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Tax Spillovers from U.S. Corporate Income Tax Reform

by Sebastian Beer, Alexander Klemm, and Thornton Matheson

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Abstract

This paper describes, and where possible tentatively quantifies, likely tax spillovers from the U.S. corporate income tax reform that was part of the broader 2017 tax reform. It calculates effective tax rates under various assumptions, showing among other findings, how the interest limitation and the Foreign Derived Intangible Income provision can raise or reduce rates. It tentatively estimates that under constant policies elsewhere, the rate cut will reduce tax revenue from multinationals in other countries by on average 1.6 to 4.5 percent. If other countries react in line with historical reaction functions, the revenue loss from multinationals rises to an average of 5.2 to 13.5 percent. The paper also discusses profit-shifting, real location, and policy reactions from the more complex features of the reform.

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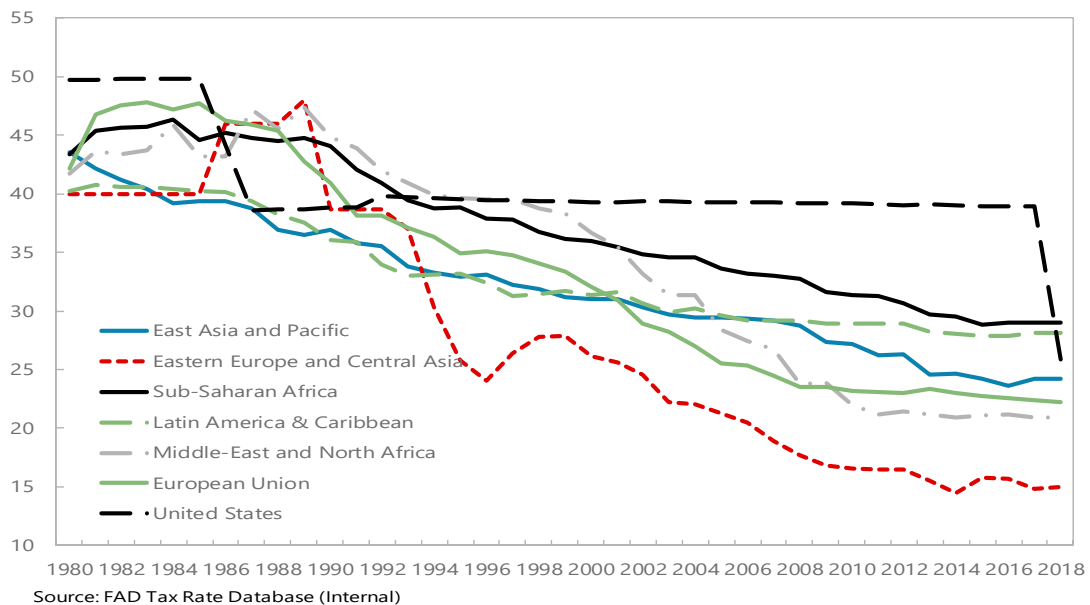
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I. INTRODUCTION

On December 20, 2017, the U.S. Congress adopted a major tax reform, affecting many taxpayers and various taxes, including corporate income, personal income, and estate taxes. Such a sweeping reform clearly has widespread implications for the domestic economy, including its growth and its distribution of income (see Chalk and Keen (2018), IMF (2018), Barro and Furman (2018)). However, in a globalized world, there will also be major spillovers to other economies.

- There are macroeconomic spillovers resulting from the reform's impact on the U.S. macroeconomy and its effects on the rest of the world. For example, stronger U.S. growth boosts export demand in trading partners.
- Moreover, there are tax-related spillovers, as changes in U.S. tax rates and structure directly affect multinational enterprises (MNEs) both of U.S. and foreign origin. Specifically, changes to relative tax levels—not just headline rates—affect the attractiveness of the United States compared to the rest of the world as a place for investment, for reporting profits, and for locating headquarters. In response to anticipated or actual spillovers, other countries may react by adjusting their tax systems, too. These direct effects of the reform are the topic of this paper.²

Figure 1. Top Corporate Income Tax Rates, Regional Averages (in percent)



Tax competition and declining corporate income tax (CIT) rates are not new phenomena. However, over the past 30 years, the United States has been an outlier in not reducing tax rates. Combined with the worldwide system of taxation, this is widely regarded as having served as an anchor to world CIT rates. Now the United States has cut its rate by 14 percentage points to 26

² See also Clausing, Kleinbard, and Matheson (2016) for an analysis of reform options for the United States and their likely spillovers. The reform adopted in 2017 shares some features with the options considered in that paper, but also has major differences.

percent (21 percent excluding state taxes), which is close to the OECD member average of 24 percent (Figure 1). Combined with the (partial) shift toward territoriality, this may intensify tax competition.

Apart from the rate cut, the reform also included a host of other features—including some novel provisions intended to address international profit shifting. Efforts to limit the scope of companies to report profit wherever taxes are low have intensified around the world in recent years. In addition to unilateral measures, this includes international efforts, notably the OECD-G20 base erosion and profit shifting (BEPS) initiative. Some of the measures taken by the United States in the recent reform are more aggressive than BEPS minimum standards and recommendations.³

Given the combination of highly mobile capital and source-based corporate income taxation, pressures on tax systems are not surprising. Tax policy spillovers are common and can be significant and sizable (IMF, 2014). For example, lowering tax rates increases a country's attractiveness as a place for investment and reduces outward profit shifting. However, this advantage is eroded when other countries do the same, leading to renewed incentives to reduce rates and to potential losses of tax revenues. Profit shifting is also addressed through increasingly complicated rules to limit such activities. There may be interactions between rate cuts and measures to reduce profit shifting. For example, anti-avoidance measures may intensify competition over real investment through the tax rate.

This paper is structured as follows. Section II describes the main features of the previous U.S. CIT system and their relevance for the rest of the world. It also describes the most relevant aspects of the reform. Section III analyzes and quantifies the likely spillovers on other countries from the change in U.S. CIT rate, covering both profit shifting and real location decisions, and allowing for policy responses by other countries. Section IV discusses the spillovers from the policy changes that go beyond the CIT rate. Section V concludes.

II. BACKGROUND: THE U.S. CORPORATE INCOME TAX AND ITS REFORM

A. The Main Features of the Pre-Reform U.S. CIT

Prior to the 2018 reform, the U.S. CIT rate was the highest in the OECD, with a central tax rate of 35 percent that state-level taxes raised to an average of around 40 percent, and with no significant change over 30 years. The 'domestic production activities deduction' reduced the federal rate to 32 percent for many lines of business,⁴ but the combined U.S. rate was still well above the 2017 OECD average of 24 percent. Compounded by investor-level taxation of

³ For example, the BEAT (see following section) goes beyond all BEPS actions.

⁴ Section 199 of the Internal Revenue Code allowed a deduction of up to 9 percent of income from production activities including manufacturing, natural resource extraction, farming, construction, architecture, engineering, and the production of software, recordings and films.

(continued...)

dividends and capital gains,⁵ high tax rates discouraged equity investment in the corporate sector while creating a marginal subsidy for debt finance. The vast majority (about 95 percent) of U.S. businesses avoided heavy corporate taxes by organizing as pass-through entities subject to the personal income tax only; however, most of the larger businesses—and certainly most MNEs—were C-corporations (i.e., subject to CIT), which accounted for slightly less than half of net business income (Coopers and others, 2016). Accessing public equity markets usually required incorporation.

The effect of high tax rates was attenuated by a narrow base. Depreciation allowances were relatively generous, and ‘bonus depreciation’ permitted expensing of 50 percent of many assets’ value in the first year. Research and experimentation were further encouraged with full expensing as well as a tax credit for incremental activity. The combination of high rates and a narrow base favored marginal and capital-intensive companies, but burdened mature, profitable companies. The U.S. CIT thus stood out in stark contrast to other OECD tax regimes, which over the preceding decades had reduced both statutory rates and depreciation allowances to attract MNE investment and reported profits.

The United States was also anomalous among major advanced economies in maintaining a ‘worldwide’ tax system, under which active foreign earnings were subject to U.S. taxation, although only upon repatriation. Once the norm among OECD countries, worldwide systems have steadily given way to ‘territorial’ systems that exempt active foreign earnings from taxes. U.S. domestic law offered a foreign tax credit for foreign income taxes (both CIT and withholding taxes) to the extent of U.S. tax liability. Any excess credits could be carried forward or used to offset U.S. tax on other active foreign income from any source country. Foreign earnings were not subject to U.S. tax until repatriated as dividends—a feature known as ‘deferral.’ The desire to avoid repatriation taxes—as well as financial accounting rules permitting companies that elected to hold earnings offshore indefinitely to avoid booking a deferred tax liability—led to the accumulation of an estimated \$2.6 trillion in undistributed foreign earnings by 2017.⁶ Anticipation of a U.S. rate reduction or another repatriation tax holiday like the one declared in 2005 may have augmented this stockpile.

The pre-reform CIT regime gave rise to a variety of tax planning practices aimed at shifting profits from the United States to lower-tax jurisdictions. Foreign MNEs investing in the United States used transfer pricing and thin capitalization to minimize their U.S. earnings (Sullivan, 2016). A common practice among knowledge industries, such as IT and pharmaceuticals, was capitalizing subsidiaries in low-tax jurisdictions with undervalued IP assets, allowing for future royalty payments to those affiliates. ‘Check-the-box’ rules allowing companies to elect their form of business (corporate or pass-through) for U.S. tax purposes facilitated cross-border tax avoidance through the use of ‘hybrid’ companies treated as different forms of business by

⁵ Qualifying dividends and long-term capital gains were taxed at rates of up to 20 percent, but other gains were taxed at rates of up to 39.6 percent.

⁶ Though these earnings were undistributed, many were held in US banks and/or US\$ denominated securities. See U.S. Senate (2011).

(continued...)

different governments.⁷ To escape repatriation taxes, numerous U.S. MNEs ‘inverted,’ reincorporating offshore or seeking acquisition by foreign companies, although the U.S. regulators repeatedly tightened rules to prevent this practice.

B. The Main Features of the Reform

Rate Cut

The most visible feature of the tax reform was a 14-percentage point cut in the statutory tax rate. The federal statutory tax rate fell from 35 to 21 percent, while the combined rate, including state taxes, fell on average from 40—one of the highest tax rates globally—to 26 percent, which is close to the 2018 OECD average of 24 percent.

Accelerated Depreciation

Another important feature of the reform is the introduction of expensing for most capital investment for 5 years. Between 2023-2027, this is scheduled to be phased out, dropping by 20 percentage points per year. Expensing means that capital can be deducted from profits when acquired, rather than being depreciated over time. While this is a generous treatment of capital, the pre-reform treatment was also more generous than true economic depreciation: as mentioned, firms could deduct an increased rate of 50 percent of capital expenditure in 2017.⁸

International Tax Provisions

The reform changes the taxation of active foreign profits by replacing the system of worldwide taxation with credits and deferral by a territorial system, as used in most other advanced economies. As a result of this change, active foreign profits are now exempt from U.S. tax. However, as a result of another change (GILTI, see below), foreign profits may in practice be taxed immediately under certain circumstances.

Three novel measures were introduced. Their exact operations is still subject to some uncertainty, as important regulations remain outstanding.

- ‘Global Intangible Low-Taxed Income’ (GILTI) creates a minimum U.S. tax on foreign active income, without deferral. There are some exceptions, though, with notably the oil and gas sector exempt. The minimum rate is 10.5 percent and the tax base is foreign income exceeding 10 percent of foreign tangible assets.⁹ A nonrefundable tax credit is granted for 80 percent of foreign taxes, so that, in general, no U.S. tax is due if foreign taxes average (on this

⁷ For a discussion of these practices, see Kleinbard (2011). Though check-the-box remains a feature of the US tax code, the shift to territoriality should greatly reduce its use, since foreign earnings are now exempt.

⁸ In 2018 this was scheduled to fall to 40 percent in the absence of the reform.

⁹ Specifically, the written-down value of the subsidiary’s non-real estate depreciable tangible business assets calculated using straight-line depreciation method (s.168(g)) is used. This is therefore not affected by accelerated depreciation or expensing and is independent of the foreign country’s depreciation rules.

base) at least 13.125 percent. Based on current legislation, the minimum rate will increase to 13.125 from 2026, raising maximum creditable foreign tax to 16.4 percent. Expense allocation rules, however, which require that expenditures such as interest on debt incurred to finance offshore investments be allocated to income from those investments, could make GILTI apply even for MNEs paying significantly higher average foreign tax rates. Interest allocated to foreign income is deducted from the 10 percent allowed return on foreign tangible assets and affects foreign tax credit entitlements, and can therefore increase the tax payable under GILTI.

- 'Foreign Derived Intangible Income' (FDII) provides a preferential rate for certain foreign earnings of U.S.-resident firms. The rate for this income is 13.125 percent and the base is defined (i) the earnings in excess of a 10 percent return on its tangible assets (calculated in the same way as GILTI), multiplied by (ii) the proportion of its net income that arises from export sales. From 2026, the rate is scheduled to rise to 16.4 percent.
- 'Base Erosion Anti-Abuse Tax' (BEAT) is an alternative minimum tax. Its base is calculated by adding back into the U.S. tax base of large U.S. corporations most foreign related-party service costs on a gross basis (e.g., interest, royalties). The rate is 5 percent in 2018, rising to 10 percent in 2019 and further to 12.5 percent from 2026. This tax does not provide credit for foreign taxes or take foreign tax rates into account.

New limits on interest deductions are not specifically international provisions, but will still affect international interest payments. Specifically, interest deductions must not exceed 30 percent of earnings before interest, tax, depreciation, amortization, and depletion (EBITDA) plus business interest. From 2022, this limit will become much more binding as it will apply to earnings before interest and tax (EBIT). Unlike 'thin capitalization' rules in some other countries and the former Section 163(j) rules in the United States, this limit is independent of the debt-equity ratio and applies equally to related and unrelated-party interest. Regulated public utilities are exempt and real estate and farming are allowed to opt out (in which case they must use the Alternative Depreciation System). In the financial (and insurance) sector, the limitation on interest deductions is likely to be less restrictive, because they will have large business-related interest income, from which interested payments can be netted off.

'Anti-hybrid' rules were introduced. These disallow deductions for related-party transactions that are hybrid in nature (i.e., not taxable in recipient country) or paid to an entity characterized as taxable in one jurisdiction, but transparent (not taxable) in another. Under BEPS (Action 2) anti-hybrid rules are recommended.

In transition to a territorial system, the existing stock of unrepatriated profits of U.S. MNEs is deemed repatriated and subject to a one-time tax. This tax is set at 15.5 percent for funds held in cash or equivalent assets and 8 percent for all other assets. The payment is spread over 8 years and is independent of whether firms actually repatriate any of these profits.

C. Impact of GILTI on Average Tax Rates

GILTI could turn out more onerous for some companies than the previous system of worldwide taxation, because it applies without deferral (and with a more limited foreign tax credit). Rough

calculations based on aggregate country-by-industry data from the U.S. Bureau of Economic Analysis suggest that GILTI could bind for some firms in many industries whose average foreign tax rate after deducting 10 percent of their foreign property, plant, and equipment (PP&E) is below 13.125 percent (Table 1).¹⁰ Whether a particular firm is subject to GILTI will of course depend on its particular configuration of assets, earnings and allocated expenses. For firms mostly operating in high tax countries or firms with large stocks of tangible capital, the system may indeed be territorial in nature. Dharmapala (2018) contains a further discussion about the conditions under which GILTI may be more burdensome than the previous system of worldwide taxation with credits and deferral, noting that this will also depend on avoidance opportunities under GILTI.

Table 1. Estimates of Average Tax Rates Including GILTI (in percent)

Sector	Foreign CIT	GILTI	Combined
All industries	7.9	2.9	10.8
Mining	80.8	0.0	80.8
Manufacturing	11.8	0.0	11.8
<i>of which:</i>			
Food	21.9	0.0	21.9
Chemicals	14.0	0.0	14.0
Primary and fabricated metals	20.5	0.0	20.5
Machinery	10.0	1.9	11.9
Computers and electronic products	7.6	3.1	10.7
Transportation equipment	15.0	0.0	15.0
Wholesale trade	11.7	0.5	12.2
Retail trade	17.7	0.0	17.7
Information	8.5	1.4	9.9
Finance and insurance	10.4	1.9	12.3
Professional, scientific, and technical services	9.0	2.6	11.6
Other industries	2.6	7.9	10.5

Source: Authors' estimates based on BEA data.

D. Impact on Effective Tax Rates

With so many simultaneous changes, the net impact on effective rates of taxation is not clear. In most cases, the rate reduction and expensing are likely to strongly reduce effective tax rates, but for some investments, for example, where the limitation on interest deduction is binding, the impact may be very different.¹¹

¹⁰ The GILTI liability (expressed as a ratio to corporate pre-tax income) is calculated for each industry as the maximum of zero and $[(\text{Foreign net income} + \text{foreign income tax} - 0.1 \cdot \text{PP\&E}) \cdot 0.105 - 0.8 \cdot \text{foreign income tax}] / (\text{foreign income} + \text{foreign income tax})$.

¹¹ New restrictions on the use of loss carry overs are also likely to raise effective tax rates, especially for cyclical businesses.

(continued...)

Effective tax rates—at least of the forward-looking tax-law-based type¹²—always depend on the assumptions. Typically, the most important assumptions are the type of asset invested in and the source of finance used—see Devereux and Griffith (2003) who develop the effective average tax rate (EATR) measure (which incorporates the effective marginal tax rate (EMTR) as a special case). In the United States post-reform system, it will also be important to distinguish among firms depending on whether the interest limitation is binding and whether one of the novel international tax provisions applies. For technical details of how these are implemented, see Appendix I. For an intuitive understanding, however, note that the EATR is a measure of the average tax rate on an investment which earns an economic rent (i.e., a rate of profit that exceeds the cost of capital), while the EMTR is the average tax rate of an investment that breaks even after tax, i.e., where the rate of profit covers exactly the cost of capital.

In this paper, we calculate effective tax rates both for the standard tax system, and taking into account some of the special new provisions, such as the interest deductibility limitations and FDII. All post-reform tax rates we report are based on the tax system in place in 2018. We do not report effective tax rates for later years, given the large uncertainties about whether the scheduled changes in tax rates and rules will take place as planned.

Effective tax rates for the post-reform standard tax system have already been calculated and fall in most cases. Spengel and others (2018) calculate EATRs for a mix of assets and sources of finance and find a decline. They also report cross-border rates taking withholding taxes into account, also finding declines. DeBacker and Kasher (2018) calculate EMTRs and EATRs for a mix of financing sources and report declines in rates for five assets considered. Gravelle and Marples (2018) calculate EMTRs, reporting separately results for debt and equity, with the former rising and the latter falling. Lyon and McBride (2018) find the same, both for EMTRs and EATRs. They also report effective tax rates for R&D investments, finding decline in EATRs, but a less favorable treatment at the margin once expensing is abolished. Mintz (2018) calculates EMTRs and shows not only results for the standard tax system, but also under the limitation of interest deductibility. He argues that such limits can raise (because of the loss of interest deduction) or lower (because investment leading to additional profit allows more interest deduction) EMTRs, but finds that more often it raises them, and it always raise them once the limit is defined as a share of EBIT.

The reform clearly reduced effective tax rates for equity-financed¹³ investments in plant and equipment in the United States under the standard tax system. These rates apply to U.S. corporations, as well as foreign corporations, except that those from the remaining countries

¹² Another approach to defining effective tax rates is to estimate them from economic aggregates, such as by dividing tax payments by profits. This approach is backward looking, because the tax payments are a function of past investment decisions and the resulting distribution of asset and funding sources. Even after a tax reform, figures will be affected by such past decisions, and importantly, by losses carried forward. Such measures are therefore less suitable for assessing firms' incentives for new investments. For a discussion of different tax measures, see for example, OECD (2001), Nicodeme (2001), or Sørensen (2004).

¹³ Equity here refers to both retained earnings or new equity. As personal income taxes are not included, this makes no difference. If personal taxes were included, new equity would typically be at a disadvantage, because of the additional taxation of dividends.

(continued...)

with worldwide taxation of their resident corporations may face additional taxes in their home jurisdiction. Table 2 shows effective tax rates for plant and machinery under the standard tax system, where none of the novel measures, such as FDII, apply. The calculations include average state taxes, raising the federal rate by 5 percentage points.¹⁴ For equity-financed investment (left columns), there is a strong reduction in both average and marginal effective tax rates. The EMTR drops to 0, which is the result of expensing, because expensing keeps the normal rate of return free of tax and achieves a tax system that is neutral to investment.¹⁵

For debt-financed investment, the result is more mixed. Before the reform, debt-financed investment faced lower effective tax rates than did investment financed by retained earnings, because of interest deductibility.¹⁶ The tax system therefore had a debt bias, as do most tax systems in the world. Moreover, the combination of interest deductibility and depreciation allowances far above true economic depreciation resulted in negative EMTRs. Here it should be remembered that companies can only benefit from negative effective tax rates if they have other profitable operations (or future profits) against which they can use tax losses.¹⁷

Following the reform, the limitation on debt needs to be taken into account. For some firms—those with low enough leverage and high profits—this may not be binding and all interest on debt used to fund a new project remains deductible. For those firms, the system is the same as before, but the lower tax rate reduces the value of interest deductibility, therefore *increasing* the EMTR (but not the EATR, if profits are sufficiently high) compared to before the reform. For new firms or a firm with existing interest exactly equal to the permissible deduction, the extent to which interest will be deductible depends on the assumed profitability of the new investment. The higher the profit, the more interest can be deducted. In the EATR shown (with a net profit of 20 percent), all interest can be deducted. With lower profits—or in the extreme case the EMTR with zero economic profit—debt finance reduces the effective tax rate by much less than in the absence of the limit. For yet other firms, the limit is fully binding, for example, because their existing leverage is so high that interest payments already exceed the allowed amount. For those firms, there is no additional interest deduction from issuing more debt. However, the EATR still falls further, because the additional profit creates more scope for interest deduction, and this can exceed the interest cost for profitable investments. Interestingly, this effect would also occur with equity finance for such firms.

¹⁴ The differences among tax rates under different scenarios are more interesting than the precise values, which depend strongly on the assumptions.

¹⁵ Strictly speaking, this is true only if investment takes place at the end of a period, but the expense can be claimed for the full year. Without this assumption, the tax rate would be low, but not zero.

¹⁶ Prior to the reform, the U.S. thin capitalization rule, Section 163(j), was less restrictive: Net interest expense exceeding 50 percent of adjusted taxable income (plus any excess limit carryover from previous years) was disallowed, unless the corporation met the safe harbor debt-to-equity ratio cap of 1.5. Disallowed interest expense or excess limit could be carried forward for up to three years.

¹⁷ The large absolute value for such EMTRs is explained by the fact the denominator (profits) is very small as these are marginal projects.

Overall, the reform has therefore clearly reduced—though not eliminated—debt bias. However, as noted, the interest limit is less restrictive for the financial sector (as netted against business interest received), where the social cost of excess leverage may be greatest.

Table 2. Effective Tax Rates, Standard Tax System

Finance	Equity		Debt			
	pre	post (2018)	pre	post (2018)		
Debt limit				not binding	marginally binding	binding
EATR	30.8	19.5	20.5	12.8	12.8	12.3
EMTR	5.2	0.0	-173.7	-56.7	-16.9	-16.9

Assumptions: Asset: plant and machinery; Inflation: 2 percent; Real rate of interest: 5 percent; True depreciation: 5 percent, Profit rate (EATR): 20 percent.

Notes: "Not binding" means that all interest is deductible; "marginally binding" means that a firm is new or its existing interest is exactly equal to permitted deductions, so that deductibility of any new interest depends on the profit of the investment under consideration; "Binding" a firm's interest bill already exceeds 30 percent of profits.

Source: Authors' estimates

The impact of FDII is highly case specific. FDII applies only to foreign sales of domestic firms, so to focus on the extreme case, the example in Table 3 assumes that all sales are foreign. Like the limit on interest deductibility, the impact of FDII will depend on a firm's total operations, including its tax positions now and in the future. Estimates by Dowd and Landefeld (2018) using historical data suggest that FDII would have provided significant (though procyclical) benefits, suggesting the cases where effective tax rates decline are more common.

- A firm with an average rate of return far below 10 percent of tangible capital, which is not raised above 10 percent by a new tangible investment will not be eligible for FDII deductions and the standard statutory and effective tax rates apply. Hence the top row shows the same effective tax rates as in Table 2.
- Some firms may be closer to a rate of 10 percent. If such a firm were to invest in capital with high rates of return, then the expensing of the investment would reduce current tax liabilities, yielding a saving at the standard rate, while part of the additional profit of the new investment will qualify for the reduced FDII tax rate. The second row shows an extreme case of such an example, in which it is assumed that there are enough profits taxed under the full tax rate that can be reduced by expensing, while it also assumes that all additional profits that exceed 10 percent of the new capital will benefit from the FDII rate. In this case, the EMTR is negative.
- Another situation would apply in a firm whose existing rate of return far exceeds 10 percent of capital. In such a firm, the new investment would raise the amount of profit subject to the standard rate, while the expensing would reduce pre-existing tax bases that were subject to the reduced rate. Hence the EMTR is then positive, as shown in the third row.
- Finally, if a firm invests in intangible investment (and provided its pre-existing profitability rate is not very low), the FDII rate applies to the entire investment. Results for this case are shown in the fourth and last row. Here the EMTR is back at 0, because the tax rate paid on profits is again equal to the tax rate that applies to expensing and there is no increase in the profit subject to the higher rate, as there no additional tangible capital. Hence, the usual

result of neutral taxation under expensing obtains. From 2022, though, the tax rate would be higher, if as legislated R&D will become depreciable over 5 years (15 years for foreign R&D) rather than being expensed. The EATR is reduced by FDII under most reasonable assumptions, the amount of reduction follows a similar pattern as the EMTR.

Table 3. Effective Tax Rates under FDII, Equity Finance, 2018

	EMTR	EATR	Notes
Return on $K_{t-1} < < 10\%$	0.0	19.5	Standard tax system applies
Return on $K_{t-1} < 10\%$	-3.5	12.9	Expense against full tax rate
Return on $K_{t-1} > > 10\%$	13.7	16.8	Expense against FDII tax rate
Intangible investment	0.0	13.6	Entire return subject to FDII rate

Assumptions: Inflation: 2 percent; Real rate of interest: 5 percent; True depreciation: 5 percent, Profit rate (EATR): 20 percent.

Note: K_{t-1} represents the existing capital stock.

Source: Authors' estimates

Effective tax rates for investment by U.S. affiliates abroad are also affected by the reform. The move to territoriality reduces effective tax rates for all foreign investment where previously some residual U.S. tax liability was borne. For firms covered by GILTI, however, there are different effects. First, for some investments effective tax rates may rise, because the immediate GILTI liability could be more onerous than the previous deferred tax liability. Second, for additional real investments with relatively low rates of return, the effective tax rate could be negative. This is because an increase in foreign tangible capital, increases the tax-free amount under GILTI. This is the mirror image of the case of the FDII, which may raise the EMTR because more capital means more profits are subject to the standard tax rates (row 3 of **Table 3**).

III. SPILLOVERS FROM THE TAX RATE CUT

Many of the reform's features are likely to spill over to other countries. Given the complexity of the reform, we follow two approaches. This section focuses on the tax rate cut, because there is an ample literature with empirical results on which we can draw to quantify the impact of the U.S. reform. The following section discusses spillovers of the other features of the reform, and how they may work to reinforce or counteract the impact from the tax rate cut.

In quantifying fiscal spillovers from the tax rate cut, we account for three reaction margins: the impact on profit shifting decisions of MNEs, the impact on real location decisions of MNEs, and the impact on policy decisions of other governments.

A. Spillover Channels

Profit Shifting

A wide body of empirical literature provides evidence that MNEs exploit differences in statutory tax rates to minimize their global tax burden.¹⁸ For instance, MNEs can effectively manage reported profitability within their group by transferring ownership rights of intangible assets, by providing intra-group loans, or by adapting the pricing of internal transactions. Such profit shifting, however, also entails some, possibly nonlinear, costs. This is both true for aggressive tax planning/legal tax avoidance, which may require fees to consultants or costs for setting up structures in low-tax jurisdictions, and illegal evasion, which carries the risk of fines or criminal sanctions. Shifting profits to countries with close operational links is easier and cheaper: for example, if large volumes are traded, a small change in the transfer price will shift a large amount of profit.

The U.S. rate cut will strengthen incentives to report profits in the United States and can be expected to lead to profit shifting out of a broad range of countries. That countries, which used to have tax rates below the U.S. rate and are now above lose part of their tax base is intuitive. However, given the tradeoff between the cost of profit shifting and the tax saving, even countries that remain above or below the U.S. rate may see a larger share of profits reported in the United States following the tax cut, because their relative position has changed. This even includes low-tax jurisdictions, because even though their tax rates remain very low compared to the U.S. rate, not all profits can be shifted there and the relative cost of keeping profits in the United States is now lower. Given the close economic links many countries have with the United States through the world's global production chains, shifting between these markets is easier than shifting to low-tax jurisdictions. Recent initiatives such as BEPS may have further increased the difficulties of shifting into low-tax jurisdictions.

Location of Real Investment

The U.S. tax cut will also make the United States a more attractive location for investment. The classic theory of the firm (e.g., Hall and Jorgenson, 1967; King, 1974) suggests that capital accumulates until its marginal return balances the sum of financing and replacement costs. Taxation affects the net return to capital and the theory thus predicts that the U.S. rate cut should foster investments in the United States. Taxation is not the only factor driving investments, but a substantial body of empirical evidence shows that corporate taxation is important in explaining investment levels globally.¹⁹

While the marginal return to capital remains unchanged in the rest of the world, several channels can account for a response of investment activity globally.

¹⁸ See for instance Heckemeyer and Overesch (2017) for a review of the literature.

¹⁹ See De Mooij and Ederveen (2003, 2006, 2008)

- Macroeconomically, the higher investment in the United States can be expected to raise the interest rate or in other words the required rate of return of investors. Moreover, a larger global capital stock would reduce the global pre-tax return on capital. This channel would reduce investment elsewhere.
- There may be capacity limits at MNEs for undertaking discrete and sophisticated investment projects. Hence those investments, which may be particularly profitable (and for which the EATR is the relevant rate), will not take place elsewhere if shifted to the United States. This may reduce the tax base, even if compensated by other investment.
- MNEs potentially anticipate profit shifting opportunities when deciding on the magnitude of real investments (e.g., Egger, Merlo, and Wamser, 2014). For some firms (those whose average tax rate is very different from the new U.S. rate), a reduction in the United States CIT rate implies an increase in profit-shifting opportunities, reducing the MNE's cost of capital worldwide. This channel suggests that real investment activity outside the United States could *increase* following the U.S. tax-rate cut. There is some ambiguity though: as the U.S. rate comes closer to the world average, for some MNEs, there could be a reduction in profit shifting opportunities, raising the cost of capital.

Policy Spillovers

The U.S. reform is likely to affect other governments' behavior through the expected impact on tax bases described above, as well as through its visibility and the impact on the tax debates. These two channels are sometimes referred to as the 'resource-flow' and 'yardstick' models of fiscal reactions. This paper does not try to disentangle both channels, but simply discusses the total impact. The empirical literature on tax reaction functions estimates function has generally found evidence that countries react to some average of other countries' rates.²⁰

B. Conceptual Framework

To simulate the effects of the U.S. reform we draw on a simple theoretical framework, developed by Hines and Rice (1994) and extended by Huizinga and Laeven (2008). At its core, the model implies that tax collections T from MNEs in country c , can be written as:

$$T_c = t_c f(K_c) \left[1 - \varepsilon_s \left(t_c - \sum_j \omega_{c,j} t_j \right) \right] \quad (1)$$

where, $f(K)$ are real profits from investing K units of capital, the structural parameter ε_s determines the costs and therefore extent of profit shifting, t_c is the statutory tax rate in country c and $\sum_j \omega_{c,j} t_j$ is a weighted average tax rate of all locations where the MNE, located in country c ,

²⁰ Most of the literature, and this section, focuses on statutory tax rates. A few papers, e.g., Overesch and Rincke (2011) also consider effective tax rates, but results are harder to interpret (given the multitude of effective tax rates depending on assumptions) and weaker.

operates. The equation indicates that reported profitability falls short of real profitability in high-tax countries, as a positive tax differential to the rest of the group incentivizes profit shifting out of the country. Correspondingly, reported profitability exceeds true profitability in low tax countries.

A simple log-linear approximation of equation (1) is a useful starting point to understand the effects of the US tax reform:

$$\log T_c = \log t_c + \log f(K_c) - \varepsilon_S \left(t_c - \sum_j \omega_{c,j} t_j \right) \quad (2)$$

We first consider revenue implications of the tax rate cut assuming that other countries' tax rates remain unchanged. In this case, tax collections decrease due to changes in investments activity and due to changes in profit-shifting behavior. Specifically, equation (2) indicates that tax revenue decreases by $\varepsilon_S \omega_{k,US}$ percent in response to a one percentage point reduction in the US tax rate. To quantify investment spillovers, we assume that capital reacts symmetrically to changes in the domestic tax rate and to changes in the weighted average foreign tax rate:

$$\frac{d \log(K)}{d(t_c - \sum_j \omega_{c,j} t_j)} = -\varepsilon_K \quad (3)$$

Accordingly, capital investments in country c decrease by $\varepsilon_K \omega_k$ percent in response to a one percentage point reduction in the U.S. statutory tax rate. To translate this into tax base changes, we define the capital intensity of production as $\alpha = \frac{d \log f(K)}{d \log K}$. With this definition, the tax base reduction is given by $\alpha_c \varepsilon_K \omega_k$ percent for each percentage point reduction in the U.S tax rate. Combining the investment and profit shifting response, we find that the tax base of country c will decrease by the following percentage in response to a one percentage point decrease in U.S statutory tax rate:

$$\frac{dT_c}{T_c} = (\alpha_c \varepsilon_K + \varepsilon_S) \omega_{c,US} \quad (4)$$

Relaxing the assumption of constant tax policy in other countries, there is an additional layer of revenue effects. First, there is a direct revenue loss from applying a lower rate. Moreover, as tax differentials are affected, the profit-shifting and real location decisions of MNEs adapt. To quantify spillovers from fiscal reactions, we assume that that tax rate response in each country follows:

$$\frac{dt_c}{dt_{US}} = \mu_c \omega_{c,US} \text{ for all } c \quad (5)$$

where μ_c captures both direct effects from country c 's own reaction to the U.S. tax rate cut, as well as all second and subsequent round effects (see Appendix II for the derivation). Equation (5) indicates that the CIT rate in country c decreases by $\mu_c \omega_{c,US}$ percentage points in response to a one percentage point reduction in the US tax rate. Country c taxed corporate profits at a rate of

t_c before the reform. A percentage point reduction in the U.S. tax rate thus implies a reduction in country c 's tax collections by $\frac{\mu_c \omega_{c,US}}{t_c}$ percent.

To some extent, the MNEs' behavioral responses through investment and profit shifting activity counterbalance the negative mechanical effect of the lower CIT rate. Specifically, investments increase by ε_K percent for each percentage point reduction in country c 's tax rate. However, other countries also respond to the U.S. tax rate cut and equation (3) shows that these responses reduce investment in country c by $\varepsilon_K \sum_{j \neq US} \omega_{c,j}$ percent. The net effect of the combined investment response is positive, but small: investments in country c will increase by $\varepsilon_K (1 - \sum_{j \neq US} \omega_{c,j}) = \varepsilon_K \omega_{US}$ for each percentage point reduction in tax rates globally. Finally, equation (5) predicts that tax rates decrease by $\mu_c \omega_{c,US}$ percentage points globally. The policy response channel will thus increase investment in country c by $\varepsilon_K \omega_{c,US} \mu_c \omega_{c,US}$ percent and the tax base by $\alpha_c \varepsilon_K \omega_{c,US} \mu_c \omega_{c,US}$ percent. A similar reasoning holds for the profit shifting response, implying that—when all three channels are accounted for—the combined revenue effect of the reform is:

$$\frac{dT_c}{T_c} = \left[\frac{\mu}{t_c} + (1 - \mu_c \omega_{c,US})(\alpha_c \varepsilon_K + \varepsilon_S) \right] \omega_{c,US} dt_{US} \quad (6)$$

C. Parameterization

Equation (6) shows that five measures jointly determine country-specific spillovers, which all need to be estimated or taken from existing studies. We draw on the literature to parametrize structural parameters which are constant across countries and use the ORBIS database to derive country-specific capital intensities and weights that indicate the importance of multinationals with a U.S. link for domestic tax revenue. The ORBIS dataset provides information on ownership structures, balance sheets, and profit and loss accounts of corporations globally. We retrieve information for all MNEs, that is firms which either own a foreign subsidiary or which are owned by a foreign shareholder, that meet basic data requirements (i.e., report profit and the capital stock for at least 3 years) and restrict the sample to firms providing unconsolidated accounts. Our baseline sample comprises slightly more than 1.8 million observations

The semi-elasticity of capital with respect to the tax rate: ε_K . De Mooij and Ederveen (2008)²¹ report that foreign direct investment (FDI) increases, on average, by 2.4 percent in response to a one percentage point cut in the domestic statutory tax rate. We acknowledge that the responsiveness of FDI in a country to changes in the average *foreign* tax rate are likely smaller.²² We thus set $\varepsilon_K = 2.4$ and regard simulated investment effects as upper bound estimates.

²¹ See also de Mooij and Ederveen (2003, 2006).

²² Becker and Riedel (2012) find that cuts in foreign tax rates may sometimes even support domestic investment, for example, because of common inputs.

(continued...)

Moreover, it is important to remember that this elasticity applies over the medium to long term, as stocks will not adjust rapidly from year to year.

The semi-elasticity of profit (holding capital constant): ε_s . Beer, De Mooij, and Liu (2018) find that profits decrease, on average, by 1.5 percent in response to a one percentage point increase in the group's statutory tax rate differential.²³ We thus set $\varepsilon_s = 1.5$ in our estimations.

The percentage point reaction in CIT rates: μ_c . The empirical literature on tax reactions functions typically estimates equations relating each country's tax rate to the (weighted) average of all others. This is typically estimated using panel data and with fixed country effects. Controls or a lagged dependent variable are often included, but the basic specification is as follows:

$$t_{ct} = \beta \frac{\sum_{k \neq c} y_k t_{kt}}{Y - y_c} + f_c + \varepsilon_{ct} \quad (7)$$

where t_{ct} is the tax rate in country c at time t , y_c is a weighting factor, e.g., GDP (or 1 if unweighted), Y is the sum of weighting factors, f_c is a country fixed effect, and ε_{ct} is the error term. The estimation of such an equation needs to address the endogeneity of the (weighted) average of tax rates in other countries. This is typically done through instrumental variables estimation (including often System-GMM) or, more rarely, maximum likelihood methods. For an overview of the issues arising in estimating such regressions see Brueckner (2003).²⁴ Leibrecht and Hochgatterer (2012) report an average reaction coefficient (β) of 0.9 in studies that control for openness and 0.3 for other studies. This means that countries respond to a one percentage point cut in the average tax rate abroad by reducing their domestic CIT rate by 0.3 to 0.9 percentage points. For our analysis we use an instantaneous reaction coefficient of 0.6, which is in line with most published papers in this literature, including Devereux, Lockwood, and Redoano (2008), Redoano (2014), and Crivelli, De Mooij, and Keen (2015).

To convert this coefficient (β) to the required percentage point reaction, we need to calculate the total response to a U.S. tax rate cut, including not only the initial reaction, but also all subsequent round effects. Specifically, if we assume that the U.S. rate cut is a shock that is not explained as a reaction to other countries—or that the United States acts as a leader²⁵—the starting point is that it reduces the average tax rate. This triggers reactions by countries, which in turn lead to further decreases in the average tax rate and subsequent reactions. The model does not have

²³ The semi-elasticity of 1.5 is a consensus-estimate from the literature, projected to the year 2015.

²⁴ See also Gibbons and Overman (2012) for a critique of commonly used empirical identification strategies in this literature. They suggest using exogenous changes in tax rates to estimate fiscal reactions, but as those are hard to find for CIT, no paper we are aware of has employed such an approach.

²⁵ Altshuler and Goodspeed (2015) argue that the United States is a leader in such tax competition in the sense that other countries react to the United States, but not vice versa. The fact that the United States is a late mover in lowering tax rates may not contradict this, because if acting as a Stackelberg leader—i.e., taking into account the rates cuts that will follow in other countries—it should cut less than in a Nash equilibrium.

lags, so everything occurs immediately. The ultimate effect of a U.S. tax shock on each country is given by (see Appendix II for derivation):

$$\mu_c = \frac{\beta}{(1 - (1 - \beta)\omega_c) \left(1 - \beta \left(\sum_{k \neq US} \frac{\omega_k}{1 - (1 - \beta)\omega_k} \right) \right)} \quad (8)$$

The capital intensity of production: α_c . We estimate country-specific capital intensities by running a regression of the form:

$$\log(\pi_{it}) = \alpha_c \log(K_{it}) + \gamma' X_{it} + \varepsilon_{it} \quad (9)$$

where π_{it} denotes profit before taxation of firm i in year t , K is the firm's stock of fixed assets, X_{it} represents control variables,²⁶ and ε_{it} is an idiosyncratic error. The coefficient α_c captures the capital intensity in country c , which is the percentage response in the tax base in response to a percentage change in the capital stock.

Country-specific weights: ω_c . The weights aim to capture the relative importance of the U.S. market. To this end, we record for each MNE in our dataset whether there exists a direct relationship (through a parent or subsidiary) to the United States²⁷ and define the country-specific weight as:

$$\omega_c = \frac{1}{N_c} \sum_i \frac{1[\text{link to US}]_i}{\# \text{ countries}_i} \quad (10)$$

where $1[\text{link to US}]_i$ equals 1 if MNE i has a direct ownership link to the United States, and $\# \text{ countries}_i$ counts the total number of countries this MNE operates in. Accordingly, country-specific weights take on values between 0 and 1. Weights are larger if a country's representative MNE operates primarily in the U.S.

The results hinge on the assumption that all ownership links are correctly specified in the ORBIS database. We thus complement our baseline simulation with a robustness check using a different definition of weights. Specifically, we exploit bilateral FDI data from the coordinated direct investment survey and take for each country c the sum of FDI outflows from the United States to country c and from country c to the United States and divide this sum by the total amount of outflows from and inflows into country c . Accordingly, the weight takes a value of one if all U.S. outward investment were directed toward country c and all FDI outflows from country c were directed toward the United States.

²⁶ We include a full set of time-specific and country-specific fixed effects as well as country-specific GDP, inflation, unemployment and population size variables.

²⁷ This definition follows the theoretical model of Huizinga and Laeven (2008), assuming that all country operations are similarly profitable.

Table summarizes country-specific capital intensities and weights. With a mean capital-intensity of 0.54, investments affect the tax base substantially. The FDI-based weights are generally higher than the weights based on micro data, giving more importance to the policy change in the U.S.

Table 4. Summary of Country-Specific Parameters

	Mean	Median	Min	Max
Capital intensity	0.54	0.54	0.23	1
Micro-weight	0.03	0.02	0	0.19
FDI-weight	0.11	0.06	0	1

Source: Authors' estimates based on ORBIS data.

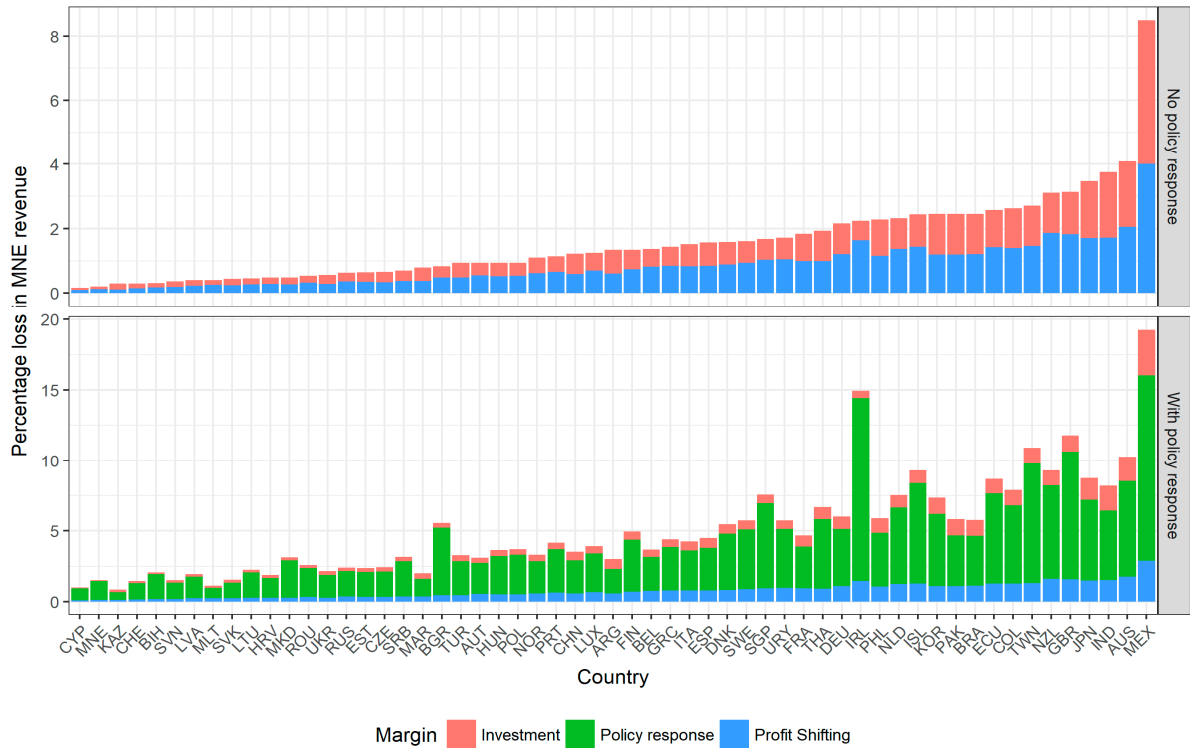
D. Simulation Results

Table 5 summarizes simulated revenue effects of the US tax reform for 57 countries. The upper part of the table considers revenue effects when other countries maintain their CIT rates at current levels; the lower part relaxes this assumption. We find that corporate tax revenue from MNEs will decrease by 1.58 percent on average across all countries when CIT rates remain unchanged. Changed profit-shifting incentives suggest that revenue will contract by 0.85 percent, on average, while the investment response implies an average revenue loss of 0.73 percent. When incorporating the policy response, revenue shortfalls more than triple, reaching an average of 5.17 percent across all countries. The actual loss is likely to be even greater, because these calculations do not include the revenue loss associated with lower tax rates on purely domestic (i.e., non-MNE) firms. Country-specific revenue losses are shown in Figure 2. All revenue losses are expressed in percentage changes of MNE profits. We do not calculate losses in percent of GDP, because we do not have country-specific data on tax revenue from MNEs (as opposed to total CIT revenue), and we prefer not to rely on ORBIS data, because of varying country coverage.

Table 5. Simulation Results, Micro Weights

Loss in MNE tax revenue (in percent) unless otherwise noted, due to	Mean	Median	Lowest Percentile	Highest Percentile
<i>No policy response</i>				
Profit shifting	0.85	0.7	0.22	2.91
Investment response	0.73	0.59	0.17	3.11
Investment response (in percent of capital stock)	1.36	1.11	0.18	4.66
Total change in MNE tax revenue	1.58	1.34	0.39	6.02
<i>With policy response</i>				
Profit shifting	0.77	0.66	0.22	2.23
Investment response	0.65	0.53	0.16	2.4
Investment response (in percent of capital stock)	1.23	1.06	0.18	3.6
Tax rate response	3.76	2.89	1.24	13.38
Tax rate response (in p.p. of tax rate)	0.84	0.69	0.1	3.95
Total change in MNE tax revenue	5.17	4.25	1.57	17.14

Source: Authors' estimates.

Figure 2. Spillovers on Tax Revenue, Micro Weights

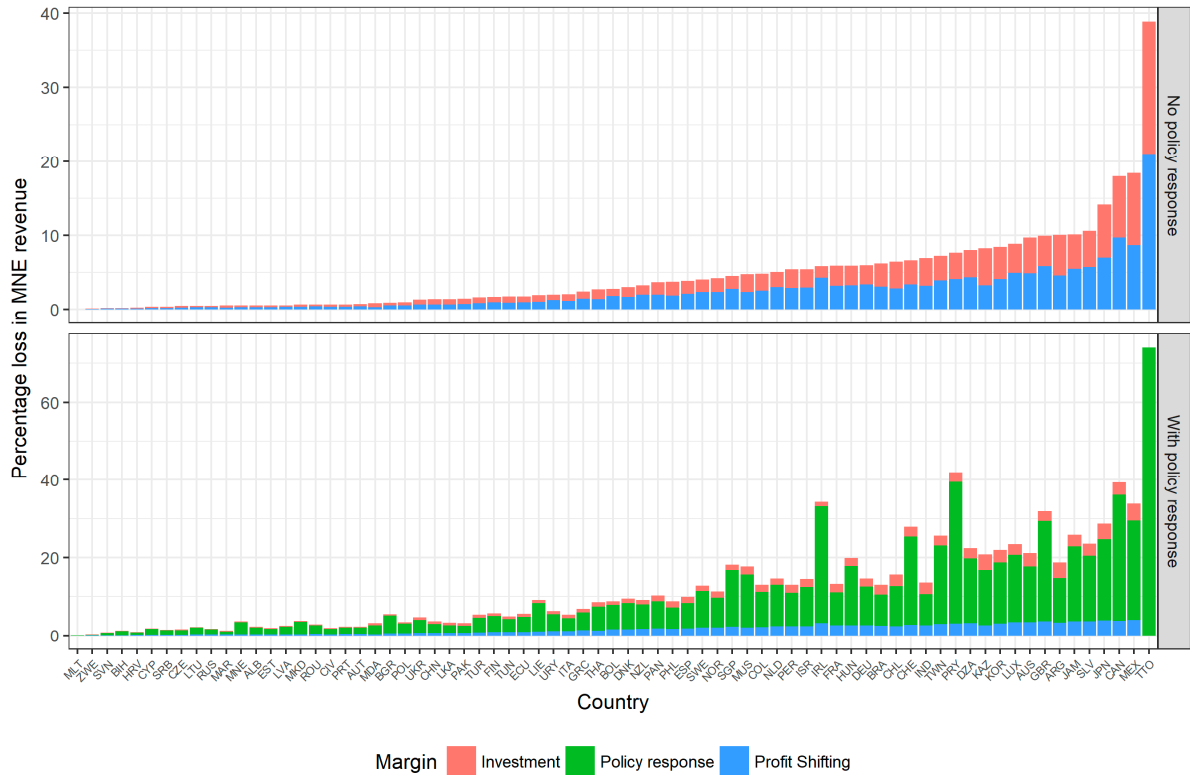
Source: Authors' estimates.

Table 6 and Figure 3 repeat the simulation using bilateral FDI weights. In general, FDI weights ascribe more importance to the U.S market, implying that the total revenue spillovers increase substantially. When neglecting policy responses, we find average revenue shortfalls of around 4.5 percent of MNE-related tax revenue. This figure increases to 13.5 percent when incorporating the policy response.

Table 6. Simulation Results, FDI Weights

Loss in MNE tax revenue (in percent) unless otherwise noted, due to	Mean	Median	Lowest Percentile	Highest Percentile
<i>No policy response</i>				
Profit shifting	2.4	1.69	0.24	12.87
Investment response	2.14	1.3	0.19	12.08
Investment response (in percent of capital stock)	3.84	2.7	0.06	20.59
Total change in MNE tax revenue	4.54	2.76	0.47	24.2
<i>With policy response</i>				
Profit shifting	1.48	1.28	0.21	3.4
Investment response	1.31	0.89	0.16	3.74
Investment response (in percent of capital stock)	2.49	2.08	0	6.26
Tax rate response	10.69	7.1	1.31	53.63
Tax rate response (in p.p. of tax rate)	2.12	1.49	0	18.5
Total change in MNE tax revenue	13.48	9.58	1.77	57.51

Source: Authors' estimates.

Figure 3. Spillovers on Tax Revenue, FDI Weights

Source: Authors' estimates.

The figures presented here should be interpreted with a healthy amount of caution. The range of elasticities found in the literature, both for profit shifting and investment, is very broad. Given this lack of precision, the reaction could be larger or smaller.

As there is particular uncertainty about the policy reaction, we further examine possible reactions. The simulations above used one set of weights for the profit-shifting, the real location, and the tax rate response decision margins. Most of the tax reaction function literature, however, has used GDP weights or sometimes inverse distance weights. Table 7 updates simulated policy responses for GDP weights (US\$ in market and PPP exchange rates) holding the reaction coefficient constant at 0.6. The difference in reactions across countries is then not very large, unlike with the weights used above. This is because the share of the United States in all countries, excluding the country under consideration, does not differ much: it is only slightly larger for countries whose own GDP is also sizable.

Focusing on GDP-weighted results and the full sample, Table 8 lets the reaction coefficient vary. It shows very clearly, that the size of the ultimate reaction will increase more than proportionally with the size of this coefficient. Given the large range of estimates of this coefficient in the literature and all the other changes, including the shift to territoriality which may affect reactions between other countries, the ultimate reaction is therefore subject to significant uncertainty.

Table 7. Estimated Tax Rate Reactions

Weights	Minimum	Mean	Maximum
<i>Full sample (182 economies)</i>			
GDP in US\$	3.8	3.8	4.1
GDP in PPP US\$	2.7	2.7	3.0
<i>Largest 30 economies</i>			
GDP in US\$	4.2	4.3	4.6
GDP in PPP US\$	3.2	3.3	3.5

Note: $\beta = 0.6$.

Source: Authors' calculation using WEO data.

Table 8. Estimated Tax Reactions by Coefficient, GDP weighted

β	Minimum	Mean	Maximum
0.3	1.3	1.4	1.5
0.4	2.0	2.0	2.2
0.5	2.8	2.8	3.0
0.6	3.8	3.8	4.1
0.7	5.2	5.2	5.4
0.8	7.0	7.1	7.3
0.9	9.7	9.7	9.9

Note: Full sample (182 economies), GDP weights.

Source: Authors' calculation using WEO data.

IV. SPILLOVERS FROM OTHER FEATURES OF THE TAX REFORM

Additional effects can be expected from the more complex aspects of the U.S. reform. Some of them reinforce the findings presented above, but others have the opposite effect, making it hard to conclude whether the estimates presented are upper or lower bounds.

A. Profit Shifting and Real Investment

FDII, GILTI, and BEAT are likely to lead to even more profits being reported in the United States than suggested by estimates based on tax rate changes. The size of this impact is hard to gauge. For example, any doubts that MNEs may have about FDII lasting over the medium term, would reduce its impact on their decisions regarding the location of intellectual property rights or other high-return investments.

GILTI and FDII may in some cases counter-intuitively increase incentives to invest in real capital outside the United States. Under GILTI this can occur, because foreign investment in tangible capital increases the tax-exempt amount, given the exemption set at 10 percent of such assets. Under FDII, the reason is that reducing tangible capital inside the United States increases the share of income benefit from reduced taxation.

Territoriality could lead to more investment abroad, as this reduces the tax rate on foreign investment. The move to territoriality may also lead to more profit shifting and more tax-sensitivity across third countries by U.S. MNEs.

The one-time tax on the existing stock of unrepatriated earnings is unlikely to have much real effect. It is essentially a windfall tax charged once, the level of which is independent of future behavior. Repatriation is deemed, but no actual return of funds is required or tax relevant. Moreover, as noted, much of these funds were held in U.S. treasuries, so while their status (and possibly the asset type) may change, there should not be significant cross-country flows. The eight-year payment window also reduces any cash-flow issues that some companies might face, and which could have led to disinvestment abroad.

B. Policy Spillovers

The many other changes in the U.S. tax code are also likely to affect other countries' policies. This could be through interaction with the tax rate changes. For example, expensing makes the United States a more attractive location for tangible investment (though this may be temporary, if investors believe in the announced phase out), and hence countries may react by reducing their tax rates more than if the depreciation scheme had remained unchanged. It could also be through direct reaction on the other measures. Staying with the example of expensing, other countries could also make their depreciation provisions more generous. There is some empirical evidence that countries do not only react to tax rates. Klemm and Van Parys (2012) show, for example, that there are also fiscal reactions on tax holidays—which are, however, not part of the U.S. reform.

The GILTI and FDII change the incentives created by the standard tax system and thereby create incentives for tax reform that vary strongly by country, depending on the type of investment they try to attract. Figure 4, from Chalk and Keen (2018) shows the optimal location decision of a U.S. MNEs focusing on the tax aspects (and ignoring for simplicity state taxes).

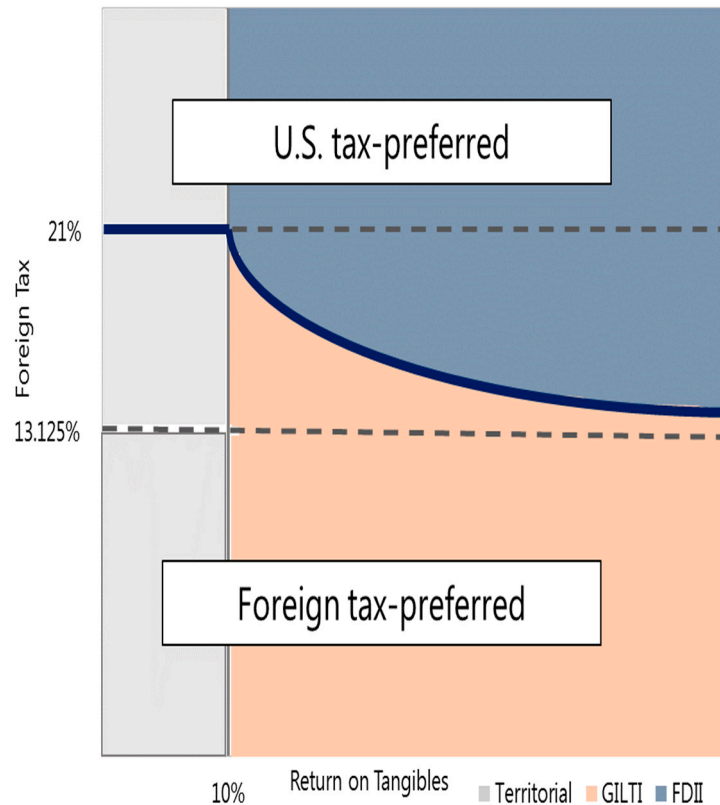
- Countries that focus on attracting tangible investment that typically has a low rate of return are not affected by the special provisions. In Figure 4 this is the case in the left most part of the figure, where the standard tax rates apply, as returns are not high enough to be liable for GILTI if producing abroad or to benefit from FDII if producing in the United States. These countries may prefer to offer generous depreciation allowances to encourage investment (and this will not affect the capital stock as calculated under GILTI).
- Countries whose main business model is to attract IP or other high-return on tangible capital investment from U.S. MNEs that choose between producing in the United States in or in their location, have an incentive to set a tax rate close to 13.125. As shown in Figure 4, the higher the return, the closer the rate needs to be to 13.125 percent to attract such capital. There is no need to cut below this rate—for low-tax jurisdictions there may even be scope to raise rates toward 13.125—as companies would also have to pay this rate if they relocated in the United States.
- Countries competing for U.S. IP or other high-return on tangible investment by firms that choose between various foreign locations rather than between the United States and one

foreign location, will also be affected by GILTI, but differently. For those countries, going below 13.125 (be it by cutting the main rate or offering a special regime to such investors) still makes them more attractive, but by much less than before the introduction of GILTI, because GILTI implies a minimum rate of 10.5 percent. Hence a country would have to give up on revenues corresponding to a 13.125 percent rate just to lower a U.S. corporation's rate on the GILTI part of its income by 2.625 percentage points. There are complications, though: First the tax base would need to be aligned with GILTI, as otherwise it would be much broader (given that typically countries do not exclude a 10 percent return). Second, as GILTI applies globally, it may not be binding for many U.S. firms that have a lot of capital globally or operations in high-tax countries. Those firms would still prefer to locate IP in countries with the lowest possible rate. Hence, without knowing more about which firms are affected and which firms countries wish to attract, there are great uncertainties about the impact.

- Countries that try to attract IP from many countries may not react much, so as not to jeopardize the investment from non-U.S. corporations.

As FDII makes the United States a more attractive location for keeping IP or other profitable export activity, other countries may react by expanding similar provisions rather than reducing their main rate. Patent boxes, for example, have already been expanding in recent years. In the EU and under BEPS they are now restricted by standards that require a link between the benefit and the expenditure underlying the research and development activity under a nexus approach. Other countries may be less constrained.

Figure 4. Optimal Location of Investment Leading to Foreign Sales



Source: Chalk and Keen (2018)

BEAT makes profit shifting out of the United States harder, and more broadly brings payments for related-party services into the U.S. tax base. Countries may react by implementing similar provisions to protect their tax bases. As BEAT predominantly applies to services and not costs of goods sold, another possible policy reaction is to encourage the location of production outside the United States, so that MNEs would then import goods with the value of the service already included.

Some of the other features of the reform may also affect the strategic interaction between third countries. Territoriality, as noted, raises the sensitivity of U.S. MNEs to tax rates, so tax competition among other countries may intensify. GILTI may have the opposite effect, at least on countries with very low tax rates: by imposing a minimum tax and thereby reducing the benefit of very low tax rates, it may reduce competition between countries with very low tax rates.

V. CONCLUSIONS

Apart from a tax rate cut, the recent U.S. CIT reforms contained many novel provisions. Their implications for corporate tax liabilities and tax planning continue to be much discussed among tax professionals. Some of these provisions, notably FDII and BEAT have caused a debate about WTO-compatibility. Avi-Yonah and Vallespinos (2018), for example, argue that FDII, with its link to exports, is likely to be a violation, while the case of BEAT is less clear. There are, moreover, clearly tax treaty issues, including with GILTI, given the incomplete foreign tax credit.²⁸ Apart from their legal consequence, they are likely to have complicated economic consequences. In most cases, they encourage more profit reporting in the United States, but they also have unexpected consequences, such as encouraging real investment outside the United States under certain circumstances.

The most clear-cut, and possibly largest, spillovers are still likely to be caused by the cut in the tax rate. As shown in this paper, they could lead to significant reallocations of tax bases and investment across countries. Depending on parameter assumptions, we find that reform will lead to average revenue losses of between 1.5 and 13.5 percent of the MNE tax base.

The finding of large spillovers should not be read as a criticism of the reform. This paper does not attempt to answer the question of whether any resulting allocation is more or less ‘fair’ or efficient than the previous one—which may in any case be an impossible question to answer. It simply attempts to describe, and as best as possible, quantify the main spillover channels. The large spillovers raise, however, the more fundamental question of whether reforms could be taken to make the international CIT system generally less prone to profit shifting and tax competition. Many recent attempts at curbing profit shifting (e.g., the G20-OECD BEPS initiative) are under way and further reforms are likely to be needed.

The paper has also discussed the likely policy reactions of other countries. To the extent that they actually take place, and tax rates elsewhere also fall (by on average around 4 percentage points

²⁸ In the United States national law has the same status as treaties, hence a newer national law can override a treaty. In case this leads to a breach of treaty, the law would still apply, but the other party could terminate the treaty.

based on tentative estimates), the effects on profit shifting and relocation of investment will be more muted, as relative tax rates will change less than in the static policy scenario, but the revenue impact will be greater. Some jurisdictions may still be affected very strongly, for example low tax jurisdictions, which will find it difficult, if not impossible, to maintain their relative attractiveness.

Despite many uncertainties, it seems very clear that further tax reforms, both in the United States and around the world are likely to happen in the near future. CIT rates have been falling for decades. In this respect, the U.S. reform is not unexpected, if anything it joined the trend surprisingly late.

So far, despite falling tax rates, CIT revenues have held up relatively well (Loretz, 2008). Initially revenues were supported by base broadening measures, though recently there is less scope for this²⁹—and the U.S. reform contained important base narrowing measures, such as expensing. It is questionable though whether rising corporate profits driven by a rising share of capital, can forever compensate for lower rates. Moreover, lower corporate tax rates may jeopardize personal income tax revenues, by increasing incentives for individuals to incorporate. Ultimately pressures on revenue can be expected and this can be expected to further increase the appetite for more fundamental reforms toward systems less prone to tax competition and profit shifting.

²⁹ A new data base on tax policy measures, described in Amaglobeli and others (2018) could be used to study such detailed reforms.

APPENDIX I. INCORPORATING SPECIAL PROVISIONS INTO EFFECTIVE TAX RATES

A. Basic Definitions and Notation

The following uses the Devereux and Griffith (2003) approach to defining effective tax rates, but with a permanent investment as in Klemm (2012). As in Klemm (2012), the EATR is defined as follows:

$$\text{EATR} = \frac{R^* - R}{p/(r + \delta)} \quad (11)$$

where R^* is the PDV of the economic rent earned in the absence of taxation, R is the same in the presence of taxation, p is the pre-tax net profit, r is the real interest rate, and δ is true economic depreciation.

$$R = \gamma \left(\frac{(p + \delta)(1 + \pi)(1 - \tau)}{\rho - \pi + \delta(1 + \pi)} - 1 + A \right) + F \quad (12)$$

$\gamma = (1 - m^d)/(1 - z)$ is a factor measuring the difference in treatment of new equity and distributions, with m^d the personal tax on dividends and z the accrual-equivalent tax on capital gains; τ is the corporate tax rate; π is inflation; $\rho = (1 - m^i)/(1 - z)i$ is the investor's discount rate, with m^i the personal tax rate on interest and i the nominal interest rate;³⁰ A is the PDV of depreciation allowances. F is a financial effect that applies for new equity (NE) or debt (D) finance (it is zero for retained earnings):

$$F^{NE} = (\gamma - 1)(1 - \tau\phi) \quad (13)$$

where ϕ is the depreciation allowance.

$$F^D = \frac{\gamma(1 - \tau\phi)(\rho - i(1 - \tau))}{\rho + \delta(1 + \pi) - \pi} \quad (14)$$

The special case of the EMTR is obtained by setting the post-tax rent R to zero and solving for the corresponding cost of capital (i.e., the for p , which is then marked by a tilde). The EMTR can then also be simplified to $(\tilde{p} - r)/\tilde{p}$.

B. The U.S. tax reform

The standard approach accommodates expensing and the lower tax rate without any need to adjust formulas. The interest deductibility limits, and the special provisions, however, require adjustments.

³⁰ Personal level tax rates are not taken into account in the calculations in the paper, but they are included here in the derivation to allow their potential inclusion by any researcher interested in their analysis.

Limits on interest deductibility

The new U.S. law limits interest deductibility to 30 percent of EBITDA (EBIT from 2022).

There are various analytically interesting cases (and even more cases in between as firms transition from one regime to the next, with further complications).

- Interest payments of a firm are well below 30 percent of profits, with no expectation that a new investment will change that, even if fully debt financed. Then the limit is not binding and the financial effect as in (14) applies.
- Interest is exactly 30 percent of profits on existing capital (or we consider a new firm). In that case, whether or not the limit is binding, depends on the rate of return relative to the interest rate, and the financial effect needs to be adapted.

$$F^D = \frac{\gamma(1 - \tau\phi) \left(\rho - i + \tau * \min(i, 0.3(p + \delta)(1 + \pi)) \right)}{\rho + \delta(1 + \pi) - \pi} \quad (15)$$

or, from 2022:

$$F^D = \frac{\gamma(1 - \tau\phi) \left(\rho - i + \tau * \min \left(i, 0.3((p + \delta)(1 + \pi) - \phi) \right) \right)}{\rho + \delta(1 + \pi) - \pi} \quad (16)$$

- Interest exceeds 30 percent by far. Then the interest on the new debt is not deductible. However, the increase in profits yields additional scope for interest deductibility:

$$F^D = \frac{\gamma(1 - \tau\phi) \left(\rho - i + \tau 0.3(p + \delta)(1 + \pi) \right)}{\rho + \delta(1 + \pi) - \pi} \quad (17)$$

FDII

FDII reduces the tax rate to τ^{FDII} , once the return on assets exceeds 10 percent. Strictly this is only valid on foreign earnings, so we assume 100 percent foreign earnings. Hence if the rate of return exceeds 10 percent (i.e., $(p + \delta)(1 + \pi) > 0.1$) equation (12) changes to:

$$R = \gamma \left(\frac{(p + \delta)(1 + \pi)(1 - \tau^{FDII})}{\rho - \pi + \delta(1 + \pi)} + \frac{0.1(\tau^{FDII} - \tau)}{\rho + \delta} - 1 + A \right) + F \quad (18)$$

Note that the 10 percent rate of return is applied to assets depreciated by the alternative depreciation system. Here we assume that the rate is equal to true economic depreciation, but it could in principle be different.³¹

³¹ A question arises about the timing of this depreciation. Equation (18) assumes that in the first year the 10 percent return applies to the full asset, in the second year to $(1 - \delta)$ and so on. One could also require the

(continued...)

Note that calculating the present discounted value of depreciation allowances can be quite complicated apart from extreme cases where FDII income is very high (and A is evaluated at the FDII rate) or very low (and A is evaluated at the standard rate).

The debt effect also needs to be adjusted, so as pick up the correct tax rate. Moreover, in the case of debt finance, equation (18) only applies if $(p + \delta)(1 + \pi) - i > 0.1$.

Because FDII is not determined individually for each investment, different cases, as in the debt limit, can be distinguished:

- If the company-wide rate of return is below 10 percent, and remains so despite the investment, then the usual effective tax rates apply with no adjustment.
- If a new project is considered that brings the rate of return above 10 percent, while the existing rate of return is below 10 percent, then the new investment benefits from the FDII rate, while the expensing reduces the tax base subject to the standard rate. In the extreme case—which is in practice probably not attainable—the present discounted value of depreciation would equal the standard tax rate, while any return on new investment above 10 percent would be taxed at the lower rate.
- If the firm is already in the FDII regime (i.e., returns already exceed 10 percent), the present discounted value of depreciation is only the FDII rate, while the new investment shifts more profit into the standard rate regime.
- If investment in intangible capital is considered (and there are no other profits at the standard rate), then the FDII rate applies to the entire return. The EMTR is zero.

GILTI

If only U.S. taxes are considered, GILTI can be incorporated into effective tax rates similarly to FDII. The only difference is that we replace τ^{FDII} by $\tau^{GILTI} = 0.105$, and we set $\tau = 0$.

The more interesting case is one including foreign taxes. When the foreign tax rate is sufficiently high so that there is no additional tax on GILTI, the standard formulae apply, and the standard tax rate needs to be set to the foreign rate. When GILTI is binding, however, the calculation is more complicated. Then the U.S. tax rate on GILTI applies, less 80 percent of foreign taxes paid. The difficulty is that the foreign tax that can be credited is calculated on a different base (not only do other countries not distinguish profits exceeding 10 percent of tangible capital from other income, they may also use different depreciation allowances). Another difficulty is that the provision applies on a global scale, hence it cannot be calculated for a single country (unless a company is active only in the United States and the one country under consideration).

depreciation be already taken in the first year in line with the treatment of standard depreciation. In that case, the second fraction in Equation (18) would need to be multiplied by $(1-\delta)$ in the numerator.

BEAT

For a typical investment, BEAT cannot be incorporated into the effective tax rate framework, as the share of costs that are nondeductible under BEAT is unknown.

APPENDIX II. DERIVATION OF THE ULTIMATE IMPACT OF A TAX SHOCK

Equation (7) can be rewritten as follows:

$$t_{ct} = \frac{\beta}{Y - (1 - \beta)y_c} \sum_{k=1}^N y_k t_{kt} + f_c + \varepsilon_{ct} \quad (19)$$

Then difference and consider a shock to the U.S. rate (the fixed effect drops out by differencing; the differenced error term is omitted for brevity):

$$\Delta t_{ct} = \frac{\beta y_{US}}{Y - (1 - \beta)y_c} \Delta t_{US,t} + \frac{\beta}{Y - (1 - \beta)y_c} \sum_{k \neq US} y_k \Delta t_{kt} \quad (20)$$

Solve for the sum in (20) using (19):

$$\begin{aligned} \sum_{k \neq US} y_k \Delta t_{kt} &= \frac{\beta y_i}{Y - (1 - \beta)y_i} \sum_{k=1}^N y_k \Delta t_{kt} + \frac{\beta y_j}{Y - (1 - \beta)y_j} \sum_{k=1}^N y_k \Delta t_{kt} + \dots \\ &= \beta \left(\sum_{k \neq US} \frac{y_k}{Y - (1 - \beta)y_k} \right) \sum_{k=1}^N y_k \Delta t_{kt} \end{aligned} \quad (21)$$

Rewrite (21):

$$\begin{aligned} \sum_{k \neq US} y_k \Delta t_{kt} &= \beta \left(\sum_{k \neq US} \frac{y_k}{Y - (1 - \beta)y_k} \right) y_{US} \Delta t_{US,t} \\ &\quad + \beta \left(\sum_{k \neq US} \frac{y_k}{Y - (1 - \beta)y_k} \right) \sum_{k \neq US} y_k \Delta t_{kt} \\ \Leftrightarrow \sum_{k \neq US} y_k \Delta t_{kt} &= \frac{\beta \left(\sum_{k \neq US} \frac{y_k}{Y - (1 - \beta)y_k} \right) y_{US}}{1 - \beta \sum_{k \neq US} \frac{y_k}{Y - (1 - \beta)y_k}} \Delta t_{US,t} \end{aligned} \quad (22)$$

(22) into (20):

$$\begin{aligned} \Delta t_{ct} &= \frac{\beta y_{US}}{Y - (1 - \beta)y_c} \Delta t_{US,t} + \frac{\beta}{Y - (1 - \beta)y_c} \frac{\beta \left(\sum_{k \neq US} \frac{y_k}{Y - (1 - \beta)y_k} \right) y_{US}}{1 - \beta \sum_{k \neq US} \frac{y_k}{Y - (1 - \beta)y_k}} \Delta t_{US,t} \\ &= \frac{\beta y_{US}}{(Y - (1 - \beta)y_c) \left(1 - \beta \sum_{k \neq US} \frac{y_k}{Y - (1 - \beta)y_k} \right)} \Delta t_{US,t} \end{aligned} \quad (23)$$

Divide by Y and define $\omega_c = \frac{y_c}{Y}$:

$$\begin{aligned}
\Delta t_{it} &= \frac{\beta \omega_{US}}{(1 - (1 - \beta) \omega_c) \left(1 - \beta \sum_{k \neq US} \frac{\omega_k}{1 - (1 - \beta) \omega_k}\right)} \Delta t_{US,t} \\
&= \mu_c \omega_{US} \Delta t_{US,t}
\end{aligned}
\tag{24}$$

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