0.0096]
Log(Total assets)	0.0043***	0.0053***	0.0052***
	[0.0005]	[0.0005]	[0.0005]
Dummy for group headquarters	-0.0181***	-0.0226***	-0.0226***
	[0.0017]	[0.0019]	[0.0019]
Dummy for other parent entities	-0.0107***	-0.0139***	-0.0138***
	[0.0008]	[0.0008]	[0.0008]
Patenting group dummy	0.0010	-0.0008	-0.0004
	[0.0018]	[0.0018]	[0.0017]
GDP growth rate	0.0024***	0.0022***	
	[0.0008]	[0.0004]	
Exchange rate (USD per local currency unit)	-0.0131	-0.0187*	
	[0.0156]	[0.0097]	
Inflation	0.0909***	-0.0434	
	[0.0282]	[0.0372]	
Log(GDP per capita)	0.0112**		
	[0.0045]		
Observations	1,154,946	1,154,946	1,154,946
R-squared	0.018	0.026	0.028
AdjR2	0.018	0.026	0.028

All regressions are ordinary least squares (OLS). *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level. Robust standard errors corrected for clustering at the country-year level are presented under brackets. The sample consists of entities in multinational groups (unconsolidated financial accounts) in 46 countries over 2000-10 (see Appendices 3 and 4 for details). To obtain coefficients directly comparable with the baseline regression, the ratio of operating profit to total assets has been rescaled by a constant factor, so that its average is equal to the average ratio of total profit to total assets.

Table A5.4 Profit shifting: refinements

	(1) Baseline	(2) Patenting firms	(3) MNE groups present in at least 5 countries	(4) Isolating links to no-tax countries	(5) Only firms with positive result in the year considered	(6) Only firms with no reported losses in the sample
Dependent variable	Pretax profit / Total assets					
Year fixed-effects	yes	yes	yes	yes	yes	yes
Industry fixed-effects	yes	yes	yes	yes	yes	yes
Diff. to avg. statutory tax rate in the group (base effect)	-0.0690*** [0.0191]	-0.0673*** [0.0192]	-0.0389** [0.0189]		-0.1000*** [0.0164]	-0.1051*** [0.0195]
Diff. to avg. statutory tax rate in the group × Patenting firm dummy		-0.0525* [0.0292]				
Diff. to avg. statutory tax rate in the group × "At least 5 countries" dummy			-0.0747*** [0.0150]			
Diff. to avg. statutory tax rate in the group, excluding no-tax countries				-0.0606*** [0.0205]		
Link to no-tax country dummy × Tax rate differential with no tax country				-0.0082** [0.0036]		
Log(Total assets)	0.0029*** [0.0005]	0.0029*** [0.0005]	0.0029*** [0.0005]	0.0029*** [0.0005]	-0.0067*** [0.0006]	-0.0068*** [0.0008]
Dummy for group headquarters	-0.0087*** [0.0020]	-0.0087*** [0.0020]	-0.0051*** [0.0019]	-0.0088*** [0.0019]	-0.0146*** [0.0025]	-0.0191*** [0.0028]
Dummy for other parent entities	-0.0032*** [0.0011]	-0.0032*** [0.0011]	-0.0024** [0.0010]	-0.0033*** [0.0011]	-0.0037** [0.0016]	-0.0067*** [0.0020]
Patenting group dummy	0.0063*** [0.0019]	0.0078*** [0.0018]	0.0052*** [0.0018]	0.0063*** [0.0019]	0.0106*** [0.0020]	0.0084*** [0.0026]
GDP growth rate	0.0029*** [0.0008]	0.0029*** [0.0008]	0.0028*** [0.0009]	0.0029*** [0.0008]	0.0020*** [0.0005]	0.0020*** [0.0006]
Exchange rate (USD per local currency unit)	-0.0196* [0.0118]	-0.0196* [0.0118]	-0.0194 [0.0120]	-0.0198* [0.0118]	-0.0137 [0.0126]	-0.0188 [0.0166]
Inflation	0.0554* [0.0325]	0.0552* [0.0324]	0.0637* [0.0325]	0.0552* [0.0323]	-0.0390 [0.0363]	-0.0619 [0.0461]
Log(GDP per capita)	0.0185*** [0.0045]	0.0185*** [0.0045]	0.0180*** [0.0045]	0.0185*** [0.0045]	0.0088*** [0.0027]	0.0083** [0.0032]
Observations	1,210,651	1,210,651	1,210,651	1,210,651	940,611	574,574
R-squared	0.015	0.015	0.016	0.015	0.051	0.058
AdjR2	0.015	0.015	0.016	0.015	0.051	0.058

All regressions are ordinary least squares (OLS). *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level. Robust standard errors corrected for clustering at the country-year level are presented under brackets. The sample consists of entities in multinational groups (unconsolidated financial accounts) in 46 countries over 2000-10 (see Appendices 3 and 4 for details).

APPENDIX 6: MISMATCHES BETWEEN TAX SYSTEMS: VARIANT REGRESSION RESULTS

Table A6.1 Mismatches between tax systems: robustness checks

	(1) Baseline	(2) Controlling for profitability	(3) Only manufact. firms	(4) Only EU countries	(5) 90% ownership threshold	(6) Tax expense over operating profit
Dependent variable	ETR (tax expense over reported profit)					
Year fixed-effects	yes	yes	yes	yes	yes	yes
Industry fixed-effects	yes	yes	yes	yes	yes	yes
Country fixed-effects	yes	yes	yes	yes	yes	no
Country*year fixed-effects	yes	yes	yes	yes	yes	no
Dummy for group headquarters	-0.0151***	-0.0170***	-0.0068**	-0.0075***	-0.0087***	-0.0237***
	[0.0031]	[0.0031]	[0.0029]	[0.0023]	[0.0030]	[0.0042]
Dummy for other parent entities	0.0020	0.0008	0.0008	-0.0041***	0.0008	0.0016
	[0.0014]	[0.0014]	[0.0010]	[0.0010]	[0.0017]	[0.0014]
Patenting group dummy	-0.0106***	-0.0099***	-0.0050	-0.0180***	-0.0150***	0.0106***
	[0.0037]	[0.0037]	[0.0035]	[0.0023]	[0.0036]	[0.0037]
Pre-tax profit to total assets		-0.0777***				
		[0.0121]				
Large firm (over 250 empl.)	0.0340***	0.0331***	0.0294***	0.0059***	0.0371***	0.0420***
	[0.0040]	[0.0041]	[0.0043]	[0.0021]	[0.0043]	[0.0068]
MNE dummy:						
Among SMEs (<250 empl.)	0.0020	0.0026	-0.0023	-0.0061**	-0.0005	0.0138***
	[0.0027]	[0.0026]	[0.0025]	[0.0028]	[0.0028]	[0.0024]
Among large firms (250+ empl.)	-0.0325***	-0.0322***	-0.0321***	-0.0216***	-0.0433***	-0.0256***
	[0.0026]	[0.0026]	[0.0030]	[0.0029]	[0.0039]	[0.0044]
Observations	2,046,838	2,045,457	539,386	1,197,271	1,618,192	1,975,503
R-squared	0.187	0.188	0.241	0.249	0.160	0.105
AdjR2	0.186	0.188	0.241	0.248	0.160	0.104

All regressions are ordinary least squares (OLS). *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level. Robust standard errors corrected for clustering at the country-year level are presented under brackets. The sample consists of entities in both multinational and non-multinational groups (unconsolidated financial accounts) in 46 countries over 2000-10. Micro-firms (less than 10 employees), loss-making firms and standalone firms (i.e. firms that are not part of a corporate group) are excluded (see Appendices 3 and 4 for details).

Table A6.2 Mismatches between tax systems: refinements

	(1) Baseline	(2) Patenting firms	(3) MNE groups present in at least 5 countries	(4) Only firms with no reported losses in the sample	(5) Effectiveness of anti-avoidance rules
Dependent variable	ETR (tax expense over reported profit)				
Year fixed-effects	yes	yes	yes	yes	yes
Industry fixed-effects	yes	yes	yes	yes	yes
Country fixed-effects	yes	yes	yes	yes	yes
Country*year fixed-effects	yes	yes	yes	yes	yes
Dummy for group headquarters	-0.0151*** [0.0031]	-0.0151*** [0.0031]	-0.0154*** [0.0031]	-0.0177*** [0.0028]	-0.0151*** [0.0030]
Dummy for other parent entities	0.0020 [0.0014]	0.0020 [0.0014]	0.0021 [0.0014]	-0.0010 [0.0016]	0.0020 [0.0014]
Patenting group dummy	-0.0106*** [0.0037]	-0.0079** [0.0032]	-0.0097*** [0.0037]	-0.0134*** [0.0029]	-0.0109*** [0.0031]
Large firm (over 250 employees)	0.0340*** [0.0040]	0.0340*** [0.0040]	0.0341*** [0.0040]	0.0273*** [0.0033]	0.0340*** [0.0040]
MNE dummy:					
Among SMEs (<250 employees)	0.0020 [0.0027]	0.0019 [0.0027]	0.0019 [0.0026]	0.0053** [0.0025]	0.0020 [0.0027]
Among large firms (over 250 employees)	-0.0325*** [0.0026]	-0.0320*** [0.0027]	-0.0253*** [0.0022]	-0.0291*** [0.0022]	-0.0362*** [0.0104]
Large MNE dummy × Patenting group dummy		-0.0061** [0.0029]			
Large MNE dummy × "at least 5 countries" dummy			-0.0122*** [0.0019]		
Large MNE dummy × Anti-avoidance strength					0.0011 [0.0028]
Observations	2,046,838	2,046,838	2,046,838	1,336,604	2,046,838
R-squared	0.187	0.187	0.187	0.203	0.187
AdjR2	0.186	0.186	0.186	0.203	0.186

All regressions are ordinary least squares (OLS). *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level. Robust standard errors corrected for clustering at the country-year level are presented under brackets. The sample consists of entities in both multinational and non-multinational groups (unconsolidated financial accounts) in 46 countries over 2000-10. Micro-firms (less than 10 employees), loss-making firms and standalone firms (i.e. firms that are not part of a corporate group) are excluded (see Appendices 3 and 4 for details).