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Revenue Implications of Destination-Based Cash-Flow Taxation

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We estimate the revenue implications of a Destination Based Cash Flow Tax (DBCFT) for 80 countries. On a global average, DBCFT revenues under unchanged tax rates would remain similar to the existing corporate income tax (CIT) revenue, but with sizable redistribution of revenue across countries. Countries are more likely to gain revenue if they have trade deficits, are not reliant on the resource sector, and/or—perhaps surprisingly—are developing economies. DBCFT revenues tend to be more volatile than CIT revenues. Moreover, we consider the revenue losses resulting from spillovers in case of unilateral implementation of a DBCFT. Results suggest that these spillover effects are sizeable if the adopting country is large and globally integrated. These spillovers generate strong revenue-based incentives for many—but not all—other countries to follow the DBCFT adoption.

I. INTRODUCTION

There is an intense debate about the vulnerability of current corporate income tax (CIT) arrangements to profit shifting practices by Multinational Enterprises (MNEs) and tax competition between countries. One approach to addressing these challenges is through reforms within the current system, such as by tightening anti-tax avoidance rules and enhancing tax transparency—e.g., through the G20-OECD Base Erosion and Profit Shifting (BEPS) initiative. Another approach is a fundamental reform of profit taxation that would resolve the vulnerabilities to profit shifting and tax competition.

One specific option for a fundamental reform is a destination-based cash-flow tax (DBCFT), occasionally referred to—slightly misleadingly—as a border-adjusted corporate income tax or a border-adjustment tax. The DBCFT was first proposed in Bond and Devereux (2002) and recently further analyzed in various papers (e.g., Auerbach et al. (2017a; 2017b)). Beyond the academic interest, in 2017 the U.S. congressmen Ryan and Brady proposed introducing a variant of the DBCFT in the United States.[2] While the U.S. tax reform in December 2017 ultimately did not include a DBCFT, the proposal triggered unprecedented policy interest in destination-based profit taxation.

The DBCFT has two components. First, a cash-flow component that enables full expensing of investment and denies interest expense deduction. This component ensures that the DBCFT is a tax on economic rents, leaving normal returns untaxed. Second, the border-adjustment component (i.e., destination-based principle) denies the deduction of imported inputs and excludes revenues from exports from the tax base. This shifts the tax from an origin to a destination base. The DBCFT is thus a rent tax collected at destination.[3]

The DBCFT triggered a discussion on a variety of matters. One much discussed issue is the impact on trade, given the taxation of imports and exemption of exports. Based on theoretical considerations, there should be no impact as changes in real effective exchange rates are expected to undo the impact of the tax.[4] Whether this applies fully in practice is subject to some debate.[5] Certainly under fixed exchange rates, adjustment will have to occur through the price and nominal wage level, which would take some time. Apart from the economic impact, there is

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[2] See: A Better Way Forward—Our Vision for a Confident America, Tax, June 24, 2016.

[3] There are other forms of a destination-based business profit tax. For example, Hebous and Klemm (2020) discuss a destination-based allowance for corporate equity (DBACE), including its revenue implications and how they deviate from those of a DBCFT in the short (greater revenue for the DBACE) and long run (no difference in present discounted value terms, but less volatility in case of a DBACE).

[4] This point is made in several papers. For a particularly clear exposition see, e.g., Auerbach (2017a).

[5] Barbiero et al. (2018), for example, argue that the dynamics of adjustment are complex and, depending on anticipation and the exact implementation of the reform, can be incomplete.

also a legal debate on implications under existing tax treaties and world trade rules (e.g., Avi-Yonah and Clausing, 2017).

The purpose of this paper is to contribute to the debate on the pros and cons of a DBCFT by shedding light on one very important empirical question: what are the revenue consequences of adopting a DBCFT? This analysis considers the impact of such an adoption on the DBCFT base and identifies country-characteristics that influence its size and thus revenue. It follows a macro-approach utilizing comparable national accounts statistics and other available macroeconomic aggregates for a panel of countries.

Theoretically, the implications for the tax base are ambiguous: One may be tempted to argue that since the CIT, in theory, taxes both normal return and rent while the DBCFT only taxes rent, the CIT base should be larger. However, many countries provide (often inefficient and ineffective) tax incentives, thereby giving up taxing (a portion of) normal or even supernormal returns. Moreover, MNEs avoidance and tax planning strategies are known to significantly erode the CIT base, especially in high tax countries. Additionally, interest expense deduction from the taxable corporate income can be sizable in some countries. All these factors imply that the actual reported CIT base is not necessarily larger than a destination-based rent tax.

The question should therefore be addressed empirically. Surprisingly, there are, thus far, no cross-country estimates, only estimates for the United States (Patel and McClelland, 2017). The present paper calculates potential DBCFT revenues using an estimated tax base constructed with national accounts data for 80 countries.

Initially, the paper calculates the revenue impact if the tax is applied globally. Our findings suggest that the level of DBCFT revenue, on a global average, is close to the current CIT revenue, given prevailing tax rates. However, a DBCFT significantly redistributes revenues across countries, given unchanged tax rates. In particular, countries with trade deficits, developing economies, and/or countries with less reliance on natural resources are more likely to gain (or lose little) revenue under a DBCFT. As a DBCFT is robust to profit shifting and tax competition, revenue losses can in many cases be offset or turned into revenue gains, by raising rates beyond what is currently feasible.

Regarding the revenue gains of countries with trade deficits, the long-term impact of the DBCFT can be different, as current accounts should balance over time.[6] To the extent that imports will be financed by future exports, current "winners" from the DBCFT that maintain a negative net international investment position (NIIP) could lose in the long-term, and vice versa.

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[6] Except if the currency is used as foreign reserve currency. Moreover, even under a balanced current account, trade imbalances can be financed from the income account, which also has tax consequences as will be discussed.

Additionally, we discuss further properties of DBCFT revenues regarding volatility, cyclicality, and the role of loss-making firms. Overall, we find that given the deductibility of investment, the volatility of DBCFT revenue is higher than the CIT, but with substantial variation between countries. Regarding cyclicality, the DBCFT could be expected to have a more procyclical impact, given the investment deductibility or a more countercyclical impact, given the immediate refunds of taxes on losses.[7] Empirically, it turns out to be more likely to have a procyclical effect, unlike the CIT which can play a role as an automatic stabilizer. Another effect of immediate tax refunds on losses is an increase in revenue risks from fraudulent and unsuccessful businesses.

Following the analysis of a global introduction, we also consider strategic interactions between countries resulting from unilateral adoption. Global adoption of a DBCFT would mean closing all (known) profit-shifting opportunities, as discussed for example in Auerbach et al. (2017b). DBCFT adoption by one country (or a small group) should, however, intensify profit shifting out of countries maintaining a CIT and also encourage moving rent-earning investment out of those countries. This is because the DBCFT reduces the tax rate on any profits shifted into a DBCFT-adopting country to zero, and also does not tax export-related rents of investors locating real capital in such a country. To shed light on this important issue, we estimate revenue spillover effects from a DBCFT country to the rest of the world. We find that spillover effects are sizeable if the implementing country is large and globally integrated and are pronounced for its major foreign partner countries. The spillovers can be large enough to prompt several countries to follow the DBCFT country in adopting a destination-based tax, leading to second round effects on remaining origin-based countries.

The rest of this paper is structured as follows. Section II discusses how the DBCFT base and revenue can be estimated from available data. Section III presents our results and discusses the factors that determine which countries are likely to gain or lose revenues and possible revenue risk factors. Section IV relaxes the assumption of global adoption and discusses the implication of unilateral adoption by one country. Section V concludes.

II. ESTIMATION METHODOLOGY AND DATA

A. The Tax Base of the DBCFT

A tax base can be estimated using a top-down approach or a bottom-up approach. The latter is particularly useful for simulating the CIT base and requires detailed administrative tax return data. Commercial (accounting) data can be misleading because in many countries financial accounting conventions differ in important aspects from tax accounting rules, for example, on depreciation, or the treatment of past losses. Using national accounts for simulating the CIT base is even more challenging, because these statistics average out profits and losses and do not take into account losses carried forward. Moreover, the concept of operating surplus is different from

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[7] We assume introduction of a pure DBCFT. The U.S. proposal did not include this feature.

profits under both an accounting and tax definition, notably because it is gross of interest. Still, economists have tried to estimate tax bases from national accounts, not least because other data—especially administrative data—are not publicly available in many countries.[8]

Fortunately, however, for simulating the DBCFT base, available national accounts data are much more suitable, because they are very close to the definition of the DBCFT base: (i) a DBCFT does not allow interest to be deducted, so using gross operating figures which are gross of interest is an advantage; (ii) a DBCFT should be symmetric to be functional, i.e., tax refunds should be paid to loss-making firms, implying that the use of aggregate profit data that nets out profits and losses of different firms is appropriate;[9] and (iii) as depreciation is not deductible under the DBCFT, there is no concern about any potential differences between tax and accounting depreciation rates. Thus, national accounts data—which are available for many countries—provide useful information for estimating the DBCFT base.

There is more than one possible way of estimating a DBCFT using aggregate statistics. The most straightforward—and as it turns out the one providing the greatest number of observations—is as follows: We start with the nonfinancial[10] corporate gross operating surplus (Π). As this is gross of depreciation (or capital consumption in national account terminology), there is no need for any related adjustment. To obtain the tax base of a cash-flow tax, corporate investment (I) needs to be deducted. To implement the border adjustment, imports (M) are added and exports (X) deducted. Revenues (R) can then be estimated by multiplying the base by the tax rate (τ):

$$R^{DBCFT} = \tau(\Pi - I + M - X) \tag{1}$$

Note that the tax rate is the statutory rate—including and local rates, where applicable—rather than an effective tax rate, because under a DBCFT depreciation allowances, interest deductibility, and other tax rules would be abolished. Of course, if a country were to keep some special regime, be it a deduction from the tax base or a reduced rate, this would have to be reflected.

Depending on data availability, equivalent calculations could be undertaken. The tax base could be defined starting with gross value added (VA), deducting investment and compensation of employees (CE), and then adding the border adjustment (Equation (2)). Another option would be to start with aggregate final domestic retail sales (S), i.e., excluding revenues from exports and

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[8] See Ueda (2018) for a discussion of the relationship between national accounts concepts and CIT bases.

[9] Carry-forward, even with interest, would not be effective, because some firms, notably exporters, are likely to be in a systematic tax loss position and would not benefit from it.

[10] In principle, Equation (1) should add deposit and transaction fees and other non-interest income since these would remain taxable under a DBCFT whereas cost of employment in the financial sector should be deducted. However, for most countries, as both effects are in opposite directions, they would likely (to a large extent) offset making a potential bias rather negligible (possibly except for a few financial centers). Internationally comparable data on the subcategories of financial fees and cost of employment in the financial sector are not available for most countries.

intermediate goods, and deduct compensation of employees (Equation (3)). In practice, these approaches, especially the latter yield fewer observations than those under Equation (1) and thus are not used in the empirical analysis.

$$R^{DBCFT} = \tau(VA - I - CE + M - X) \tag{2}$$
$$R^{DBCFT} = \tau(S - CE) \tag{3}$$

Irrespective of how revenues are estimated, we define the change in revenue as the difference between actual CIT revenues and estimated DBCFT revenues:

$$\Delta R = R^{DBCFT} - R^{CIT} \tag{4}$$

The use of actual CIT revenues in this comparison has the advantage that it reflects all complicated aspects of the CIT system that could not be modelled. Under the DBCFT, assuming a clean introduction, there would be no such complications. One disadvantage of comparing actual to theoretical revenues, however, is that actual CIT revenues also reflect compliance. The DBCFT revenue measure, however, implicitly assumes full compliance (at least to the extent that national accounts items are not mis-measured because of noncompliance with the current system). Compliance is likely to be higher under a DBCFT than the current CIT, because there are fewer margins available to companies to reduce tax liabilities. Sales are very hard to falsify, and the border adjustment removes international profit-shifting opportunities. Nevertheless, compliance is unlikely to be full, as some options, such as cross-border shopping, would continue to exist and immediate tax refunds may open the door for tax fraud schemes. The estimate of revenue changes may therefore be slightly biased upward.

B. The Impact of Profit Shifting

The estimates calculated from the approach above do not take into account that moving to a different tax base would also change behavior. A particularly sizable and rapid response can be expected on profit shifting, which will be analyzed in greater detail. An impact on real investment decisions can also be expected with a change to a neutral tax system. The size of that change is, however, difficult to gauge.[11] Even the sign is ambiguous, as current tax systems discourage equity-financed investment, but often subsidize debt-financed investment, so moving to a neutral system could boost or reduce the capital stock, depending on the marginal source of funding in a given country. Both channels also interact: profit shifting reduces the cost of capital and hence encourages investment. In high tax countries this is the case, because firms know that they can avoid some of the tax. In low-tax countries this is the case because locating investment

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[11] See Carton, Fernandez-Corugedo, and Hunt (2019) for an analysis of the impact on investment using a multi-region forward-looking DSGE model.

there may facilitate profit shifting from operations in high-tax countries.[12] Both effects that would disappear under a DBCFT.

Under global adoption, a DBCFT would remove any incentive for profit shifting. However, as the current tax system encourages profit shifting, the removal of such incentives would change behavior. Another way to think about it is to consider current macroeconomic statistics, on which our estimates rely, as contaminated by profit shifting. For example, low tax jurisdictions can be expected to have overstated trade balances, because the prices of exported goods likely tend to be exaggerated, and the prices of imported goods understated.

Auerbach (2017b) argues that this is not a concern, because any mismeasurement of the trade balance resulting from profit shifting would also affect measured GDP (or the underlying operating surplus in equation (1)). The two effects cancel out in estimating the tax base of a DBCFT so that unadjusted figures can be used—which is what we do in most of our reported estimates.[13]

C. Data

Data for gross operating surplus and investment are taken from the OECD wherever possible. Specifically, these are the series: gross operating surplus (nonfinancial accounts, generation of income account, gross operating surplus and mixed income) and investment (gross fixed capital formation – corporations). To extend the sample, data for additional countries are taken from the United Nations Statistics Division.[14] The UN publishes data from countries calculated using different vintages of the methodology. We use the newest vintage as the starting point, extending the data backward with older vintages by splicing it using the ratio of the most recent common year.

Data for current revenues are taken from the World Revenue Longitudinal Database (WoRLD). Corporate income tax rate data are taken from the IMF FAD Tax Policy Rates Database and include any local or surtaxes. Data for exports and imports as well as some control variables are taken from the latest published version of the WEO (Spring 2018).

The resulting sample contains data on operating surplus and investment for 80 countries and data for CIT revenues for 73 countries. However, the number of years available vary substantially and do not always overlap. The year with the most observations is 2011 where we can compare

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[12] See Klemm and Liu (2019) for a discussion and further references.

[13] Despite the theoretically compelling argument by Auerbach, if data on the gross operating surplus are collected differently from trade data, then changes in profit shifting could affect measures of both items differently. As a robustness check, we therefore repeat the analysis in this paper, with data that are published by Tørsløv, Wier, and Zucman (2018) published data corrected for profit shifting. While there is an active and so far unsettled debate about the validity of recent profit shifting estimates(Blouin and Robinson, 2020), we have used those adjusted data as a robustness check and obtained very similar results from those on unadjusted data.

[14] United Nations Statistics Division: National Accounts Official Country Data: Non-financial corporations.

63 countries directly. A relatively large and wide balanced panel covers the years 2002 to 2011, for which there are data for 48 countries. This 10-year panel forms the basis of most of the comparisons over time and is described in Table 1 through selected statistics. Because of data availability, some calculations are made on different sample, which is then indicated in the relevant figure/table headings.

Table 1. Descriptive Statistics for Balanced 10-year Panel
(in percent of GDP, unless otherwise noted)

Variables	Observations	Mean	S.D.	p5	Median	p95
Imports (M)	480	45.7	24.1	17.4	39.9	81.5
Exports (X)	480	45.6	27.2	16.8	40.3	83.5
Investment (I)	480	13.8	4.5	6.6	13.4	22.0
Gross operating surplus (Π)	480	26.2	6.1	17.5	25.3	37.8
CIT revenue (R^{CIT})	480	3.3	1.7	1.4	2.9	6.3
Tax rate (τ) (in percent)	480	26.8	7.3	15.0	28.0	38.9

Source: Authors' calculations.

III. RESULTS UNDER GLOBAL ADOPTION

A. Estimated Revenues

We find—maybe surprisingly—that on average across countries and years, revenues from the DBCFT would be close to those obtained from the current CIT. However, there are substantial differences between countries, creating winners and losers. The sample is distributed such that around a third each would lose substantially, stay at around the same level, and gain substantially. Some countries would even end up with negative revenue from compensating tax losses. As shown in Figure 1, countries that stand to gain the most are Guatemala, Mexico, Honduras, Greece, and the United States. On the losing side are Luxembourg, Norway, Kazakhstan, China, and Cyprus. In the following analysis, we will investigate the factors determining these differences in outcomes.

For the United States, we can compare our results to a study by Patel and McClelland (2017) who use U.S. tax return data to simulate the DBCFT base. They find that the domestic cash-flow tax base is similar to the existing CIT base. However, once the border-adjustment is taken into account, the DBCFT base is significantly higher, in line with our result.

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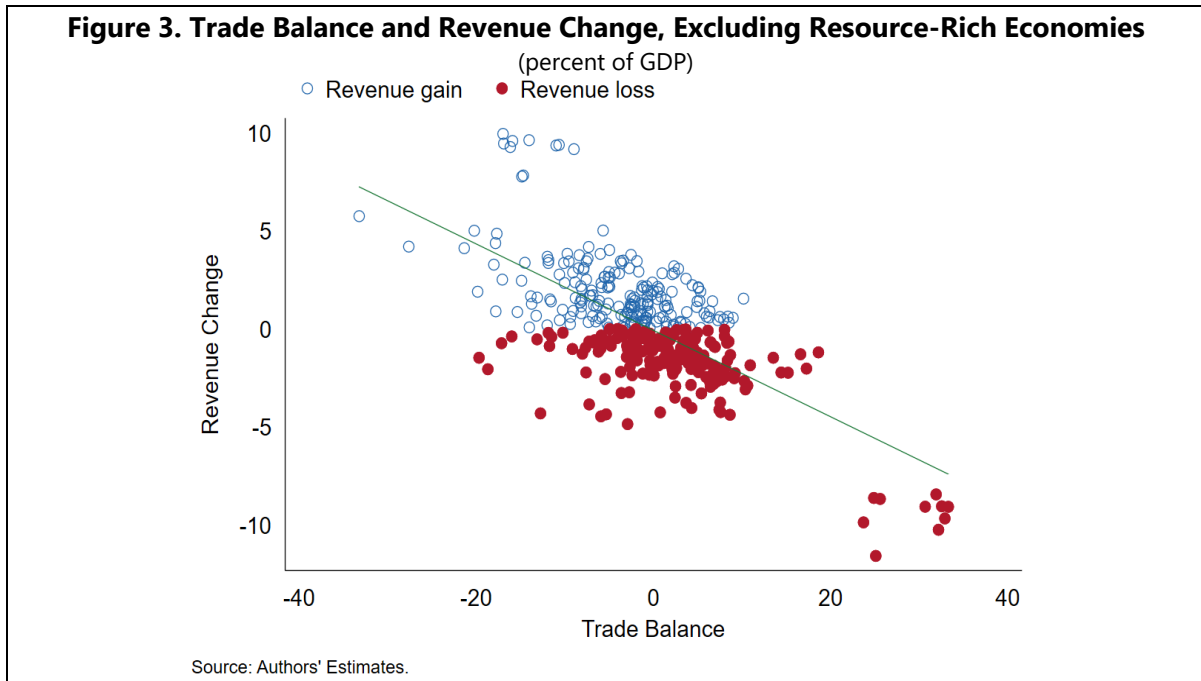**Figure 1. DBCFT and CIT Revenues, (Averages over 2002-2011)**

Source: Authors' Estimates.

In the sample period, the share of countries that gain from a DBCFT is relatively stable at about 52 percent, on average representing 70.6 percent of total GDP in the sample. The fraction of years for a country that would yield revenue gains from a DBCFT is approximately 50 percent, on average. However, this average value masks cross-sectional heterogeneity as some countries benefit in most or all years (such as the United States) while others lose in most years (such as Switzerland and Luxembourg). Also, in some cases, a country may switch "status" from a loser to a gainer but the with a little gain.

Another way to illustrate the issue is by considering the tax rate that would need to be charged under a DBCFT to maintain the same revenue as under the current system. Remembering that under DBCFT, the tax rate is irrelevant for location decisions of firms, countries would arguably be able to raise rates compared to the current ones. Tax rates that would maintain revenues in 2011 are shown in Figure 2. This reveals that for two thirds of all countries, the change in rate would be negative or a small increase. Almost 90 percent of countries would be able to maintain revenues with rates of no more than 40 percent. However, for the remaining countries, revenue-neutral rates would be very high, so that this is not a realistic option, although the feasible maximum rate is likely much higher than under the current system. Moreover, as seen in Figure 1, some countries would have negative tax bases, which would not allow maintaining revenues at any rate.

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Figure 2. Revenue-Neutral Tax Rates in 2011

Note: Countries with negative tax base are not included.
Source: Authors' Estimates.

Low tax jurisdictions are expected to lose revenues from switching from current CIT arrangements to a system without (or with significantly less) profit shifting. The reason is that currently these countries attract profits from other countries without necessarily attracting the underlying real production (at least there is some foreign profit in low tax countries that is not generated by domestic production). Consistently with this prediction, results in Figures 1 and 2 suggest that well-known "investment hubs" (such as Cyprus, Ireland, Luxembourg, and Switzerland) tend to have a lower tax base under a DBCFT compared to the current CIT base. However, the tax attraction of such jurisdictions is not necessarily reflected by the statutory CIT rate, for example, because of preferential tax regimes.

The Role of Trade Balances and Border Adjustment

Because imports are taxed and exports exempted under the DBCFT, in terms of tax revenue trade deficit countries would be expected to gain from DBCFT adoption, whereas trade surplus countries would lose. As shown in Figure 3, this is indeed true on average, with a clearly negative relationship between the trade balance and the revenue change. Nevertheless, there are still many individual cases where a trade surplus country would gain revenue and vice versa, because the other factors outweigh the effect from the trade balance. For example, a country with a trade surplus, but that is currently losing significant revenues from profit shifting, could potentially gain from a DBCFT.

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Figure 3. Trade Balance and Revenue Change, Excluding Resource-Rich Economies
(percent of GDP)

As shown in Figure 4, the impact of the border adjustment far dominates the impact of moving to a cash-flow base, both in trade surplus and trade deficit countries, although obviously in opposite directions. Even the cash-flow component has opposite effects, reducing the tax base in trade deficit countries and raising it in trade surplus countries. This pattern is in line with higher investment (which is deductible) in trade deficit countries, which can be expected, given that a negative balance of payments implies investments exceeding savings. However, as under a destination base, imported investment goods would not be deductible, it is not surprising that this tax base-reducing effect does not hold after the border adjustment.

Figure 4. Border Adjustment versus Cash Flow Component of Revenue Change
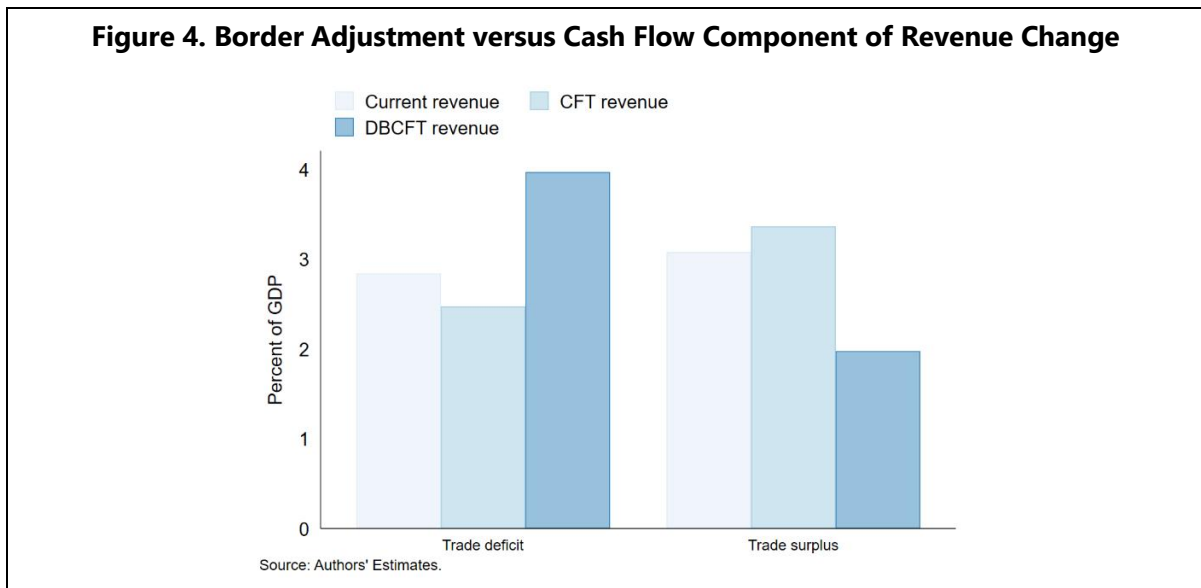
Advanced and Developing Economies

An important question in evaluating the effect is the distribution of gains and losses between advanced and developing economies. A priori, the relative impact on developing countries is ambiguous. Given their higher growth rates, they can be expected to be capital importers running trade deficits, which would raise revenues—although in practice developing countries are often capital exporters. Moreover, tax incentives are particularly common in developing countries (see for example, Abbas and Klemm (2013)); replacing them with a clean cash-flow tax would be more likely to broaden the base than in advanced economies. On the other hand, developing countries often rely heavily on the resource sector and the taxation of location-specific rents. While we exclude those countries most reliant on resource revenues (which are analyzed further below), it is still likely that the share of revenues from the resource sector is higher in developing economies.

As shown in the left panel of Figure 5, developing countries would on average be beneficiaries of a move to a DBCFT. Moreover, as shown in the right panel, there is a more general tendency that advanced economies lose more revenue. Among both types of economies there is a wide range covering revenue winners and losers.

Figure 5. Revenues by Income Group and Level

Source: Authors' Estimates.
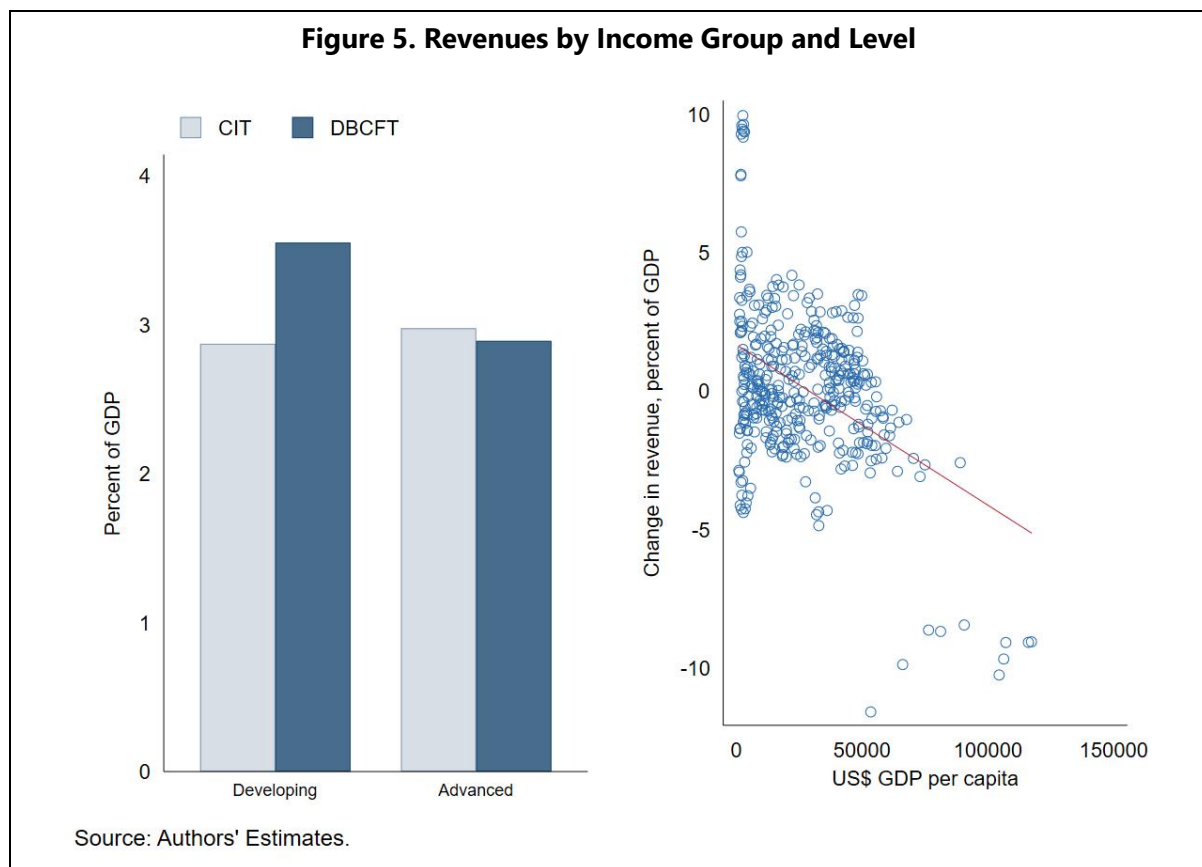
As the balanced sample used for these charts does not include that many developing countries, we also repeated the same analysis on a wider unbalanced sample, which yielded the same result. One note of caution regarding developing economies is that the assumption of full compliance might be particularly problematic for them.

Natural Resources

Natural resources—and in principle any other location-specific rents—can be taxed efficiently at source. Profit shifting in this sector is still a major issue in many (especially developing) countries. Taxing location-specific rents on a destination basis can be expected to dramatically reduce revenues in resource-rich economies. However, there are counterarguments.

First, if the CIT is replaced by a DBCFT, any additional sector-specific taxes could continue to apply, and there would be no reason for those to be switched to a destination principle. Natural resources are subject to location-specific taxes as well as CIT, of which only CIT would be affected by the change to DBCFT. The sum of origin-based (non-CIT) taxes and revenues make up an important source of revenue in many natural resource rich countries. These include, for example, efficient rent taxes or simple volume-based taxes such as production royalties and other revenue arrangements such as production sharing agreements. The revenue loss would therefore be limited to CIT collected from this sector. Countries wishing to maintain the same level of revenue from the resource sector could raise their sector-specific taxes.[15]
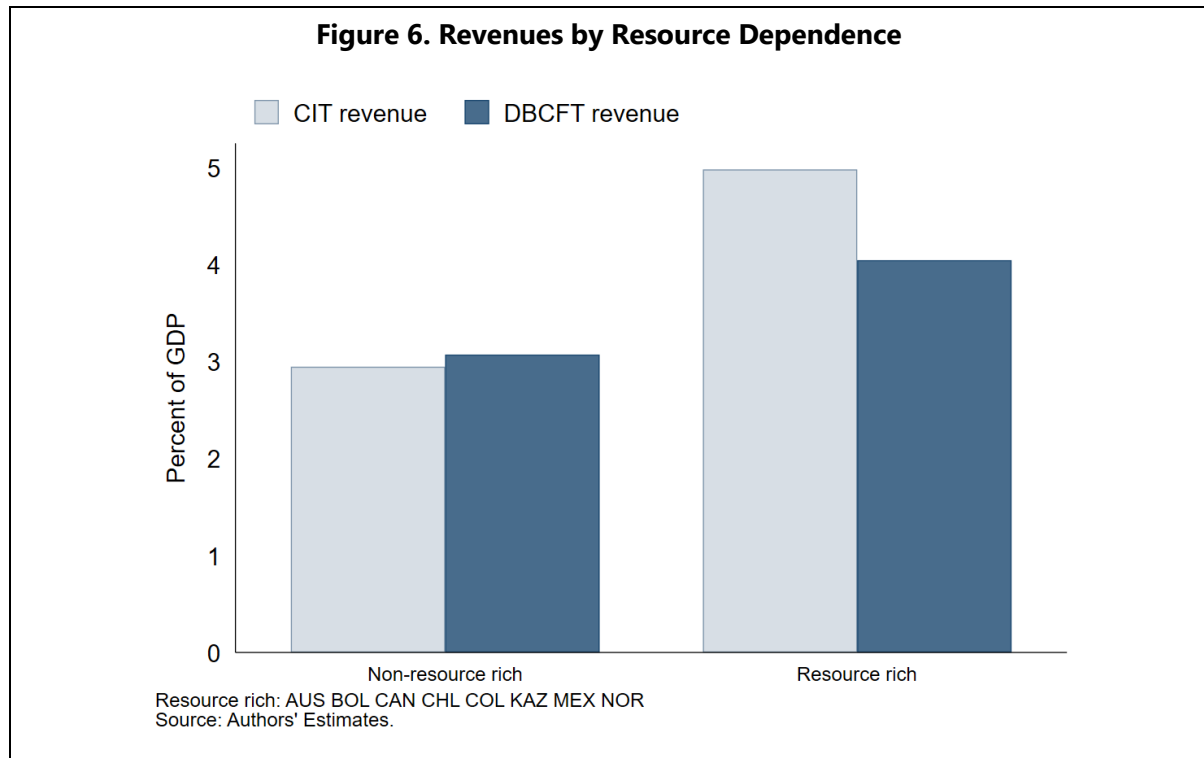
Second, just because the DBCFT is collected at the destination, it does not follow that its incidence will also occur at the destination. It will depend on whether investors exploiting the resource are residents and when and how they spend their gains:

- If a resident investor exploits a natural resource, then the rent obtained will show up as a stronger trade balance. For the external accounts to balance, this will require imports to rise too (at least ultimately, temporarily the proceeds could be invested abroad—see below for a discussion on trade balance reversals). The imports are, however, taxed, so ultimately revenue will be same as if collected on an origin basis. Another way to think about this is to use the result that the DBCFT is incident on consumption financed out of non-wage income (Auerbach et al., 2017a), including rents from exploiting natural resources.

- If a foreign investor exploits the resource, the rent would equally boost the trade balance. In this case, however, as there is an offsetting outflow on the income balance, the overall balance of payments need not adjust, and no tax is collected in the country where the resource is located (and revenue may be lost if there are deductible costs).

Overall then, resource-rich countries should be expected to lose revenues to the extent that rents in this sector are earned by non-residents. As shown in Figure 6, resource-rich countries would in

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[15] See Daniel, Keen, and McPherson (2010) for options on efficient resource-sector taxes.

practice lose revenues on average. It should also be noted, though, that if the graph is done with the entire (unbalanced) sample, which increases the number of resource rich countries, the difference in gains or losses disappears, so this finding is not very robust.

Figure 6. Revenues by Resource Dependence

Resource rich: AUS BOL CAN CHL COL KAZ MEX NOR
Source: Authors' Estimates.

Combined Analysis of Revenue-Determining Factors

As all the discussed factors behind revenue gains and losses interact, it is useful to undertake a multivariate regression analysis to identify the main correlations. Moreover, using country and year fixed effects estimation on panel data allows us to control for any unobserved country-specific differences and common shocks.

Table 2 shows that the most important determinants of the revenue gain from moving to a DBCFT are the trade balance, the investment rate, resource rents, and income levels—which all reduce the revenue gain from moving to a DBCFT. This finding holds both in parsimonious regressions (regressions (1) through (3)) and those with more simultaneous control variables (regression (5)). While the income level is important in determining the revenue gain (regressions (3) and (5)), there is no evidence that the relationship between the revenue gain and the most significant explanatory variables is different in advanced economies (regression (4)).

Table 2. Change in Revenue and Explanatory Variables

	(1)	(2)	(3)	(4)	(5)
Trade balance	-0.227***	-0.171***	-0.220***	-0.260***	-0.184***
	(0.028)	(0.028)	(0.026)	(0.026)	(0.028)
Investment	-0.263***	-0.237***	-0.248***	-0.311***	-0.243***
	(0.043)	(0.048)	(0.043)	(0.042)	(0.044)
Resource rents		-0.087**			-0.082**
		(0.038)			(0.038)
GDP per capita			-0.686*		-0.671*
			(0.359)		(0.379)
Investment*Advanced				0.123	0.048
				(0.082)	(0.099)
Trade balance*Advanced				0.090	0.030
				(0.058)	(0.062)
Observations	1,097	889	1,097	1,097	889
R-squared	0.434	0.374	0.443	0.445	0.387
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Number of countries	73	71	73	73	71

GDP per capita is logged. All other variables are in percent of GDP. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
Source: Authors' Estimates.

B. Further Considerations

Trade Balance Reversals

In principle, countries cannot continually record current account surpluses or deficits. Balance of payment deficits will add to foreign liabilities until an adjustment takes place and extended trade deficits are expected to be followed by future trade surpluses. Hence, countries that would gain revenue from a DBCFT on introduction (in the short-term) because of their trade deficit are in general expected to lose some of the revenues in the future. While answering the question of how much and how fast the trade balance should change in the future to satisfy solvency conditions is beyond the scope of this paper, we illustrate the impact of this adjustment on the long-term gains from a DBCFT.

Recall, the NIIP in year t can be expressed as a period-by-period resource constraint in an open-economy as follows:

$$NIIP_t = X_t - M_t + (1 + r_t)NIIP_{t-1,} \tag{5}$$

where r_t is the interest rate on external assets and liabilities. From this, under standard simplifying assumptions in the literature (e.g., Bohn, 2007; Durdu et al., 2013), it can be shown that the intertemporal resource constraint can be formulated as:

$$NIIP_t = -\sum_{t=1}^{\infty} \rho^i E_t (X_{t+i} - M_{t+i}),$$

(6)

where $\rho = \frac{1}{1-r}$. Equation (6) states that, in present-value terms, expected future trade surpluses equal the current value of outstanding net liabilities vis-à-vis the rest of the world. Thus, if today a country 's NIIP is positive and the trade balance is positive the country is expected to run a trade deficit in the future. This implies that while the country would initially lose from a DBCFT, it would gain revenue as the trade balance adjusts. Note, the change in the revenue due to the border adjustment is given by $\tau(M_t - X_t)$. To illustrate, such a case is depicted in the upper right quadrant of Figure 7, and the opposite case is in the lower right quadrant (i.e., countries that would benefit today from a DBCFT, but the effect is expected to reverse in the future). There are four quadrants in Figure 7. The vertical line separates the trade surplus from the deficit countries, which provides a good (albeit not perfect) indication of likely short-term revenue loss or gain. The horizontal line separates the positive NIIP countries from the negative NIIP countries indicating long-term impact. Below this line, countries have a greater chance of losing revenues in the future as they are expected to run trade surpluses. Figure 8 then populates the same quadrants with data and reveals both the current and likely future path of DBCFT revenues for the countries in the sample.

An interesting observation that follows from this is that if the DBCFT were introduced at the beginning of time, when all country had an NIIP of zero, then one could expect gains and losses from trade balances would even out over the years. However, given that introduction would occur with some legacy NIIP, it means that countries that have accumulated foreign assets in the past never gave up revenue, but will stand to gain from the trade deficits that they can finance from their strong income balance, and vice versa.

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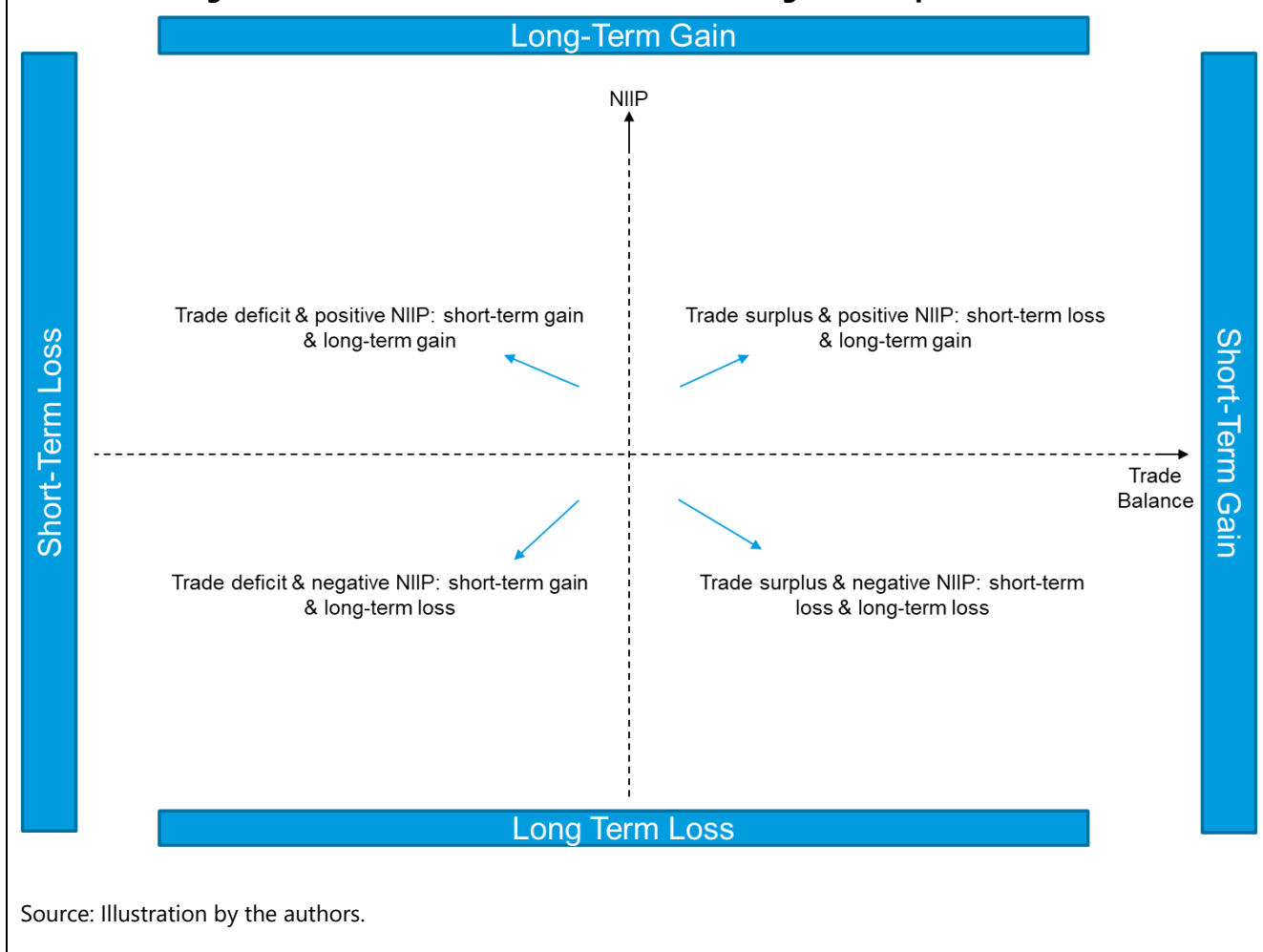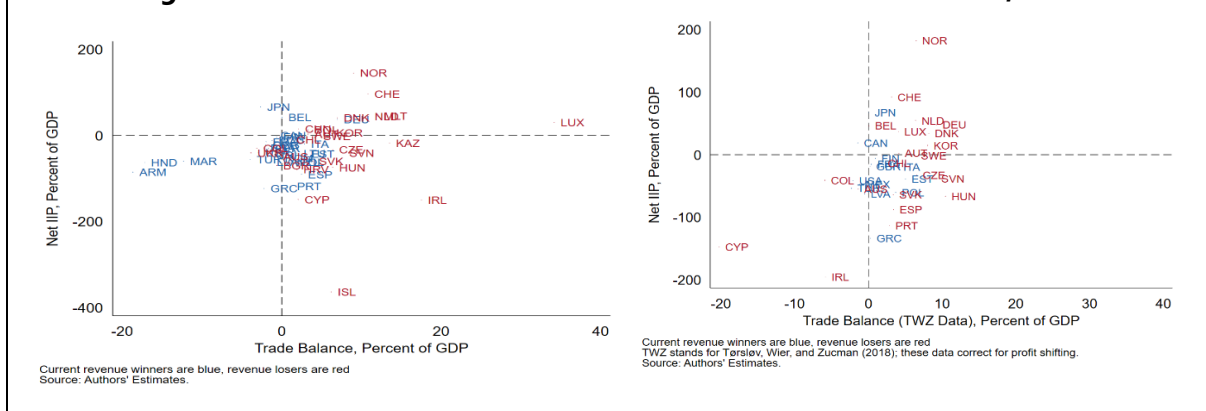## Figure 7. Trade Balance and NIIP: Short- vs. Long-Term Impact of DBCFT

Long-Term Gain

Short-Term Loss

Short-Term Gain

NIIP

Trade deficit & positive NIIP: short-term gain & long-term gain

Trade surplus & positive NIIP: short-term loss & long-term gain

Trade Balance

Trade deficit & negative NIIP: short-term gain & long-term loss

Trade surplus & negative NIIP: short-term loss & long-term loss

Long Term Loss

Source: Illustration by the authors.

Figure 8. Trade Balance and Net International Investment Position, 2014

Current revenue winners are blue, revenue losers are red
Source: Authors' Estimates.

Current revenue winners are blue, revenue losers are red
TWZ stands for Tørsløv, Wier, and Zucman (2018); these data correct for profit shifting.
Source: Authors' Estimates.

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There are various reasons, though, why future trade balances may follow a different path than expected under Equation (6). First, current trade statistics can be contaminated by profit shifting practices, particularly with a pronounced effect in the case of international trade with services (Hebous and Johanessen, 2020). This implies that the trade balance in very low tax jurisdictions is likely to be overestimated (overstating exports and understating imports), and the opposite occurs in high tax countries. To shed more light on this issue, the right panel of Figure 8 use trade balance data that correct for profit shifting from Tørsløv, Wier, and Zucman (2018). Admittedly, it is challenging to precisely correct trade statistics for mispricing. Still, these numbers are indicative. In the right panel of Figure 8, countries such as Ireland and Cyprus move to the bottom left quadrant as after correcting for profit shifting their trade balances switch from a surplus to a deficit. As argued above, this should not affect the estimated DBCFT base, but it does mean that trade account reversals may be of different size than indicated by unadjusted figures.

Second, the NIIP may also change as a result of valuation gains or losses, which are ignored in the equation and hard to predict. Third, while Equation (6) assumes that only the NIIP matters for the income balance, in practice returns on assets could be very different from those on liabilities. For the United States, for example, it is documented that the rate of return on its international assets is larger than the rate of return on its international liabilities, meaning that even with a negative NIIP, foreign income can be positive and finance a permanent current account deficit. Moreover, countries that issue reserve currency could permanently run deficits, financed by the demand for such currency by other countries.

Volatility

While the analysis so far has focused on the amount of revenue raised, another important consideration is the stability of revenues. The DBCFT can be expected to be more volatile than a standard CIT, because investment, which is a flow variable, will vary more over the cycle than depreciation, which is linked to a stock and averages out the flows of various past years. Another reason for expecting greater revenue volatility is the immediate refund of tax on losses, while most current CIT systems merely allow the carry forward (or very limited carry back) of losses, smoothing revenues over time. The impact of the border adjustment is less clear: in countries where the economic cycle is strongly dependent on demand from the rest of the world, the non-taxation of exports could reduce volatility, but in countries where domestic demand is more volatile, not taxing export earnings could increase volatility.

To assess this empirically, we calculate the standard deviation of tax revenues under both systems. Figure 9 presents the results and shows that the DBCFT is indeed more volatile on average, but not in every country. These results were calculated for the longer panel to allow calculation of the standard deviation of a longer period. Calculated on the shorter and wider panel, the difference between both average standard deviations is much smaller.

Figure 9. Standard Deviation of Annual Revenue, 2000-2014
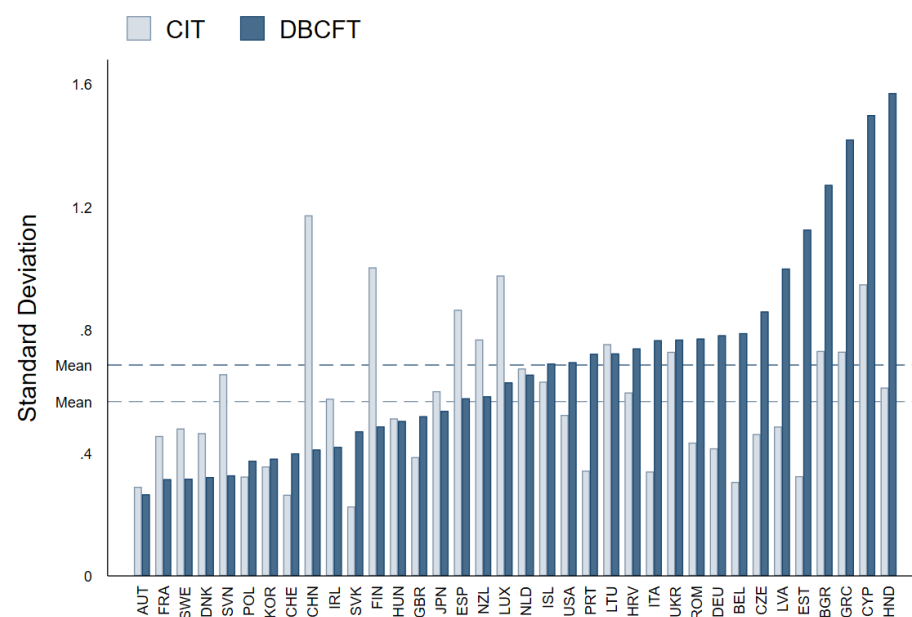
Source: Authors' Estimates.

Cyclicality

Another important consideration in assessing a tax is its revenue performance and its cyclical impact. There is a natural tension between the aim to have taxes with countercyclical impact, i.e., those whose revenues rise in booms and decline in recessions,[16] and with the need for regular revenue provision discussed above. Countries may place more importance on one or the other feature, depending on their circumstances, but both need to be considered in evaluating a tax.

The CIT, as a tax on profit, acts as an automatic stabilizer, because profits are highly cyclical. On one hand the DBCFT may weaken this aspect, because investment, which is highly cyclical, is deductible, reducing tax payments during boom times. On the other hand, the immediate refund of tax on losses, would be a powerful counter-cyclical aspect in times of recession. Which of these effects dominates over the cycle is an empirical question. We address it by running a standard regression from the literature assessing cyclicality of fiscal policy:[17]

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[16] Some confusion may occur because the terms pro and countercyclicality can be used to describe association with the cycle or the policy impact. Hence, a procyclical income tax (whose revenues rise with greater amplitude than GDP) has a counter-cyclical impact.

[17] See Appendix in Klemm (2014) for a table summarizing the specifications used in the literature.

$$R_{it} = \beta_0 + \beta_1 R_{it-1} + \beta_2 G + f_i + \varepsilon_{it}, \tag{7}$$

where β are regression coefficients, G is an indicator of the cyclical position, such as the output gap or the growth rate, f is a country fixed effect, and ε an error term. Subscripts i and t indicate country and time.

The regression is estimated on the full sample of countries, as well as on a sample restricted to advanced economies, because the empirical literature on cyclicality has generally found that advanced economies have more countercyclical fiscal policy.[18] The combination of a lagged dependent variable and a fixed effect can lead to biased results. This bias, however declines with the number of time periods (Nickell, 1981). Given that our panel is quite long with 14 to 19 time periods on average per country, depending on the specification, the bias should be minimal. We also repeated all regressions without a lagged dependent variable, obtaining very similar results. Another important consideration in estimating Equation (7) is the endogeneity of the cyclical position, because this can be affected directly by tax policy. To address this, we instrument it by its lagged value.

The results (Table 3) show that the existing CIT has an acyclical or countercyclical impact, depending on whether we use the output gap or growth rate as an indicator. The DBCFT, however, is always a less effective automatic stabilizer: in regressions using the output gap it acts procyclically, and in those using the growth rate it is acyclical.

Overall, the conclusion is then the DBCFT is less likely to act countercyclically. This is particularly regrettable, as it is also more volatile. In trading off revenue certainty with automatic stabilization, the DBCFT appears to be a deterioration in both dimensions.

Table 3. The Cyclicality of the CIT and DBCFT

Dependent variable	CIT revenue				DBCFT revenue			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	Full		Advanced economies		Full		Advanced economies	
Lagged depenent variable	0.599***	0.641***	0.734***	0.754***	0.772***	0.770***	0.844***	0.856***
	(0.063)	(0.031)	(0.032)	(0.029)	(0.040)	(0.022)	(0.030)	(0.032)
Output gap	-0.025		-0.011		-0.029**		-0.032**	
	(0.026)		(0.012)		(0.014)		(0.015)	
GDP growth		0.082***		0.069***		0.007		-0.032
		(0.026)		(0.013)		(0.020)		(0.023)
Observations	1,473	2,179	666	676	952	1,143	612	617
Countries	89	154	35	35	61	78	32	32

Note: Output gap / GDP growth instrumented with their lag. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
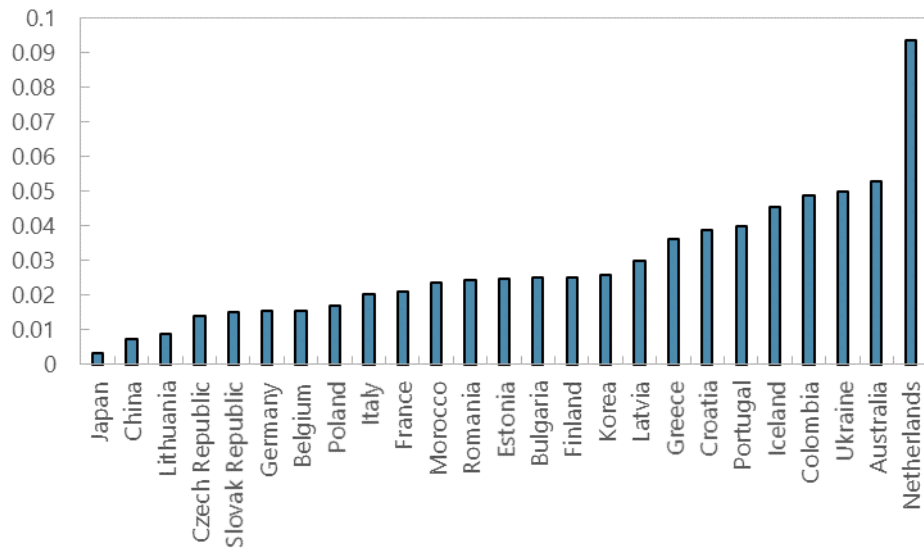Source: Authors' Estimation.

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[18] E.g., Gavin and Perotti (1997), Alesina, Campante, and Tabellini (2008).

Loss-Making Firms

Under a DBCFT, losses would trigger immediate tax refunds rather being carried forward. This is needed for it to function, as some firms, notably those whose sales are mostly to foreign customers, would be expected to have systematic tax losses. Loss carry-forward, even with an interest rate, would therefore not be an option.

Figure 10. Average Ratios of Losses to Sales, 2015-18 (Percent)

Source: Authors' Calculations Using Orbis Data.

This poses another risk to public finances. The calculated DBCFT revenue estimates already include the impact of losses, as the starting point is the corporate operating surplus, which nets off all profits and losses in the economy. However, given the increased value of losses in a system where they lead to immediate tax refunds, the incentive to create losses, including artificial ones, would rise. The extent to which this may happen is unknown, but data on the prevalence of losses may give a rough indication of where such risks may be high and where rules are particularly important to deal with legacy losses (Figure 10).

IV. UNILATERAL ADOPTION

Theory and Methodology

Thus far, our focus has been on the revenues and implications for the countries that implement a DBCFT. In the unlikely case of all countries moving simultaneously to a DBCFT, that would be the only relevant scenario. More likely is that one or a few countries introduce a DBCFT, which would have repercussions on all other countries. Multilateral adoption would put an end to known forms of tax competition and profit shifting. Unilateral adoption, however, would imply an

extreme intensification of incentives to shift profits or real investment that earns export-related rents into the DBCFT country.

Profit shifting can occur through transfer price manipulation, royalty payments, and the location of debt. The first two would increase measured exports of the DBCFT country and imports of the CIT country. The latter would be reflected in international interest flows. There are no tax implications of any of these profit-shifting methods for the DBCFT country, as exports and interests are untaxed. The tax base of the CIT country, however, would be reduced.

Relocation of real activity to the DBCFT country could also occur. Suppose a firm that produces and sells in the non-DBCFT country moves production to the DBCFT country (maintaining its only market in the non-DBCFT country). Exporting to the non-DBCFT country becomes untaxed but the cost of production for the firm goes up due to the adjustment in real exchange rates. The normal return is therefore untaxed. Any export-related firm-specific rent, however, would also be untaxed, making this a very attractive move. There are no direct tax implications for the DBCFT country (since exports are untaxed), but there may be indirect consequences, for example if employment rises. For the country maintaining origin-based taxes, there is both a direct loss of revenue, as well as any indirect effect from losing employment.

Focusing on the direct tax consequences for countries maintaining origin-based CITs, we calculate the expected loss, based on elasticities from the literature. This literature relates profit-shifting or real investment decisions to changes in relative tax rates between countries (or sometimes to the absolute tax rate of the host country). In the case of a DBCFT country, the relevant tax rate is then zero. For each country, assuming that their own tax rate remains constant, the relative change in tax rates is therefore equal to the original tax rate in the DBCFT country (which is cut to zero), weighted by the importance of the DBCFT country.

The tax revenue (T) from taxing an MNE in (non-DBCFT) country c is given by:

$$T_c = \tau_c f(K_c)\left[1 - \varepsilon_s\left(\tau_c - \sum_j \omega_{c,D}\tau_D\right)\right],$$

(8)

where $f(K_c)$ is the real profit from producing using capital K. As shown in the term in the square bracket, shifting profits depends on the difference between the own tax rate and the weighted average foreign tax (where the MNE operates) denoted by $\sum_j \omega_{c,D}\tau_D$, where ω is the bilateral weight and the elasticity ε_s, which depends on the cost of profit shifting. Taking a semi-log transformation yields:

$$\ln(T_c) = \ln(\tau_c) + \ln(f(K_c)) - \varepsilon_s\left(\tau_c - \sum_j \omega_{c,D}\tau_D\right).$$

(9)

There are two spillover effects from a change in a foreign tax rate, or —put it differently— from a foreign country adopting a DBCFT. First, the impact of profit shifting from country c to D on the tax base of c is given by $\varepsilon_s\omega_{c,D}\tau_D$. The second spillover effect is the impact of shifting investment

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from *c* to *D* on the tax base of *c*. Let the reaction of capital to changes in the domestic tax rate and the weighted average foreign tax rate be: $\frac{d\ln(f(K_c))}{d(\tau_c - \sum_j \omega_{c,D}\tau_D)} = -\varepsilon_k$, and the capital intensity be $\alpha = \frac{dln(f(K))}{dln(K)}$, then the change in the tax base in country *c* as a result of a 1 percentage point change in the foreign tax rate τ_D is $\alpha_c \varepsilon_K \omega_k$. Combining both effects:

$$\frac{dT_c}{T_c} = (\alpha_c \varepsilon_K + \varepsilon_S)\omega_{c,D}\tau_D, \tag{10}$$

where ε are the elasticities for real investment (subscript *K*) and profit shifting (subscript *S*) with respect to the tax rate. We use the above equation to compute the change in revenues for each non-DBCFT country *c* if one country adopts a DBCFT by setting the tax rate for the DBCFT country to zero. We abstract from policy reaction (i.e., we keep all other tax rates unchanged).

To parametrize the equation, we use the standard assumption of 1/3 for the capital intensity. For the elasticity of capital, we use 2.4 based on the meta study by De Mooij and Ederveen (2008), and for the profit-shifting elasticity we use 1.5 based on the meta study by Beer, De Mooij, and Liu (2019). The calculations assume common elasticities across country pairs. Also, Equation 10 abstracts from a potential covariance between ε_K and ε_S.[19] In practice, profit shifting and real investment responses can be linked. The weight should reflect how closely linked both economies are in terms of bilateral capital mobility. As this is a theoretical concept, based on potential rather than actual capital movements, there is no perfect measure for it. As an approximation, we use existing FDI links between both countries:

$$\omega_{c,k} = \frac{FDI\_In_{c,D} + FDI\_Out_{c,D}}{FDI\_In_{c,world} + FDI\_Out_{c,world}}, \tag{5}$$

where *FDI_In* is the FDI stock in country *c* and *FDI_Out* is the stock owned abroad by country *c*. The second subscript indicates the partner, either the DBCFT country *D* or the whole world.

To calculate the impact, we need to pick a first mover to introduce a DBCFT. To give a flavor of possible differences we use (i) the United States, as the largest and a highly-integrated economy, (ii) the United Kingdom, as a smaller advanced economy that is also very highly integrated, and (iii) India, and (iv) Brazil, as two emerging markets. The choice is purely illustrative and does not imply any judgement about the likelihood of such a reform in those countries.

Results

Figure 11 shows the results of the simulation using data for 2011. If the United States adopted a DBCFT, resulting revenue losses would be quite high, especially in countries like Mexico and Canada that have very close economic links. The spillovers would be lower if the United Kingdom

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[19] The covariance between profit shifting and real investment can be of either sign. There can be a colocation of real assets and paper profits (e.g., because the presence of capital makes profit shifting easier) and/or a decoupling (as raising tax rates discourages investment less strongly when profits can be shifted). See Klemm and Liu (2019) for a discussion of the interaction between investment and profit shifting.

adopted such a tax, but still sizeable in some economies. If Brazil or India adopted a DBCFT, the impact on the rest of the world would be much smaller, although all of these findings are subject to the caveat that current FDI links are only a rough proxy for economic links between countries.

Fig 11. Revenue Spillovers from Unilateral DBCFT Adoption, 2011
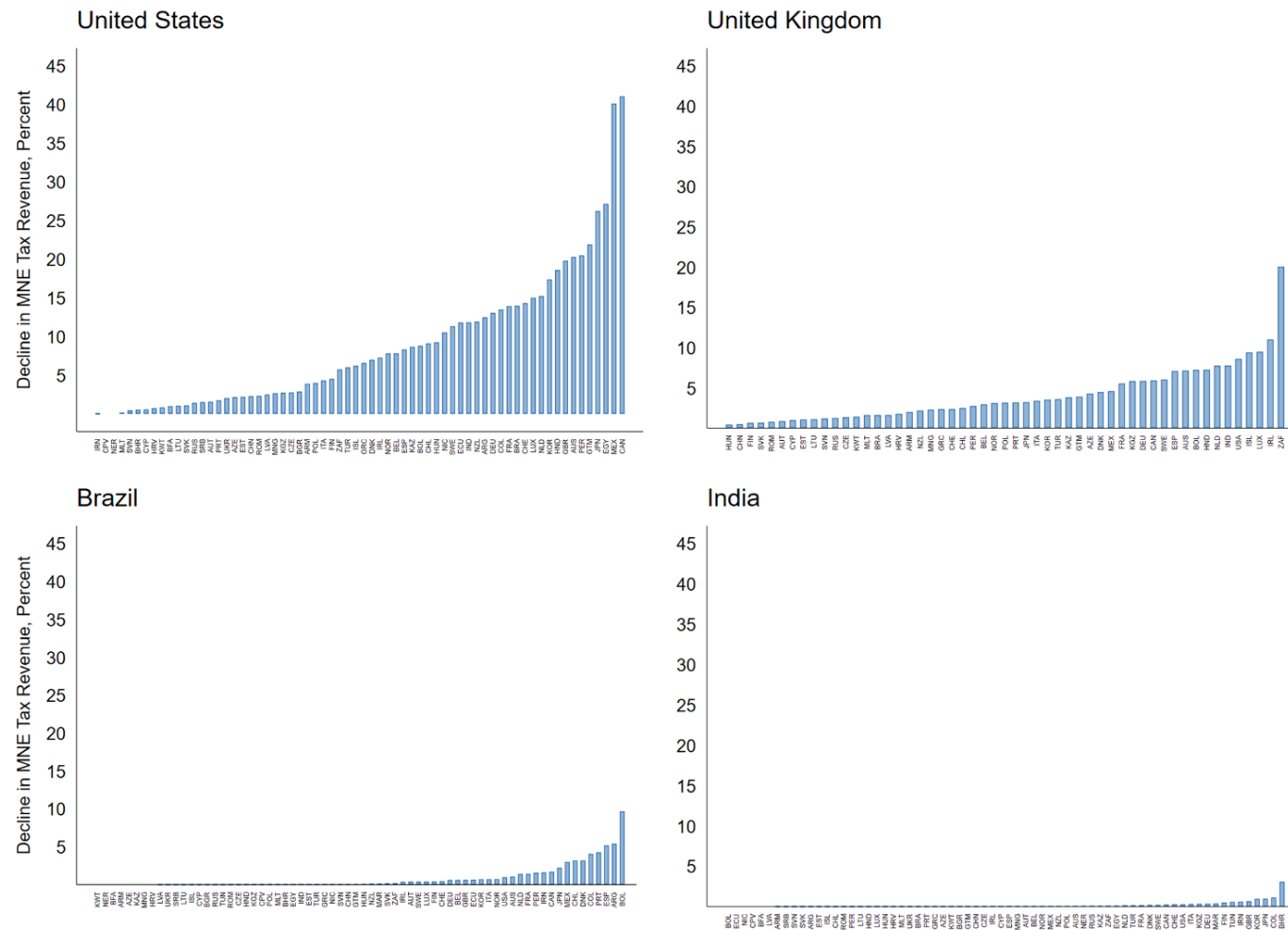
Source: Authors' Estimates.

Incentives for Policy Reactions

There is an empirical literature on fiscal reaction functions, estimating how countries react to tax cuts elsewhere, recently surveyed by Leibrecht and Hochgatterer (2012). One possible approach for non-DBCFT countries would be to think of the DBCFT country as a CIT cut to zero, and then react accordingly by reducing their own tax rate to regain competitiveness. Another option—and the one focused on here—is to follow by adopting a DBCFT as well. This would reduce revenues in some countries, as calculated above, but is likely to be much less costly than a massive reduction in the tax rate. In some cases, the revenue loss from DBCFT adoption may even be smaller than the revenue loss from staying put and suffering from profit and capital outflows.

Figure 12 compares the revenue impact of different policy choices following the hypothetical adoption of a DBCFT in the United States in 2011, with the dotted line indicating equal revenue impacts. If a country also adopts a DBCFT, there is no revenue loss from profit shifting and the revenue gain or loss, as calculated in Section IIIA, applies and is marked on the horizontal axis. As before, the losses under a DBCFT are averaged over the time span of the main sample to address the high volatility of the DBCFT. If a country maintains a standard CIT, there will be losses from more intense profit shifting to the United States (as in the upper left panel of Figure 11) and these are marked on the vertical axis. Countries that gain revenue by adopting a DBCFT are marked green. Countries that lose revenue by adopting a DBCFT but would lose even more revenue if staying with a CIT are marked orange. Finally, countries that would lose more from adopting a DBCFT than from staying put are marked red.

Figure 12. Revenue Changes under DBCFT and CIT Following Hypothetical U.S. Adoption of DBCFT in 2011

Source: Authors' Estimates.

If, following adoption in the United States (or any other country), there is no backlash in terms of a legal challenge or retaliation, then the green (i.e., revenue-gaining) countries have a clear incentive also to introduce a DBCFT. Equally the orange countries have an incentive to follow to minimize their losses. Once all of these countries adopt a DBCFT, the losses of the red countries will rise further, as now many more of their economically-linked partners have a DBCFT.

Figure 13 shows the revenue losses for countries that were red in Figure 12, following DBCFT adoption by all countries that were green and orange Figure 12. The loss under DBCFT adoption is unaffected, but the loss if maintaining a CIT rises, as profit shifting pressures increase with more partners having effectively a zero rate on shifted profits. As a result, a further three countries now have an incentive to adopt a DBCFT. In principle further rounds are possible, but as these three additional countries are small, no further reaction occurs in this particular sample. Ultimately, further countries might introduce a DBCFT even if it is not the revenue-maximizing option, because they might value the higher investment. Some countries, however, would face massive revenue losses under the DBCFT—with even negative revenues in some cases as noted—imposing a high cost on the option of following with DBCFT adoption.

Figure 13. Second-Round Spillovers

Source: Authors' Estimates.
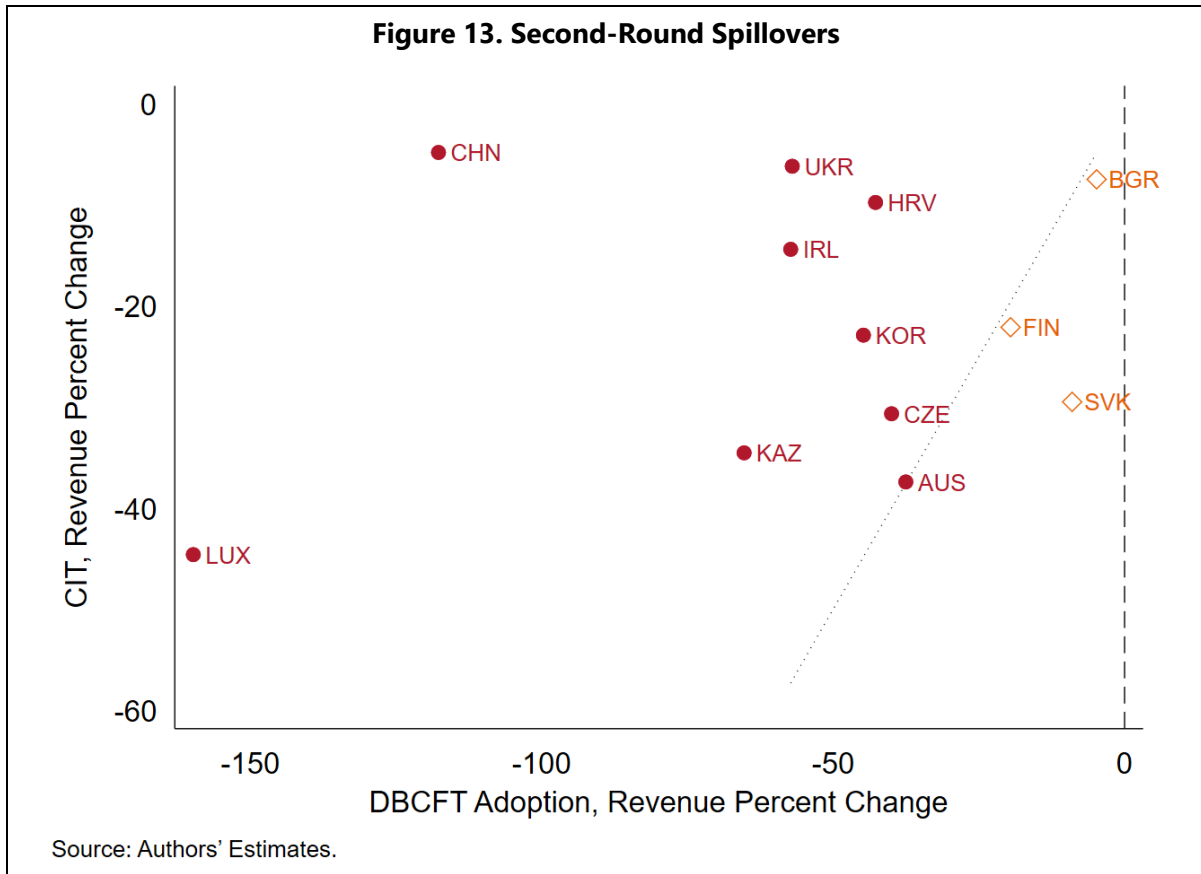
V. CONCLUSION

This paper has provided estimates of DBCFT revenues using national accounts data. On average, a universally adopted DBCFT surprisingly generates a similar level of revenue as the CIT, but some countries lose while others win. Countries with a large trade surplus would face the largest decline in revenue, at least in the short term. We find no evidence that developing countries lose more revenue than developed countries—if anything, results suggest that the opposite pattern is more likely. Natural resource-rich countries, on average, would generate lower DBCFT revenue than CIT revenue, but would still have additional taxes at their disposal. Other factors such as loss-making firms and revenue volatility could pose revenue risks for some countries.

Unilateral DBCFT adoption can generate negative spillover effects, which are found to be sizeable if the DBCFT country is large and integrated. We find that spillovers could prompt other countries to adopt a DBCFT, too, either as an immediate reaction, or in some cases in a later round, as a rising number of DBCFT countries raises the cost of maintaining source-based CITs. Some countries, however, would never have a revenue incentive for adopting a DBCFT.

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