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Empirical evidence on the global minimum tax: what is a critical mass and how large is the substance-based income exclusion?

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Abstract
This paper presents empirical evidence on the proposed global minimum tax (GMT) of the OECD's Pillar 2. First, it addresses how many, and which, countries or country groups can be seen as constituting a 'critical mass' for its successful implementation; given such a critical mass, remaining jurisdictions worldwide will have an incentive to implement the GMT as well. Second, it assesses the generosity of the substance-based income exclusion (SBIE), which is informative for the revenue collected under the GMT.

KEYWORDS
multinational firms, minimum tax, substance-based income exclusion

JEL CLASSIFICATION
F23, H25, H26

1 | INTRODUCTION

In a landmark deal in October 2021, almost 140 countries of the G20/OECD Inclusive Framework agreed to a two-pillar proposal for the fundamental reform of the international tax system.[1] Pillar 1 seeks to reallocate taxing rights for part of the profit of large multinational enterprises (MNEs) towards the market country. Pillar 2 introduces a global minimum tax (GMT) on corporate profit.

This paper aims to shed light on two important aspects of the GMT. The first concerns the incentive of countries to implement the GMT. This depends on some key features of the proposal and, in particular, the different ways in which the top-up tax can be collected by different countries in which an MNE operates. It also depends on the extent to which MNEs have operations in countries that do introduce the GMT. Our results suggest that most in-scope MNEs operate in several large, developed countries. Given the detailed proposals of how the GMT would operate, this implies that a coordinated

[1] OECD/G20, 2021a.

implementation of the GMT in a critical mass of even three or four such countries would create a significant incentive for other such countries to follow suit in implementing the GMT. That, in turn, would create an incentive for most other countries also to implement the GMT. In particular, the recent commitment by the EU27 to introduce the GMT creates a significant incentive for other countries to follow.[2]

The second aspect concerns the revenue from the top-up tax that would be collected under the GMT. The GMT proposes to implement a top-up tax equal to a top-up rate multiplied by 'excess profit', defined broadly as financial profit less a 'substance-based income exclusion' (SBIE). The SBIE is in turn defined as a proportion of the value of tangible assets and payroll costs. A key factor in the size of the revenue collected is therefore the size of the SBIE relative to financial profit. The SBIE is also important in affecting the likelihood of competition between countries in the presence of the GMT. That is, profit from real activities, as opposed to profit shifted into a country, may generate a relatively large SBIE. In such cases, the top-up tax could be relatively small, and countries may therefore seek to continue to compete to attract such real activities.

Our findings suggest that a GMT implemented in Europe would result in total taxation of around 9 per cent of financial profit of in-scope MNEs in the short run and around 12 per cent in the longer run. We also document that behavioural responses by in-scope MNEs have the potential to substantially increase the share of profit covered by the SBIE.

The remainder of this article proceeds as follows. In Section 2, we present methodology, data and results for determining the critical mass of countries. In Section 3, we present methodology, data and results for share of profit covered by the SBIE. Section 4 briefly concludes.

2 | CRITICAL MASS OF COUNTRIES

In this section, we address the question of what would constitute a critical mass of countries to implement the GMT. This depends on two factors: the design of the GMT and the extent to which MNEs are active in a small number of key countries. Note that the countries that signed the agreement have not so far committed to introduce it but only to accept the application of the rules by other countries.[3]

2.1 | Conceptual framework

The GMT allows for the possibility that three types of country might implement the top-up tax. To approach this, let us consider a hypothetical MNE with a parent company and headquarters in a high-tax country A, real activities in other high-tax countries, B and C, and also a subsidiary in a low-tax country, D. Let us assume that the subsidiary in D faces an effective tax rate in D of less than 15 per cent. This triggers a top-up tax of a percentage of 'excess profit', as defined in the Pillar 2 Model Rules.[4]

A key question for the incentive to implement the GMT is which countries might collect this top-up tax. There is a clear rule order. First, country D may introduce a qualified domestic minimum top-up tax (QDMTT) equal to the top-up charge. If it does so, then no other countries levy any further tax.[5] If country D does not levy a QDMTT, then country A may levy the top-up tax through an Income

[2] European Council, 2022.

[3] OECD/G20, 2021a.

[4] OECD/G20, 2021b.

[5] An exception may arise if country A imposes a controlled foreign corporation (CFC) tax on active income arising in country D, such as the US GILTI provision. The OECD has recently announced (OECD/G20, 2023) that such a tax would not affect the right of country D to introduce the QDMTT. However, country A may levy a CFC tax in addition to taxes levied in country D.

Inclusion Rule (IIR). If country A does not do so, then countries B and C may collect the top-up tax through an Undertaxed Payments Rule (UTPR). In practice, the UTPR would operate by denying deductions for costs incurred by the MNE in those countries, and there are rules as to how the revenue would be shared between B and C.

To understand the incentives created by this structure, let us start with country A.[6] In the absence of any GMT, country A would be unlikely to unilaterally implement a tax along the lines of the IIR. Doing so would create a disincentive for MNEs to locate their parent companies in A. Those MNEs that nevertheless did so may face a competitive disadvantage compared with MNEs with parents located elsewhere and which were not subject to the IIR. The US is the only country with a tax akin to the IIR (the GILTI),[7] which reflects the size and market power of the US.

How would country A's incentives be changed if other countries adopted an IIR, but no countries adopted a UTPR or QDMTT? In this case, there would be no competitive disadvantage to implementing an IIR. However, there would be a competitive advantage from *not* implementing an IIR, since A would become a relatively attractive location for parent companies.

The existence of the UTPR may remove this potential competitive advantage, however. In our example, if countries B and C implemented a UTPR, then – at least with respect to our hypothetical MNE – there would be no competitive advantage for A in *not* implementing an IIR. That is because the top-up tax would simply be collected by countries B and C instead. By *not* having an IIR, country A would be giving up tax revenue without creating any incentives for MNEs to locate their parent companies there.

The UTPR therefore plays a crucial role in creating an incentive for countries hosting parent companies to implement an IIR. But how crucial the role is depends on the structure of MNEs and on whether other countries implement a UTPR. If most MNEs with parents in A are also present in B and C, and each has a UTPR, then there is a strong incentive for A to implement an IIR. If the MNEs are not present in B and C, then that incentive is much weaker. The empirical analysis below therefore focuses on this issue: 'To what extent are MNEs with parents in large and developed countries also present in other large and developed countries?'.

Note in passing that if all countries implemented an IIR, then no revenue would be raised from a UTPR. The value to, say, country B of implementing a UTPR is to provide an incentive for other countries – notably A – to introduce an IIR, and thereby make it feasible for B also to have an IIR.

Finally, if A, B and C had all introduced an IIR and a UTPR, then there is a clear incentive for D to introduce a QDMTT. Again, if D did *not* introduce a QDMTT, then it would be giving up potential tax revenue, without any effect on incentives for MNEs to shift either real activity, or mobile profit, to D.

In sum, if a critical mass of large and developed countries each introduces an IIR and a UTPR, then that would create an incentive for other countries to follow suit. But it is an empirical question as to what would constitute such a critical mass. We now turn to that question.

2.2 | Data, methodology and results

To study the critical mass of the GMT, we analyse parent and subsidiary location data of in-scope MNEs. In the Orbis database (provided by Bureau van Dijk), we observe in 2018 11,334 firm groups that have consolidated revenues above the GMT revenue threshold of €750 million. These firms have aggregate turnover of €65 trillion and aggregate pre-tax profit of €5 trillion. For 5,878 of the firm groups, we have subsidiary location data. These firms have aggregate turnover of €35 trillion and aggregate pre-tax profit of €3.0 trillion.

[6] These issues are developed further in Devereux (2023).

[7] Although, as noted above, it appears that GILTI will not be explicitly treated as an IIR.

Most of the firms for which we have subsidiary location data are MNE groups. In total we observe 4,842 MNEs. These have aggregate revenues of €32 trillion and pre-tax profit of €2.8 trillion. By comparison, the OECD (2020) identified a total number of MNEs in 2016 (including those not subject to the GMT) of almost 28,000 with aggregated revenues of $51.5 trillion (€46.8 trillion) and pre-tax profit of $4.1 trillion (€3.7 trillion).

In Table 1, we focus on G7 countries. The first column reports the total pre-tax profit of MNEs with a headquarters in each of the countries listed; for example, in 2018, the total worldwide profit of in-scope US-headquartered MNEs in our sample is €949 billion. Of course, only a fraction of this profit might be subject to the GMT. The second column reports the percentage of this total profit that can be attributed to MNEs that have no subsidiary in any of the other G7 countries. Again for example, only 4 per cent of the total profit of in-scope US MNEs is earned by those MNEs that do not have any presence in other G7 countries. The next seven columns examine what percentage of the total profit is attributable to MNEs that have a subsidiary in each other G7 country. For example, 91 per cent of the total profit of in-scope US MNEs is attributable to those MNEs that have a subsidiary in Canada.

As already noted, the total profit figures in the first column do not represent profit that might be subject to the GMT. Nevertheless, the table is instructive. The second column indicates that (with the possible exception of Italy-headquartered MNEs) almost all the profit of in-scope MNEs headquartered in G7 countries is attributable to those MNEs with subsidiaries in at least one other G7 country. Further, taking account of the profit attributable to MNEs headquartered in each country, most of the profit of MNEs headquartered in the G7 is attributable to MNEs that have operations in many G7 countries.

This has important implications for the use of the UTPR, and hence the IIR, in these countries. Suppose that a G7 country – say the UK – decided not to implement an IIR, but that the other G7 countries all implemented a UTPR. Then (in the absence of a QDMTT in the source country) it seems very likely that the vast majority of profit that would otherwise be subject to a UK IIR would instead be subject to a UTPR in the other G7 countries. Indeed, even if the US were the only country to implement a UTPR, the same would be true.

Table 1 therefore provides strong evidence that an agreement between G7 countries – or even a subset of G7 countries – to introduce a UTPR would constitute a powerful incentive for those countries to also introduce an IIR.

TABLE 1 Total profit of MNCs by G7 headquarters and subsidiary country

HQ country	Total profit before tax (€ billion)	Percentage of profit of MNEs in HQ country without subsidiaries in any other G7 country	Percentage of profit of MNEs in HQ country with subsidiaries in each other G7 country						
			US	Canada	Japan	Germany	France	UK	Italy
US	949	4		91	65	73	77	86	74
Canada	50	1	98		13	34	30	46	22
Japan	366	5	94	62		71	72	80	59
Germany	116	4	89	80	71		94	90	87
France	97	1	93	85	76	96		94	95
UK	223	3	94	88	73	84	85		70
Italy	43	11	76	57	27	75	75	82	

Note: The table shows the total profit before tax and percentage profit of MNEs with a subsidiary in each other G7 country by G7 headquarters country.
Source: Authors' calculation based on Orbis database 2018, provided by Bureau van Dijk.

TABLE 2 Share of profit of MNCs in top 10 headquarters jurisdictions with subsidiaries in at least *n* of the EU27 countries

Top 10 HQ jurisdiction (excluding EU27)	Total profit before tax (€ billion)	Percentage of profit of MNEs in HQ jurisdiction with subsidiaries in at least *n* of the EU27 countries				
		$n = 1$	$n = 2$	$n = 3$	$n = 4$	$n = 5$
US	949	89	84	81	78	75
Japan	366	84	76	71	69	64
UK	223	99	97	94	87	86
China	137	33	16	14	11	10
South Korea	102	93	79	78	77	75
Australia	71	70	37	33	10	7
Taiwan	62	50	44	18	15	15
Switzerland	59	98	95	95	95	95
Cayman Islands	58	81	72	71	71	68
Hong Kong	57	17	12	11	4	4
Total (not just top 10)	2,835	84	77	73	69	66

Note: The table shows total profit before tax of MNEs and the percentage of profit of MNEs with subsidiaries in at least one, two, three, four or five of the EU27 countries by headquarters jurisdiction for the top 10 headquarters jurisdictions, excluding the EU27 countries.
Source: Authors' calculation based on Orbis database 2018, provided by Bureau van Dijk.

To investigate this further, we assess whether the EU27 – which recently reached an agreement to introduce the GMT[8] – would represent a critical mass for the implementation of the GMT worldwide. Table 2 reports the share of profit for the top 10 jurisdictions for MNE headquarters (excluding the EU27 countries) with operations in at least one, two, three, four and five of the EU27 countries.

The bottom row of Table 2 indicates that of all in-scope MNEs, 77 per cent of their aggregate profit is attributable to MNEs that have subsidiaries in at least two EU27 countries. Assuming that all EU27 countries successfully implement a UTPR, this suggests that between them they would constitute a powerful incentive for other countries to introduce an IIR.

That incentive does vary across jurisdictions, however. The percentage is very high in G7 countries, but considerably lower in other jurisdictions. The EU27 countries would arguably create a critical mass for the US, Japan, the UK and Switzerland but possibly not for important Asian and Australasian jurisdictions – for example, the percentage is only 16 per cent in China, 37 per cent in Australia and 44 per cent in Taiwan. However, if some other countries – notably the US, Japan and the UK – also followed suit by implementing a UTPR, then the incentive to introduce an IIR would be stronger also for those jurisdictions. Our calculations do not, however, suggest that the change to the incentive would be very strong: even if the US, Japan and the UK in addition to the EU27 European countries implemented the GMT, only 39 per cent (22 per cent) of the profit of MNEs headquartered in China would belong to those MNEs that have a subsidiary in at least two (three) of these countries.

More broadly, given the importance of Europe and the US as homes of MNE headquarters, if the EU27 countries created a strong incentive for the US, Japan and the UK to also introduce an IIR, then there would also be a strong incentive for low-tax countries to introduce a QDMTT. In short, the EU27 countries alone may well represent a critical mass that would induce a much broader implementation of the elements of the GMT proposal.

[8] See European Council (2022).

2.3 | Summary

In this section, we have discussed the incentives from the perspective of individual countries to introduce the various elements of the GMT: the QDMTT, IIR and UTPR. A key issue is whether the UTPR will be implemented successfully in a small number of key countries. If it is, then that creates a strong incentive for other headquarters countries to implement an IIR, and in turn for low-tax countries to introduce a QDMTT.

The evidence presented indicates that the vast majority of the profit of in-scope MNEs is attributable to MNEs that have a presence in G7 countries. That suggests that the G7 – or probably a subset of the G7 – could represent a critical mass sufficient for the GMT to be implemented much more broadly. Indeed, the EU27 countries, which have recently reached an agreement to implement the GMT, would very probably constitute a critical mass as well.

3 | SUBSTANCE-BASED INCOME EXCLUSION

In this part of the paper, we turn to analysing the generosity of the substance-based income exclusion. The SBIE is a formulaic carve-out. Initially it will be set to the sum of 10 per cent of payroll and 8 per cent of tangible assets (an average of the beginning and the end of the financial year). The percentages will decline gradually until the tenth year, after which they will be 5 per cent of both payroll and tangible assets.

The size of the SBIE plays an important role for the GMT. The SBIE is deducted from total global anti-base erosion (GloBE) income – adjusted financial accounting profit – to derive the measure of 'excess profit'. This is the base for any top-up tax levied, whether it is applied in the form of a QDMTT, an IIR or a UTPR. A higher SBIE therefore reduces the top-up tax, and hence the overall effective tax rate ultimately levied. As Devereux, Vella and Wardell-Burrus (2022) point out, the GMT puts a minimum floor on total tax paid of 15 per cent of excess profit (at least in the absence of qualified refundable tax credits).

3.1 | Data and methodology

We assess the size of the SBIE using unconsolidated financial statements of foreign-owned EU subsidiaries of MNEs. We use data from the Amadeus database, collected by Bureau van Dijk. We use data for 2019 on sales, pre-tax profit, wage costs, tangible assets and depreciation provisions. We use 2019 data to remove the impact of COVID-19 on corporate profit. Dropping foreign-owned firms with no data on depreciation provisions leaves us without any firms in Cyprus, Greece and Lithuania.

Our main measure of interest is the share of pre-tax profit covered by the SBIE. We therefore exclude firms with non-positive profit. We also consider other measures of expected profit, based on a return to equity, and we therefore also exclude firms with non-positive equity. Some elements of profit may be non-taxable – for example, dividends received. In our base case, we address this issue by removing firms with a ratio of pre-tax profit to sales in the top 5 per cent of the distribution (a ratio of around 34 per cent). We report the robustness of our results to this below.

The GMT applies only to firms belonging to an MNE with aggregate revenue above €750 million. However, we do not observe complete ownership structures, nor aggregate revenue for the consolidated MNE. We therefore apply our analysis to all foreign-owned firms in the EU27 and the UK. Our sample consists of 43,564 firms. We test the robustness of this approach by also using only data on MNEs on which we have the necessary data to identify them as being in-scope for the GMT.

Table A1 in the online appendix compares the aggregate turnover of the EU firms in the raw data and our sample with country-level macroeconomic data from Eurostat. The sample coverage is good for most countries, and the sample restrictions have only a modest impact on the coverage. However, since coverage is less than 5 per cent for Latvia and the Netherlands, we exclude these countries from the analysis. Thus, our analysis is based on foreign-owned firms in 22 EU countries plus the UK.

3.2 | The size of the SBIE relative to pre-tax profit

Figure 1 shows the distribution and cumulative distribution of the ratio of SBIE to pre-tax profit for our sample. As described above, we use data from 2019, and apply the rules of the proposed GMT. We do not account for any behavioural change in response to the introduction of the GMT.

The figure indicates significant heterogeneity among firms. The SBIE (based on the initial proportions of payroll and tangible assets) is below pre-tax profit for around 70 per cent of firms; for the remaining 30 per cent, the SBIE exceeds pre-tax profit, sometimes by a wide margin.

Since unused SBIE cannot be carried forward, in our base case summary statistics in Table 3 we cap the ratio of SBIE to pre-tax profit for each firm to 1, meaning the SBIE cannot exceed pre-tax profit. Based on this adjustment, we calculate that in the first year that the GMT applies, the average ratio of SBIE to pre-tax profit is 57 per cent and the median ratio is 52 per cent. These shares fall to 41 per cent and 28 per cent respectively after 10 years due to the reduction in the percentages for the calculation of the SBIE. Based on an average ratio of SBIE to pre-tax profit of 57 per cent, excess profit is on average approximately 43 per cent of GloBE income, implying a minimum tax of 6.45 per cent of GloBE income. This rises to 8.85 per cent after 10 years.

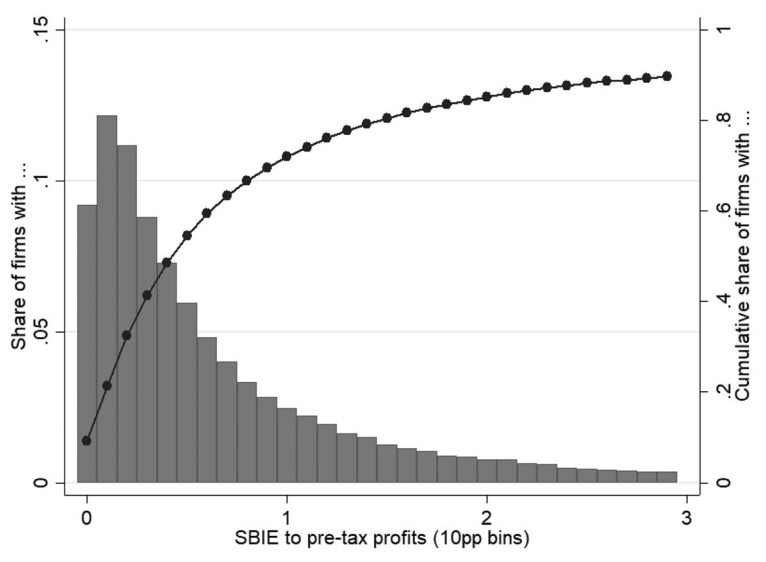

FIGURE 1 Distribution and cumulative distribution of SBIE to pre-tax profit (first year)

Note: The figure shows the distribution and cumulative distribution of firms by the ratio of SBIE to pre-tax profit (using 10-percentage-point bins). Firms with a ratio of SBIE to pre-tax profit in the top 10 per cent of the distribution are not shown.
Source: Authors' calculations based on Amadeus database, provided by Bureau van Dijk.

TABLE 3 Ratio of SBIE to pre-tax profit

	First year	After 10 years
% of pre-tax profit shielded by SBIE		
Average firm	57	41
Median firm	52	28
% of total pre-tax profit shielded by SBIE	37	23

Note: The table shows the share of pre-tax profit covered by the SBIE for the average and the median firm, and the share of total pre-tax profit covered by the SBIE. Results are reported for the first year the GMT applies and after 10 years.
Source: Authors' calculation based on Amadeus database, provided by Bureau van Dijk.

Table 3 also shows the ratio of total SBIE relative to total pre-tax profit. The share of *total* pre-tax profit shielded is 37 per cent in the first year and 23 per cent after 10 years.[9] Given that this ratio is below the share of profit covered by the SBIE for the average (and median) firms, this implies that firms with higher absolute profit have a higher ratio of profit to SBIE. In other words, the share of profit covered by the SBIE tends to fall with the absolute amount of profit. The minimum total tax on aggregated profit of all the firms included in our sample is 9.45 per cent in the first year and 11.55 per cent after 10 years.

3.2.1 | Sensitivity analysis

We report two forms of sensitivity analysis.

First, the ratios reported in Table 3 are based on all foreign-owned firms in our sample, for the reasons set out above. When we instead use only a subsample of foreign-owned firms for which aggregate revenue data are available, and which we determine to be in-scope for the GMT, we calculate an average ratio of SBIE to pre-tax profit of 56 per cent – almost identical to our base case.[10] This falls to 38 per cent after 10 years.

Second, we also repeat this exercise dropping only the top 1 per cent of firms in the distribution of the ratio of pre-tax profit to sales, instead of the top 5 per cent. This has little impact on the average or median ratio. However, in this case, the share of total profit shielded by the SBIE is lower: it is initially 28 per cent, and falls to 18 per cent after 10 years, substantially below the results reported in Table 3.[11] This reduction in the total ratio is somewhat stronger in countries with a low statutory tax rate, and in Ireland and Luxembourg.

3.2.2 | Results by country

Given that our sample includes both low-tax and high-tax jurisdictions, the sample average may hide important heterogeneity across countries. We therefore also report results by country. In Figure 2, for each country we plot the share of total profit shielded by the SBIE against the statutory corporate income tax rate (this is for the first year; Figure A1 in the online appendix shows the position after 10 years).

[9] These results are comparable to those of Barake et al. (2021) who use country-level data to assess the impact of the substance-based carve-out on tax revenue collected under the GMT.

[10] The average ratio for out-of-scope firms is also 56 per cent initially and 39 per cent after 10 years. We find similar results for subsidiaries of domestic MNEs.

[11] Not dropping any firms in the distribution of the ratio of pre-tax profit to sales reduces the share of total profit shielded to 26 per cent in the first year the GMT applies and to 17 per cent after 10 years.

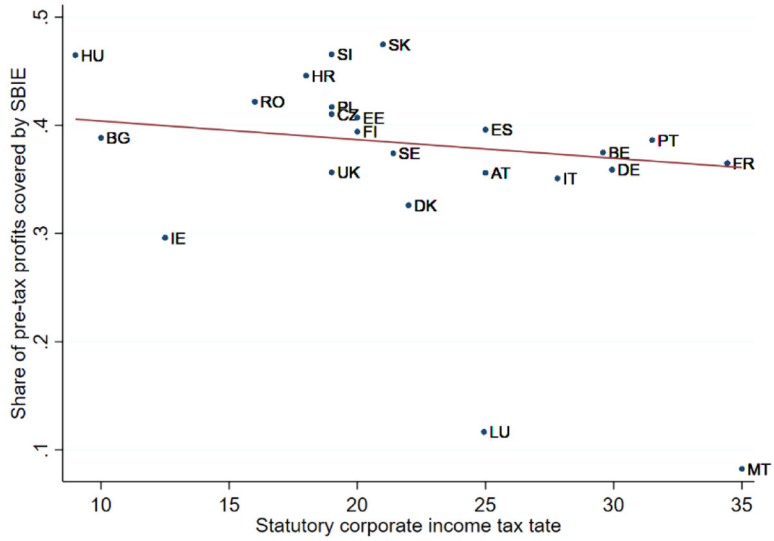

FIGURE 2 Share of pre-tax profit covered by SBIE by country (first year)

Note: The figure plots for each country the share of total pre-tax profit covered by the SBIE in the first year the GMT applies against the statutory corporate tax rate.
Source: Authors' calculation based on Amadeus database, provided by Bureau van Dijk.

Two results emerge. First, the share of total profit covered by the SBIE declines with the statutory tax rate, albeit only to a small degree. Second, Luxembourg, Malta and, to some extent, Ireland are different; their share of total profit covered by the SBIE is substantially lower than those for the other EU countries. Given that these three countries are known for offering favourable tax conditions to MNEs, these results are in line with the hypothesis that MNEs book higher profit in low-tax jurisdictions and that statutory tax rates are only a weak predictor of the tax burden on company profit.

3.2.3 | Ownership of assets

We now return to an issue raised above – that some firms may have unused SBIE since their SBIE exceeds their pre-tax profit. This creates an incentive for firms with unused SBIE to mix with in-scope firms with SBIE that is insufficient to prevent a top-up charge. In principle, this could be done by exchanging assets (and the associated income stream) or by merging firms. Here we ask: 'How much of the profit of foreign-owned firms that are not covered by the SBIE could be covered by using unused SBIE of other firms?'. In this case, we consider merging firms. For example, a profitable domestic firm could be acquired by an in-scope MNE. The combined profit would then be subject to the GMT, and we examine how far that would reduce the top-up charge of the MNE. In considering other firms, we examine both profitable foreign-owned firms and profitable domestic firms located in the same country.[12] The results for the first year of the GMT are shown in Table 4. The first column indicates the share of aggregate profit of foreign-owned firms not shielded by the SBIE, expressed as a percentage of pre-tax profit of these firms. The next two columns show the unused SBIE of profitable

[12] We focus only on profitable firms here since affected firms are unlikely to acquire unprofitable firms only because they have unused SBIE. We assume firms to be profitable if their return on equity is above 10 per cent. In undertaking this exercise, we are not able to distinguish between in-scope and out-of-scope firms.

TABLE 4 Aggregate unused SBIE by country (first year)

	Aggregate profit of foreign-owned firms *not* shielded as a percentage of aggregate pre-tax profit of foreign-owned firms	Aggregate *unused* SBIE of … as a percentage of aggregate pre-tax profit of foreign-owned firms		
		Profitable foreign-owned firms	Profitable domestic firms	Profitable foreign-owned and domestic firms
Austria	64	4	15	19
Belgium	63	7	7	14
Bulgaria	61	4	3	7
Czech Republic	59	4	2	6
Croatia	55	3	5	8
Denmark	67	6	12	18
Estonia	59	4	12	16
Finland	61	6	22	28
France	64	4	6	10
Germany	64	8	9	17
Hungary	54	6	7	13
Ireland	70	4	6	10
Italy	65	5	14	19
Luxembourg	88	4	1	5
Malta	92	0	0	0
Poland	58	3	3	6
Portugal	61	6	5	11
Romania	58	4	4	8
Slovakia	53	6	2	8
Slovenia	53	5	7	13
Spain	60	7	9	16
Sweden	63	7	14	21
United Kingdom	64	6	9	15

Note: The table shows the ratio of aggregate unused SBIE for profitable foreign-owned firms and for profitable domestic firms to aggregate pre-tax profit of foreign-owned firms by country.
Source: Authors' calculation based on Amadeus database, provided by Bureau van Dijk.

foreign-owned and domestic firms respectively, also expressed as a percentage of the pre-tax profit of foreign-owned firms. The final column combines these two groups of other firms.

We find that the size of unused SBIE of other foreign-owned firms is small relative to the total profit of foreign-owned firms. For example, in aggregate in Austria, 64 per cent of the profit of foreign-owned firms is *not* shielded by the SBIE. But if all of the surplus SBIE of other foreign-owned firms were allocated to those without surplus SBIE, this percentage would only be reduced by 4 percentage points to 60 per cent. The size of the unused SBIE of domestic firms, in contrast, is more important: in the case of Austria, the share of total profit not shielded is reduced by a further 15 percentage points by including the surplus SBIE of purely domestic firms. Across countries, a more efficient use of the SBIE could increase the share of total profit covered by the SBIE by around 15 percentage points or almost 40 per cent. While this would benefit in-scope MNEs, it may well lead to economic inefficiencies by inducing acquisitions purely for tax purposes. These findings should be interpreted

with some caution, since our sample of foreign-owned firms is not restricted to in-scope MNEs, and the coverage of domestic firms varies by country.

3.2.4 | Heterogeneity by sector and source of finance

We now explore heterogeneity in the ratio of the SBIE to pre-tax profit. We analyse two factors that may affect the ratio: the use of intermediate materials and the use of debt finance.

First, we consider variation in the costs of materials. Some firms may produce intermediate materials themselves, using tangible assets and labour, while others buy such intermediate materials. The former group is likely to have a higher ratio of SBIE to pre-tax profit. We explore this variation in Table 5 by considering sector-level differences. The table reports the ratios of average material costs, average wage costs and average tangible assets, all to pre-tax profit. Unlike the ratio of SBIE to pre-tax profit, these ratios are not percentages: for example, a ratio of material costs to pre-tax profit of 40 means that for each £1 of profit there are on average £40 of material costs.

Table 5 indicates that the sectors with the lowest average ratios of SBIE to profit are retail (46 per cent) and finance (49 per cent). The low ratio for retail seems to be driven by the high importance of material inputs, with a very high ratio of material inputs to pre-tax profit. This is not true for finance, where the low ratio seems instead to reflect very high average profitability. The sectors with the highest ratios of SBIE to pre-tax profit are accommodation (78 per cent), transportation and storage (68 per cent) and real estate (68 per cent). These are all industries with a relatively low importance of material costs, and a high relevance of tangible assets (real estate and accommodation) or wages (transportation and storage).

Second, we analyse how the ratio of SBIE to pre-tax profit depends on the use of debt finance. Since pre-tax profit is after interest payments, greater use of debt will tend to reduce pre-tax profit and hence yield a higher ratio of SBIE to pre-tax profit. Figure 3 provides evidence on the relationship between debt financing and the share of profit covered by the SBIE. It shows the median ratio of SBIE

TABLE 5 SBIE to pre-tax profit by industry (first year)

	Average … to pre-tax profit			
	SBIE (%)	**Material costs**	**Wage costs**	**Tangible assets**
Agriculture	64	40	9	36
Mining and quarrying	62	15	11	19
Manufacturing	61	32	10	13
Electricity	54	63	4	22
Utilities	59	19	6	10
Construction	58	22	12	6
Retail	46	63	7	5
Transportation/storage	68	21	16	12
Accommodation	78	10	11	25
Information	62	7	11	4
Financial sector	49	7	9	10
Real estate	68	10	8	47
Professional activities	62	13	14	5
Other	68	12	19	10

Note: The table shows the average ratio of SBIE, material costs, wage costs and tangible assets to pre-tax profit by industry (NACE Rev 2 Codes).
Source: Authors' calculation based on Amadeus database, provided by Bureau van Dijk.

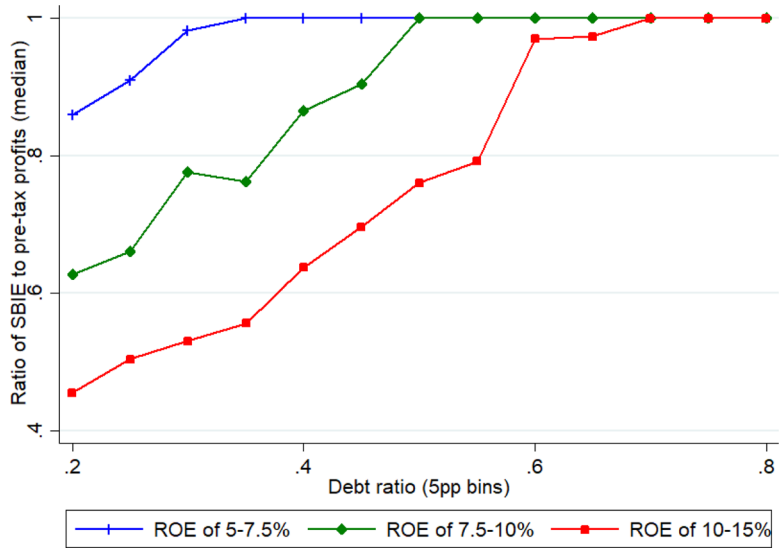

FIGURE 3 SBIE to pre-tax profit by debt ratio (first year)

Note: The figure shows the median ratio of SBIE to pre-tax profit by debt ratio (5-percentage-point bins) for companies with pre-tax profit over equity (ROE) between 5 and 7.5 per cent, between 7.5 and 10 per cent, and between 10 and 15 per cent.
Source: Authors' calculation based on Amadeus database, provided by Bureau van Dijk.

to profit of firms with a particular debt ratio (using 5-percentage-point bins) and a particular rate of return on equity (ROE). As expected, the share of profit covered by the SBIE increases substantially with firms' debt ratio: the ratio is around 60 per cent for a firm with a return on equity of between 10 and 15 per cent and a debt ratio of 40 per cent, and around 70 per cent for an otherwise similar firm that has a debt ratio of 50 per cent. The figure also demonstrates that, for a given debt ratio, the ratio of SBIE to pre-tax profit rises as the ROE falls.

3.3 | Summary

In this section, we have investigated various aspects of the size of the SBIE, measured as a proportion of pre-tax profit – effectively the share of profit shielded by the SBIE. This is important in determining the minimum tax burden on profit, and hence the revenue consequences, of the GMT.

We find that the share of total profit covered by the SBIE is just under 40 per cent in the first year the GMT applies and 23 per cent after 10 years. This implies a minimum tax burden on total profit of 9 per cent and 12 per cent respectively. There is considerable heterogeneity in the share of profit covered by the SBIE. We explored two elements of the heterogeneity, depending on the use of material inputs and the use of debt finance.

We also investigated the scale of unused SBIE in each country, and considered how aggregate SBIE could be used more 'efficiently' by MNEs to reduce their tax burden, if they acquire other firms with unused SBIE. We calculate that a more efficient use of the SBIE within a country could increase the share of profit covered by the SBIE by almost 40 per cent.

4 | CONCLUSION

The aim of this paper is to shed light on two central issues of the GMT: (i) the critical mass of countries required to implement the GMT for a worldwide roll-out and (ii) the generosity of the SBIE.

We present evidence that the EU27 countries, which have recently reached an agreement to implement the GMT, most likely constitute a critical mass. In addition, we document that, for our sample of firms, the share of total profit covered by the SBIE is around 40 per cent in the first year the GMT applies and close to 20 per cent after 10 years. This suggests that the minimum total tax on corporate profit around the globe will be at 9 per cent in the short run and around 12 per cent in the medium term.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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