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From: The Secretary

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Board Action: Executive Directors' **consideration** (Formal)

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Publication: Yes, it is intended that the full set of the Fiscal Monitor documents will be released to the public at the time of the Fiscal Monitor press conference, tentatively scheduled for **Wednesday, April 20, 2022**.

The analytical chapters will be made available to the public on the IMF website in advance of the publication of the full document.

Questions: Mr. Hebous, FAD (ext. 35754)
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Additional Information: The paper will be revised for publication in light of the Executive Board discussion. If Executive Directors have comments, they should notify Mr. Mauro, Mr. Medas and Mr. Hebous by **5:30 p.m. on Tuesday, April 5, 2022**.

Coordinating Taxation across Borders

Prepared by the Fiscal Affairs Department
In consultation with the other departments—Approved by Vitor Gaspar, April 2022
April 2022 Fiscal Monitor—Chapter 2

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future, personal tax coordination will gain importance and raise issues such as those related to corporate taxation.

Carbon-Pricing Coordination

As global warming threatens our planet, urgent actions and coordination are required to curtail emissions. Despite progress under the Paris Agreement and the UN 26th Climate Change Conference (COP26), there remain critical gaps in both policy and the ambition for global mitigation. A small number of key emitting countries could coordinate speedily to deliver the emission reductions required to complement the Paris Agreement. Price-based approaches such as carbon taxation or emission-trading systems are generally the most efficient. However, alternative approaches such as regulations can be accommodated in the same agreement. The following are the main findings:

- Reinforcing the Paris Agreement with an international carbon price floor for key emitting countries (accommodating alternative approaches through the calculation of equivalent prices) can limit global warming to 2°C or less, while accommodating differentiated responsibilities, depending on income level. Implementing such an agreement would reduce emissions in 2030 by 35–50 percent below baseline levels for advanced economies and 20–30 percent for emerging market economies. This computation assumes measures equivalent to a carbon price of \$75 per ton for advanced economies, \$50 per ton for high-income emerging market economies such as China, and \$25 per ton for low-income emerging market economies such as India.
- Nonpricing policies such as regulations can be accommodated through a consistent cross-country method (outlined in Chapter 2) to map the agreed-upon emission reductions into an equivalent carbon price, which can serve as a common metric.

International coordination is essential to overcome the limits of unilateral action. Recent progress in the income tax area have shown that countries can together deliver tangible results. With such progress as inspiration, the priority is to agree on concrete plans to limit global warming to below 2°C, before it is too late: What are we waiting for?

Introduction

1. International coordination on tax matters is needed now more than ever. National governments share challenges in securing revenues, addressing inequalities, and curbing greenhouse gas emissions. Succeeding in these efforts increasingly requires dealing with pressures that cannot be stopped by national borders. These cross-border spillovers—the effects of one country’s actions on other countries—necessitate international coordination. The most pressing areas for coordination are the taxation of multinational enterprises (multinationals) and individuals, as well as carbon pricing.

2. Recent achievements toward international tax coordination include the agreement in October 2021 under the OECD/Group of Twenty (G20) Inclusive Framework to reform the taxation of multinationals ([OECD 2021d](#)), international agreements to exchange information led by the Global Forum, and countries’ pledges under the Paris Agreement and the UN Climate Change Conference at Glasgow (COP26) to reduce emissions.¹ However, much more should be done.

3. The rising need for international coordination on taxation stems from three developments in the past few decades:

- *Globalization and digitalization* of the economy have created opportunities for development but have also intensified the mobility of the income tax base (profits and personal income) and factors of production (capital and, increasingly, people). Global firms draw on global supply chains to serve global markets, with increased possibilities for generating large profits without physical (taxable) presence. All these developments have tax implications, which without coordination can adversely affect efficiency, distribution, and in some cases, international economic and trade relations.
- *Saliency of aggressive tax avoidance and outright tax evasion* has raised demands for fairer and less unequal societies. This call is fueled not only by leaks of documents showing widespread egregious use of offshore opaque structures, but also by systematic evidence of weak tax compliance by rich individuals. As it becomes possible to transfer funds across borders through virtual assets with near anonymity, tax administrations, especially in developing countries, struggle to keep up, even as they upgrade their own use of technology to collect and process data to identify compliance risks.
- *Climate change*—a vital global challenge—demands urgent measures to curtail emissions. Carbon taxation (charges on the carbon content of fossil fuel supply) or other carbon-pricing or regulatory policies aimed at discouraging emissions can make a difference only if adopted by enough large emitters. If carbon pricing cannot be internationally coordinated, then other unilateral approaches would likewise entail international elements.

4. This chapter opens with brief general considerations for addressing cross-border tax spillovers. Next, the chapter addresses how international coordination can improve the taxation of multinationals and individuals and reduce greenhouse gas emissions. The discussion is framed around improving existing international coordination arrangements, with special attention to the standpoint of developing countries.

Coordinated Approach to Global Tax Challenges

5. From a global perspective, uncoordinated tax interactions among independent jurisdictions, with their different objectives, often lead to unsatisfactory outcomes. To illustrate, if a country lowers its tax

¹ The OECD/G20 Inclusive Framework on Base Erosion and Profit Shifting ([BEPS](#)) was established in 2016 for countries to collaborate on implementing the initiative (it currently has 141 member countries and 14 observer organizations). The Global Forum refers to the Global Forum on Transparency and Exchange of Information for Tax Purposes, founded in 2000 (currently with 163 members). *COP26* is the 26th *Conference of the Parties* (the supreme decision-making body of the United Nations Framework Convention on Climate Change, or UNFCCC). The *Paris Agreement* is a treaty adopted by 196 parties at the COP21 in 2015.

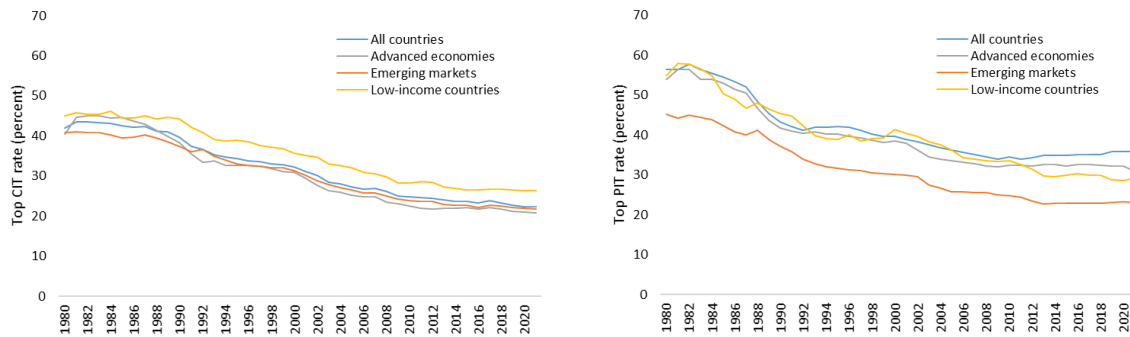
on capital, it attracts tax bases from other countries in the form of real capital or “paper” profits, even without real capital movement (that is, profit shifting). The corresponding contraction in the other countries’ tax base lowers those countries’ tax revenues. And spillovers do not end with profit and capital movements. The other countries are under pressure to lower their capital taxes too, with further repercussions. A similar interaction can occur in the context of taxing the rich. This “race to the bottom”—which can result in inefficiently low taxation and hence insufficient public investments and social expenditures (Keen and Konrad 2013)—has been reflected in the downward trends of corporate and top personal income tax rates (Figure 2.1).

Figure 2.1. National Corporate and Personal Income Tax Rates, by Income Group and Population

(Percent)

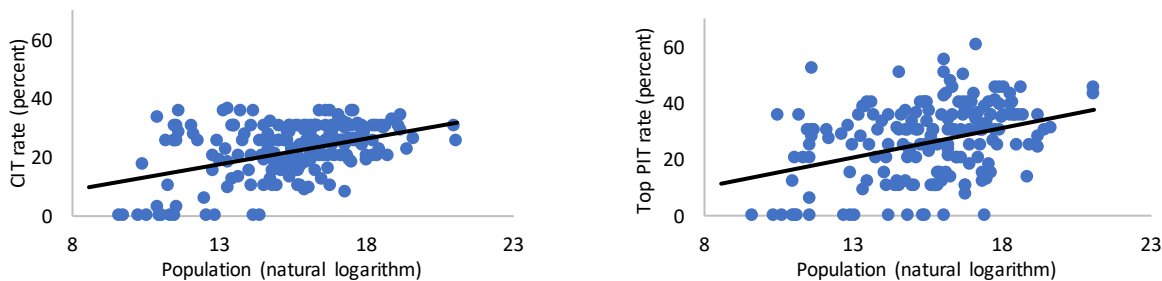
Corporate and personal income tax rates have been declining for decades.

1. National Corporate Income Tax Rate, by Income Group, 1980–2020 **2. National Personal Income Tax Rate, by Income Group, 1980–2020**



Large countries have higher tax rates.

3. National Corporate Income Tax Rate, by Country Size **4. National Personal Income Tax Rate, by Country Size**



Source: IMF staff calculations.

Note: CIT (PIT) denotes the statutory corporate (top marginal personal) income tax rate, obtained from the IMF Fiscal Affairs Department Tax Database. CIT = corporate income tax; PIT = personal income tax.

6. Depending on context and specifics, international coordination on the level or location of taxation can improve global outcomes with or without disadvantaging some countries. In federations, tax competition can be alleviated, and compensation can take place through fiscal transfers between

subnational governments or through central policies. However, countries need to find common ground in coordination and be guided by economic assessment to understand global and country-specific effects. The ideal assessment entails comparing coordination options not only with the status quo, but also with counterfactuals of *futures* with and without coordination. For example, unchanged policies may be more beneficial now but less beneficial in the future relative to coordinated outcomes.

7. Coordination in tax matters is challenging because countries' interests diverge with their characteristics, including the size of their economies and populations. The cost of lowering the tax rate is generally higher for larger economies because they have a larger domestic, relatively *immobile*, tax base. For larger economies, cutting the tax rate (in response to competition pressures on the *mobile* base) means collecting less revenue from the (large) immobile base. This explains why small countries tend to have lower taxes (Figure 2.1). Small, low-tax countries have attracted high shares of international investment (they frequently reach the top of the list of investment countries worldwide), corporate profits (with an estimated 11–36 percent of multinational profits in small low-tax jurisdictions), and global wealth stock (with 8 percent of worldwide financial household wealth).² But even (small) low-tax countries incur costs from tax competition to attract a foreign tax base. The costs can take various forms, including unilateral countermeasures (tax and nontax) imposed by other countries and reputational risks that affect some investors' decisions.

8. In analogy to income tax competition, uncoordinated attempts to discourage greenhouse gas emissions face national hurdles. Higher carbon pricing in one country, for instance, increases the costs for its domestic producers, posing competitiveness concerns and potentially motivating production and emissions to move to other countries (that is, carbon leakage). Even if some countries begin implementing domestic mitigation policies, others may wait to benefit from avoiding the costs of reducing emissions. This “free-riding” issue, together with competitiveness concerns, hampers global progress on emission reduction.

9. But in contrast with the vital role of small countries in hosting global income and wealth, a handful of large economic regions account for the majority of global emissions. International coordination could therefore generate significant progress—at least initially—in a setting with fewer participants. For example, China, the European Union, India, and the United States together are responsible for 64 percent of global emissions (Parry, Black, and Roaf 2021).

10. Differences among countries' incomes raise further challenges to coordination. Whereas advanced high-tax economies and developing countries face similar tax base erosion challenges, the latter countries tend to import capital, have far fewer multinational headquarters, and face harder capacity constraints in tax enforcement. An agreement must reconcile the interests of developing and developed countries. And within each set, countries are different, for example, in the relative importance of specific sectors such as digital-heavy companies, natural resources, and financial firms.

11. The form of coordination can facilitate agreement. For example, regarding corporate income taxation, combining zero-sum reallocation of revenues with a revenue raiser facilitates agreement (as discussed in the section on corporate income tax coordination). Coordination of mitigation policies among key large emitters could be effective in the immediate term and would constitute an important start (as discussed in the section on carbon-pricing coordination).

12. Countries' common interests can become more coherent in the face of a common threat. Following the global financial crisis, countries agreed on reforms to mitigate risk within the international

² Data on international investment, corporate profits, and global wealth stock for small, low-tax countries are from the IMF Coordinated Direct Investment Survey (<https://data.imf.org/?sk=40313609-F037-48C1-84B1-E1F1CE54D6D5>); Beer, de Mooij, and Liu 2020, Table 3.9 in OECD 2020, and Tørslov, Wier, and Zucman 2021; and Zucman 2013, respectively.

banking sector (Basel III, in 2009). Climate change is a shared serious threat, but commonalities are masked by differences in discounting short-term versus long-term benefits.

13. The legal coordination modality also matters in shaping agreement. In practice, coordination can take the form of either “hard law” (with binding legal obligations for the country, for example, through a treaty) or “soft law” (based on political commitments, for example, to international standards) (Table 2.1). A soft-law approach typically offers more flexibility for domestic implementation and can be coupled with a monitoring mechanism (for instance, peer review) to ensure continued commitment to the agreement. The Paris Agreement is often described as combining both hard law (on mandatory transparency) and soft law (on enforcement).

Table 2.1. Hard and Soft Laws Regarding International Coordination, in Practice

Method of Coordination:	<i>Hard Law</i>	<i>Soft Law</i>
Modality	Creation of legally binding obligations	Entry into political commitment
Implementation	Recognition of hard-law instrument	Greater choice of instruments
Enforcement	Remedies for breach of obligations	Monitoring mechanisms (possibly with peer review)
Examples	Tax Treaties, WTO rules, EU treaty	BEPS initiative, Basel III

Source: IMF staff compilation.

Notes: BEPS = Base Erosion and Profit Shifting; EU = European Union; WTO = World Trade Organization.

Corporate Income Tax Coordination

At a Glance

- The historic October 2021 Inclusive Framework agreement is a watershed moment in international corporate tax coordination, demonstrating that countries can jointly make progress in response to a global challenge.
- Allocating a portion of the tax to market countries is new and efficient, offering a preferable multilateral approach to unilateral digital-services taxes.
- Implementing a global minimum corporate income tax would reduce pressures from profit shifting and tax competition, raising global corporate income tax revenues by about 5.7 percent through the top-up tax and potentially by an additional 8.1 percent through reduced tax competition.
- Domestic tax reforms would be key to complementing the revenue gains from the agreement, including revisiting wasteful tax incentives and better taxation of monopolistic rent on efficiency, equity, and revenue grounds.
- Future coordination efforts should focus on addressing remaining needs of low-income countries.

14. The historic October 2021 agreement is a watershed moment in international tax coordination that could not have been politically envisaged even a few years ago. Implementation risks and potential refinements, though, continue to be at the forefront, as do broader challenges in taxing multinationals. This section reviews broad outcomes of the agreement and outlines potential further reform directions.

15. Two questions are at the heart of the ongoing discussion on coordinating taxation of multinationals:

- *Where to tax?* Current outdated arrangements, loosely, split the place of taxation between a headquarters (residence) country (which taxes the foreign “passive” incomes of its multinational affiliates abroad, such as interest income) and a source country where production is located (which taxes the “active” income of the multinational affiliate physically present in the country). This distinction is meant to prevent double taxation when both countries claim to tax a multinational. It is not fit, however, for a digitalized globalized economy, considering it ignores a third possible location of taxation, namely, that of consumers and users (in the destination, or market, countries). For

example, under current arrangements digital-heavy companies can generate profits without a taxable physical presence in a country. This situation has triggered controversial unilateral digital-services taxes, often in the form of a tax on turnover from specific digital activities, spreading tensions to international trade with the use of tariffs as a countermeasure.

- *How much to tax?* How much to tax multinationals has been left internationally uncoordinated since the inception of corporate taxation, resulting in the downward trend in corporate tax rates shown. The long-standing, well-known challenges here stem from (1) difficulties in enforcement (rules apply to affiliates of a multinational as if they were independent, thereby enabling profit shifting),³ and (2) tax competition among countries through tax rates and preferential regimes.

16. To date, 137 jurisdictions (of 141 Inclusive Framework members) have joined the two-pillar Inclusive Framework agreement, whose first pillar addresses the “where” question and second pillar addresses the “how much” question. This agreement is the first fundamental change to international tax norms in more than a century—a major achievement on which to build as the international community shifts focus to implementation and beyond.

Major Elements of Pillars 1 and 2

17. *Pillar 1 allocates a portion of profits to market jurisdictions*, thereby giving them taxing rights even without a multinationals’ physical presence. Pillar 1 applies to multinationals with global turnovers above €20 billion and allocates 25 percent of their “excess” or “residual” profit—that is, profits exceeding 10 percent of global revenue—to market jurisdictions using sales by destination. The extractives sector and regulated financial services are excluded. Implementing Pillar 1 will require countries to sign a multilateral treaty obligating them to eventually remove unilateral digital-services taxes and similar measures, with a commitment not to introduce new ones. Implementation is mandatory for all signatory jurisdictions, with planned effect in 2023. A parallel—unfinished—workstream under Pillar 1 foresees certain measures to simplify the computation of profits from specific activities of multinationals to be taxed in the source country.

18. *Pillar 2 is an agreement on a global minimum corporate income tax* if income in a given country is taxed below 15 percent. This pillar covers multinationals with global turnover exceeding €750 million. The minimum tax is a common approach, meaning that it is not mandatory for countries to implement its rules; however, by joining the agreement, countries accept its adoption by others. Pillar 2 includes three broad interrelated tax rules planned to go into effect in 2023:

- The *headquarters* country (where the parent company is located) subjects profits of affiliates abroad to an income inclusion rule (that is, a top-up tax for affiliates effectively taxed abroad below 15 percent).
- If the tax in the headquarters country is below the minimum (and it does not apply the income inclusion rule), then the *source* country (where the affiliate is located) applies the undertaxed-payments rule (that is, the top-up minimum tax).⁴ Whether to give priority to tax explicitly to the headquarters country has been a contested issue, especially from a developing-country standpoint. However, in principle, the source country can choose reforms to raise its tax to the minimum to preempt the application of minimum tax in the headquarters country. The draft model rules (released in December 2021) enable the adoption of special domestic top-up taxes as opposed to general increases in tax rates to the minimum.

³ Multinationals use several techniques to shift profits. For instance, one affiliate can inflate its costs in a high-tax country by overpricing its imports from another affiliate in a low-tax country (IMF 2014). Pressures on existing corporate income tax arrangements are well known and discussed in de Mooij, Klemm, and Perry (2021).

⁴ The undertaxed-payments rule would be applied by denying tax deductions for payments (such as interest paid by an affiliate to a parent company) that are taxed below the minimum where they are received.

- Separate from the income inclusion and undertaxed-payments rule is a subject-to-tax rule, under which low-income source countries can impose withholding taxes on specific cross-border payments if a multinational is taxed on receipt of those gross payments abroad below a minimum rate. Details are yet to be finalized, including on the scope of covered payments and the minimum rate, but the tax paid under this rule would count in the calculation of the income inclusion and undertaxed-rules, thereby giving it priority and making its scope especially important for developing countries.

19. What are the effects of both pillars? To answer this question, the discussion starts with an analysis of profits of multinationals and next discusses revenue estimates, then broader outcomes.

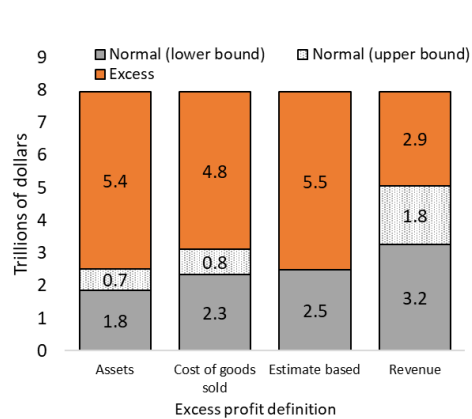
Decomposition of Multinationals’ Profit

20. A distinction between “normal” and “excess” profit has been important in the debate on taxation reform for multinationals, considering the two types of profits can be treated separately (IMF 2019a). It is empirically challenging to measure excess profit with precision. Normal profit, conceptually, is broadly equivalent to normal return to capital, whereas excess profit is above the normal return to capital. Excess profit is largely associated with firm monopolistic power and firm-specific intangible assets, which are in turn difficult to value or attribute to a geographical location (IMF 2021). Taxing economic rent is efficient because it does not distort investment decisions (IMF 2019a; 2016).

Figure 2.2. Disaggregation of Total Profit of Multinational Corporations (Trillions of US dollars)

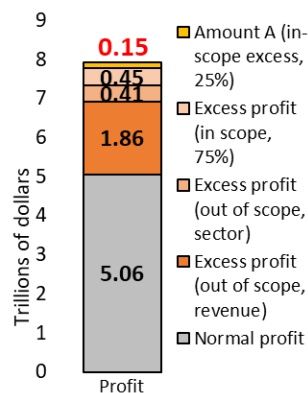
1. Normal and Excess Multinational Profit (Simplified Measures), 2019

Rough measures of excess profit can reach 60 percent of total profit.



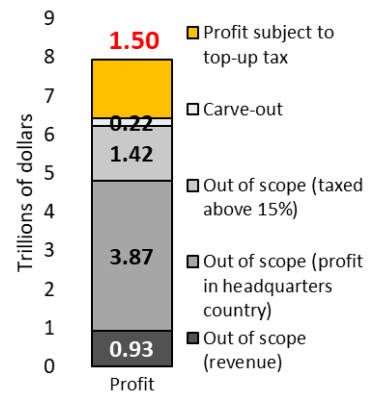
2. Total Multinational Profit, as Taxed under Pillar 1 of the Inclusive Framework

Pillar 1 reallocates a small fraction of total profit (2 percent).



3. Total Multinational Profit, as Taxed under Pillar 2 of the Inclusive Framework

Pillar 2 covers 18.5 percent of total profit.



Source: IMF staff estimates, as described in Online Annex 2.1.

Note: These analyses use the Standard & Poor’s Capital IQ database. Panel 1 shows empirical proxies for normal and excess profit across four simplifying measures (5.0–7.5 percent of total assets; 5.0–7.5 percent of costs of goods sold; estimate-based model using econometric specifications as specified in Online Annex 2.1; and 5.0–7.5 percent of revenue). *Amount A* refers to profit reallocated under Pillar 1. Panels 2 and 3 disaggregate total multinational profit into amounts included and excluded in Pillar 1 and Pillar 2, respectively. The carve-out is (transitionally) a deduction of 8 percent of assets and 10 percent of payroll. *Out-of-scope (revenue)* refers to companies below the revenue thresholds to be included under Pillars 1 or 2, whereas *out-of-scope (sector)* refers to excluded regulated financial and extractives sectors under Pillar 1. In the third panel, *out-of-scope (profit in headquarter country)* is the sum of profits that multinationals reported in their headquarters countries, and hence are not subject to the income inclusion rule of Pillar 2.

21. Multinationals generated profit of \$7.9 trillion in 2019 (9.2 percent of global GDP). Estimates, based on simplifying assumptions, suggest that a sizable share of multinationals’ profit (possibly reaching 60 percent) is excess profit. This illustrative estimate is based on simple ratios, for example, considering normal profits to be 5.0–7.5 percent of total assets or alternatively 5.0–7.5 percent of cost of goods sold. Similar results are obtained from a third method that estimates normal profit using firm-level data, as the counterfactual earnings firms would generate in the absence of market power and risk premia (Online Annex 2.1 and [Beer and Loeprick 2022](#)). A fourth measure that uses 5–10 percent of revenue reduces excess profits to 37 percent of total profits (Figure 2.2).

Revenue Effects of Pillars 1 and 2

22. Pillar 1 is a relocation of revenue (creating a zero sum of losers and winners), but Pillar 2 is (mostly) a revenue raiser. Combining both in one coordination package potentially tends to make the Inclusive Framework agreement a net benefit for countries facilitating coordination.

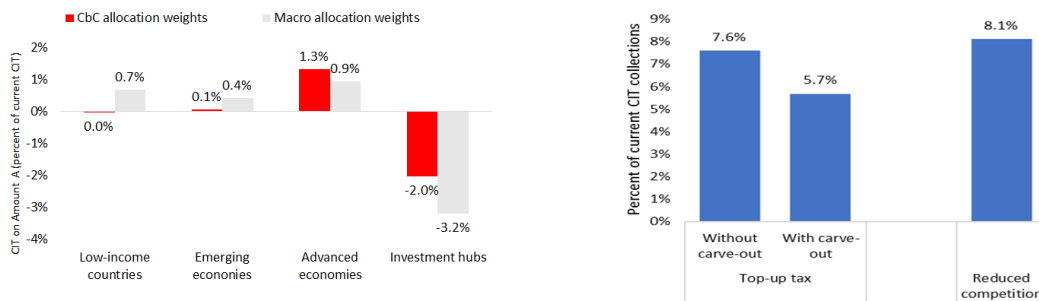
23. The reallocation of a portion of excess profit to market countries under Pillar 1 is estimated to apply to only about 140 companies, capturing a small global tax base of 2 percent of global profit (Figure 2.2). Results suggest that revenues will be reallocated from low-tax investment hubs (about 2 percent of their total corporate tax) to other countries, raising revenues there by 0.7 and 0.9 percent of corporate tax revenues in low-income countries and advanced economies, respectively (Figure 2.3).⁵

Figure 2.3. Revenue Effects of the OECD/G20 Inclusive Framework Agreement, Pillars 1 and 2
(Percent of current corporate income tax)

1. Effect of Pillar 1 Proposals on Tax Revenues 2. Effect of Pillar 2 Proposals on Tax Revenues

Pillar 1 reallocates revenues from low-tax investment hubs to other countries.

Pillar 2 raises global corporate income tax revenues by 5.7 percent through the top-up tax and by an extra 8.1 percent potentially through reduced tax competition.



Source: IMF staff estimates based on the Standard & Poor’s Capital IQ database, 2017 reports from the Organisation for Economic Cooperation and Development’s CbC database, and statistics from the US Bureau of Economic Analysis, as described in Online Annex 2.1.

Note: *Amount A* refers to profit reallocated under Pillar 1. The calculation uses weights to proxy sales by destination for the reallocation. Macro allocation weights are taken from Beer and others (forthcoming) and computed using national accounts, whereas country-by-country (CbC) weights are computed using the CbC database. Under Pillar 2, the carve-out is (transitionally) a deduction of 8 percent of assets and 10 percent of payroll. The tax base for the minimum tax is excess profit after the carve-out is deducted (that is, the *with carve-out* bar). CIT = corporate income tax.

⁵ The reallocation of the tax base depends on the sales-by-destination weights at the firm level, which are not directly observed, generating some uncertainty about the exact reallocated amount.

24. Although the global tax revenue from Pillar 1 is relatively small as a share of total taxes, it appears broadly comparable with that from existing unilateral digital-services taxes. Digital-services taxes typically raise less than 0.02 percent of a country's GDP, although the proportion varies across countries (Aslam and Shah 2020; Dabla-Norris and others 2021). Skepticism about digital-services taxes arises because the digital economy cannot be meaningfully ring-fenced and these taxes are less efficient than the alternative of destination-based taxation under Pillar 1. For example, 'digital' taxes on sales would be too high for low-profit or loss-making digitalized businesses, possibly disincentivizing investment, and would imply a lower tax on high-profit businesses raising issues of fairness. Furthermore, destination-based taxation of profits is more robust to tax competition (because consumers are less mobile than capital and profits) or profit shifting (because the tax base is largely based on global consolidated profit rather than profit in each separate jurisdiction).⁶

25. Pillar 2 is estimated to capture a tax base of \$1.47 trillion (Figure 2.2, panel 3), which increases global annual corporate income tax revenues by roughly 6 percent (about \$150 billion) (Figure 2.3).⁷ This calculation applies the minimum tax only to profits exceeding 8 percent of assets and 10 percent of payroll (called the "carve-out" in the agreement). Removing the carve-out would increase Pillar 2 revenues to an estimated 9 percent of current global corporate income tax revenues. Under the assumption that low-tax countries remain below the minimum, these "static" revenue gains are concentrated in advanced economies (Figure 2.3), because multinationals headquartered in these countries generate 20 times more profit than those located in emerging markets. On the other end of the spectrum, if all source countries apply the minimum, then source countries will capture the revenue gains (it is the same amount of revenue gains because it is a top-up tax). The likely outcome depends on how countries and firms react to the implementation of the Inclusive Framework agreement. To obtain a complete assessment, next, the discussion considers these reactions.

The Reactions of Firms and Countries to Corporate Income Tax Coordination

26. The agreement affects firms by reducing incentives for profit shifting that in turn affect real investment decisions and countries by reducing incentives for tax competition. These effects could further increase global revenues and the tax base shares allocated to nonheadquarters countries. The outcome of countries' tax-setting responses, following a minimum tax, would likely be higher tax rates and revenues for most.

27. Firms' reactions can be summarized as follows:

- *Profit shifting by in-scope⁸ multinationals generally decreases* to the extent that the effective minimum rate is above that firms are currently paying, and the tax rate differential between countries declines. This reduction in profit shifting implies that the global profit reported in low-tax jurisdictions declines, thereby increasing tax revenues in the other countries.⁹ Pillar 1 also helps reduce profit shifting, as discussed.
- *Investment becomes more costly, but the aggregate effect is modest.* The effective tax rate on investment—which considers both the statutory tax rate and the tax base, such as with depreciation allowances—increases because of the smaller scope for profit shifting and higher taxation (attributable to the

⁶ Various international reform options tax excess profit largely in the destination country (de Mooij, Liu, and Prihardini 2019 2019; Devereux and others 2021; Hebous, Klemm, and Stausholm 2020; IMF 2019). The extractive sector is one exception for taxing the (location-specific) excess profit in the source country (Albertin and others 2021).

⁷ Estimated global annual corporate income tax revenues under Pillar 2 decrease to 4.8 percent if the United States is excluded, considering that it levies its own minimum tax (the global intangible low-taxed income provision). The estimates in the paragraph are smaller than those of Barake and others (2021) and larger than those of OECD (2020).

⁸ In-scope⁷ multinationals are those that meet the criteria of Pillars 1 or 2.

⁹ The OECD (2020, Table 3.10) estimates that the amount of profits in investment hubs would be reduced by 9–10 percent as a result of a minimum tax of 12.5 percent with no carve-out.

minimum tax). The [OECD \(2020\)](#) estimates this increase to be 1.4 percentage points (expressed as a global weighted average rate), with variation across countries. However, in calculating the full effect on multinationals' investment, any analysis should also consider that a minimum tax brings a high-tax country closer to the world average (that is, it reduces the *tax rate differential*). Estimates indicate that aggregate investment in fixed assets remains roughly constant at a global minimum tax of 15 percent, but with large differences in country-specific effects, reaching a decline of 20 percent in some low-tax countries ([Keen, Liu, and Pallan, 2022](#)).

28. *Low-tax countries are likely to raise their taxes to the minimum*—possibly only on in-scope companies, because incentives to compete over the out-of-scope tax base remain intact. Countries are permitted under the Inclusive Framework agreement to impose a minimum tax only on in-scope companies ([OECD 2021e](#)). This top-up tax enables low-tax countries to collect revenues from multinationals without raising their *general* corporate tax rate, thereby weakening the incentives to raise the general rate. Raising the general rate, however, can be beneficial for low-tax countries, especially if high-tax countries raise their rates as well ([Hebous and Keen 2021](#)).

29. *High-tax countries are likely to halt their downward trend and possibly raise their corporate taxes*. Empirical evidence and historical experience suggest that countries' tax rates tend to move in the same direction. If low-tax countries raise their rates to the minimum (even through a top-up tax on in-scope multinationals), then high-tax countries would likely react by raising their rates as well. New estimates are broadly in line with previous studies indicating that a 1 percentage point change in the average foreign statutory tax rate leads the home rate to change by up to 0.6 percentage point in the same direction (Online Annex 2.2). Concurrent discussions in some countries (such as the United Kingdom and the United States) also indicate that tax rate increases are possible, or at least that future rate cuts can become less attractive ([Seely 2021](#); [US Department of the Treasury](#)).¹⁰

30. *Developing countries have a strong case for revisiting, and potentially abolishing, ineffective and inefficient tax incentives*, which would support both revenues and the integrity of the tax system ([IMF and others 2015](#)). Pillar 2 reduces competition pressures: multinationals would not react to a tax holiday, for example, because they would then be liable for tax in the headquarters country. Although the motivation is somewhat muted by the existence of the carve-out and out-of-scope companies, the agreement is generally an opportunity to reconsider the use of tax incentives as a tool to attract foreign investment.

31. Rough estimates suggest that the agreement would result in reduced tax competition, thereby increasing global corporate tax revenues by an extra 8.1 percent (panel 2 of Figure 2.3). Such revenues could finance social spending, public investment, or reductions in more distortionary taxes. Precisely quantifying this effect is challenging. The calculation here assumes that below-minimum countries raise their rates to the minimum—increasing the world average tax rate—and in turn other countries raise their rates by 0.6 percentage point in reaction to each 1 percentage point increase in the world average rate. As a result, the average world corporate tax rate rises from 22.2 to 24.3 percent.¹¹

Opportunities to Enhance Coordination

32. The two-pillar solution demonstrates that coordination can succeed. The Inclusive Framework agreement is a step in the right direction, considering that Pillar 1 breaks with old norms and Pillar 2 puts

¹⁰ As mentioned above, the higher tax would have a muted effect on aggregate investment of multinationals in the presence of a global minimum tax.

¹¹ Generally, it is difficult to determine who ultimately pays the corporate income tax because it may be passed on in lower wages for employees, in higher prices to consumers or in lower prices to producers. However, a tax on economic rent does not affect the investment or price decisions of a firm that maximizes economic rent. The rent tax is thus efficient because it does not distort investment. Moreover, as the price is unaffected, its burden is not shifted to consumers or employees or producers ([Devereux and others 2021](#)). As profitable businesses tend to be owned by the better off, rent taxation supports progressivity.

a floor on tax competition. Still, both pillars are somewhat limited in scope. Hence, following their implementation more steps will be needed to address spillovers and further incorporate the interests of low-income countries. The agreement lays the foundation for the international community to expand both pillars to capture more of the tax base.

33. Building on the two pillars, efforts can focus more on low-income countries' circumstances by taking the following actions:

- *Agree on simplification measures* (based on those delayed under Pillar 1) that allow source (mostly low-income) countries to apply a simplified tax (for example, a fixed sales ratio) to some activities (such as buying from affiliated companies for resale, “redistribution activity”). Although such a simplified approach lowers administrative and compliance costs, it entails a margin of error in taxing actual returns, with possible adverse efficiency effects. Such costs are estimated to be the lowest for redistribution activity and a few subsectors of manufacturing—indicating that simplifications could be extended to include them ([Beer Leduc, and Loeprick, 2022](#)).
- *Maximize the benefits of a minimum tax* for low-income countries by considering withholding taxes on a wider set of cross-border payments than currently envisaged under Pillar 2's subject-to-tax rule.
- *Facilitate timely access to the country-by-country information* on multinationals on the part of low-income developing countries to support tax enforcement. Access to information is part of the broader enforcement challenges, which include capacity building to improve administration (as provided by the IMF and other international organizations) and information availability. To make taxation more transparent, the 2015 Base Erosion and Profit Shifting initiative requests multinationals (with a global turnover exceeding €750 million) to provide information about their activities on a country-by-country basis, which would be essential for enforcing current and envisaged rules. But a recent analysis finds that only three low-income countries have access to these reports ([OECD 2021a](#)). Other low-income countries cannot access this information until they meet requirements concerning confidentiality, consistency, and appropriate use of information (see the next section, on tax transparency and personal income tax coordination). Progress on this front is critical to maximizing the benefits of coordination for low-income countries and helping them strengthen corporate taxation.¹²

34. Existing rules to curb profit shifting remain important. Current corporate tax arrangements remain largely applicable (because of various exceptions). Hence, a multitiered framework is likely, because the agreement reduces, but does not eliminate, profit-shifting possibilities.¹³

35. International coordination makes domestic corporate tax reforms more feasible, particularly reforms to better tax monopolistic rent on efficiency, equity, and revenue grounds. For instance, one option to target excess profit is to offer deductions to returns to equity (like those to interest expenses) and increase the tax rate.¹⁴ Such deductions are efficient because they resolve the chronic debt bias in corporate taxation, which encourages debt by allowing interest deductions without analogous deductions for returns to equity. This nonneutrality adversely affects investment decisions and amplifies economic-instability risks. Excess-profits taxes, generally, can be compatible with the broad directions of

¹² Other initiatives to enhance country-by-country reporting include the [Extractive Industries Transparency Initiative](#) and the European Banking Authority's [Capital Requirement Directive](#), which requests that banks established in the European Union publish country-by-country reports.

¹³ The rules of the Inclusive Framework agreement use financial accounts (ultimately prepared for shareholders), rather than the domestic tax accounts based on a country's tax system. This implies it will also be important to prevent abuse of financial accounting to minimize taxes.

¹⁴ On the taxation of economic rent, see [de Mooij \(2012\)](#), [Hebous and Klemm \(2020\)](#), [Hebous and Ruf \(2017\)](#), and [IMF \(2016\)](#).

international reforms (Hebous, Prihardini, and Vernon, 2022). For example, Pillar 1 distinguishes between two types of profit, whereas Pillar 2 treats the carve-out differently from the rest of profit.

Tax Transparency and Personal Income Tax Coordination

At a Glance

- Curbing tax evasion requires availability, sharing, and effective use of information.
- Significant steps have been taken to exchange information between countries under the Global Forum on Transparency and Exchange of Information for Tax Purposes.
- Establishing beneficial-ownership registries would enhance tax enforcement and compliance, and further capacity building—for example, to upgrade tax administration technology—is critical for enabling low-income countries to reap the full benefits from cross-border information-sharing agreements.
- Stronger enforcement, through international information coordination, offers opportunities to revisit personal income taxation to address increasing income inequality.
- As the mobility of workers, including digital nomads, increases with the expansion of opportunities for cross-border remote work, coordination in this area will likely gain importance.

36. Personal taxation in a global digital economy, much like corporate taxation, requires coordination across borders to tackle tax base erosion, primarily through information sharing to enforce tax laws. Furthermore, cross-border mobility of people is increasingly relevant for taxation.

Tax Evasion and Exchange of Information

37. Global undisclosed offshore wealth is sizable, with macro-relevant fiscal implications.¹⁵ Wealth generates capital income (such as rental income, dividends, interest, and capital gains). Yet the concern about tax evasion using nontransparent offshore structures goes beyond revenue leakage: it is also a matter of tax progressivity and perception of fairness. The issue is directly related to tax compliance at the top of the income and wealth distributions, considering that capital income constitutes a significant fraction of income at the top of these distributions (Scheuer and Slemrod 2020). And available estimates suggest that the wealthiest 1 percent (who own up to 40 percent of the wealth in some countries) evade up to 25 percent of their income taxes using offshore structures (Alstadsæter, Johannesen, and Zucman 2019; Guyton and others 2021).

38. Moreover, governance-related concerns arise about the sources of undisclosed wealth. For example, the proportion of wealth held abroad correlates with characteristics in the wealth's countries of origin, such as political and economic instability, natural resources, and inflows of foreign aid (Alstadsæter, Johannesen, and Zucman 2018; Andersen, Johannesen, and Rijkers 2022). Thus, nontransparent offshore structures can be associated with other serious legal aspects beyond taxation (and the coverage of this chapter), including concealing the proceeds of corruption, financial crimes, and other illicit uses.¹⁶

39. Individuals are typically taxed in the country of residence. A notable exception is the United States, which taxes its citizens irrespective of residence (that is, even if they are permanently living in a foreign country) but generally credits taxes paid abroad. The United States typically levies the tax on

¹⁵ Global undisclosed offshore wealth is estimated at \$7 trillion (8 percent of global household wealth or 9.3 percent of global GDP; Alstadsæter, Johannesen, and Zucman 2018; Zucman 2013). Estimates suggest that this hidden wealth corresponds to roughly \$150 billion in unpaid income tax annually. This calculation assumes that hidden wealth: (1) earns a rate of return of 7 percent (the five-year average return on US federal funds and the [MSCI World Index](#), with 75 percent of offshore funds invested in securities markets) and (2) would be taxed at 28 percent (the average capital income tax rate, weighted by GDP). This estimate reflects only income taxation, excluding inheritance, transaction, or wealth taxes.

¹⁶ The IMF has actively contributed to policies against money laundering and the financing of terrorism. Its work in these areas is fully integrated into other IMF workstreams, including capacity development and fintech. Likewise, work on transnational facilitation of corruption is part of the IMF Framework for Enhanced Engagement on Governance ([April 2019 Fiscal Monitor](#)).

individuals on labor incomes (wages) and capital income. The latter is also relevant for the self-employed. A few countries additionally tax the stock of net wealth.

40. Enforcing capital taxation requires reliable third-party information, including from other countries. Salaries are generally easier to monitor than capital taxation because employers usually withhold taxes on behalf of employees and remit the amounts to the tax authorities. Taxing capital requires more third-party information (to cross-validate and verify the final tax) that can be difficult to obtain, especially if the taxpayer has offshore activities.

41. Difficulties arise in enforcing capital taxation:

- *Information sharing*: Foreign authorities should be willing and have the legal framework to share information with other countries. For example, if a resident holds a bank account offshore, then tax authorities need to access information about this account through foreign authorities to assess self-declared information about this account.
- *Information availability*: Reliable information must be available, considering that determination of beneficial ownership is essential to ensuring the integrity of the tax system (Box 2.1). Ownership can be obscured by using an anonymous (“shell”) offshore company (or a trust) that holds a bank account offshore, which is used to manage private wealth (Sharman 2010).¹⁷ As a result, a verified identity of the beneficial owner can be lacking. For example, based on leaked data, Collin (2021) finds that 80 percent of financial assets in his sample are held by entities (such as trusts) rather than individuals and the location of the beneficial owner is generally different from that of the legal owner.

42. As the use of crypto assets rises, lax reporting requirements in this domain further complicate tax enforcement and increase risks of tax evasion.¹⁸ Even as some countries strengthen their rules to combat anonymous crypto transactions and prepayments, countries still need to share information promptly. Some countries also effectively exempt crypto-asset investment gains from taxes, with potential spillovers onto other countries’ tax bases.

43. International coordination on information sharing, such as on residents’ foreign bank accounts, is necessary for enforcing capital taxation. Without information, tax authorities lack a cost-effective mechanism to protect the tax system, and tax audits generally fail to detect offshore income and assets. Ad hoc unilateral enforcement initiatives and occasional offshore voluntary disclosure programs can lead to disclosures of offshore wealth, but usually of only a small portion (for example, only 10 percent of total offshore hidden wealth was disclosed following enforcement initiatives in 2008 in the United States that included offshore voluntary disclosure; Johannesen and others 2020).¹⁹ During the last decade, progress has been made on information sharing among countries, although much improvement is needed to maximize the benefits, as will be discussed.

International Arrangements for Exchanging Information

44. After the global financial crisis, in 2009, the G20 committed to ending banking secrecy and restructured the Global Forum—with its current 163 member jurisdictions, the primary multilateral body for global transparency and exchange of information standards to combat offshore tax evasion.

¹⁷ There can be legitimate nontax reasons to establish trusts. There can also be tax avoidance opportunities that are not necessarily considered illegal evasion (Collins 2021). Tax evasion or avoidance structures can include taxes on income, wealth, and inheritance, as well as stamp duty.

¹⁸ There are also other risks. For example, Alnasaa and others (2022) find that crypto asset usage is higher in countries with perceived weak governance, strengthening the case for taking appropriate policy and regulatory actions.

¹⁹ For an overview of design of voluntary disclosure programs, see Benedek and others (2022). Tax amnesties reduce future compliance because current evaders may expect to have amnesty available in the future, reducing the cost of evading (for example, see Bayer, Oberhofer, and Winner 2015).



45. In 2014, the Global Forum reached an agreement on *automatic* exchange of information. To date, 120 countries are committed to implementing the standard outlined in the agreement (among large advanced economies, the United States is a notable exception). Under this standard, financial institutions (such as banks and hedge funds) report predefined financial information on nonresidents to domestic tax authorities, who in turn share it automatically and annually with tax authorities where the account holders are tax resident.²⁰ The Global Forum monitors and reviews the effectiveness of the implementation of this standard.

46. Additional international channels to share taxpayers’ information include bilateral tax information exchange agreements and ad hoc requests. In 2010, the United States introduced the Foreign Account Tax Compliance Act, requiring financial institutions to share financial account information on US taxpayers with the US Internal Revenue Service. Further international and regional forms of cooperation on tax administration complement or use information-sharing mechanisms, including those to resolve international tax disputes, conduct joint audits and risk assessments, trace cross-border debtors and assets to collect tax arrears, and tackle cybercrimes and threats related to crypto assets.

Box 2.1. The Need for Timely and Accurate Beneficial-Ownership Information

It is pivotal for tax authorities to effectively obtain, verify, and use beneficial-ownership information, which necessitates establishing or accessing *beneficial-ownership registries* (or alternative mechanisms that are just as effective). Owning or controlling a company or trust as a beneficial owner through complicated ownership structures, using multiple jurisdictions, as well as with no visible or direct ownership stake, allows criminals to hide their identity and the origins of their assets and to commit tax evasion and other crimes. Authorities should assess—and design measures to mitigate—risks from such activities.

Table B2.1. What Is Beneficial-Ownership Information and How Can Beneficial-Ownership Measures Be Implemented?

 <p>Definition</p>	<ul style="list-style-type: none"> • <i>Beneficial owner is the natural person</i> who ultimately owns or controls a legal entity (such as a company) or legal arrangement (such as a trust). • <i>Always a person at the end of an ownership or control chain</i>; differs from the concept of legal ownership of an entity (which can be another company or trust that is a shareholder). • <i>The IMF uses the Financial Action Task Force definition of beneficial ownership</i>, which has also been adopted by the Global Forum.
 <p>Implementation</p>	<ul style="list-style-type: none"> • <i>Identify beneficial owners</i> when a company is created, and when changes to ownership and control are made, to prevent misuse and to foster transparency in business dealings. • <i>Centralize verified and up-to-date information into a database</i>: Establish a beneficial-ownership registry, for example with company registries, financial-intelligence units, and tax authorities. • <i>Provide access to the registry</i>: If the registry is not public, then at a minimum, government entities (including tax authorities), financial institutions, and gatekeepers (for example, lawyers, accountants, notaries, and trust and company service providers) should all have access. • <i>Use a multiprong approach</i>: Require companies and trusts to know their own beneficial owners, incorporate beneficial-ownership identification in customer due diligence processes, and use beneficial-ownership information for public procurement.

²⁰ Information on nonresidents includes bank account number, account balance, name of account holder, and address. Also, complementarily, since 2009 the standard of *exchange of information on request* allows exchanging of broader information that is foreseeably relevant for the administration of taxes.

Benefits from Exchange of Information

47. Automatic exchange of information has achieved notable success, globally covering nearly 75 million financial accounts in 102 jurisdictions in 2020 ([OECD 2021c](#)). Also, through the Foreign Account Tax Compliance Act, 110 countries are currently providing information to the United States. Empirical studies suggest that information sharing reduced bank deposits in and portfolio investment from low-tax jurisdictions by 11–38 percent and 21–29 percent, respectively ([Menkhoff and Miethé 2019](#); [O’Reilly, Ramirez, and Stemmer 2019](#)). Still, there is evidence of behavioral responses to information sharing that dampen its effectiveness: shifting hidden wealth to locations with less-stringent regulations or fewer information-sharing agreements, escaping reporting by using citizenship-by-investment schemes, or shifting wealth to assets not (easily) reported under the agreements ([Casi, Spengel, and Stage 2020](#); [De Simone, Lerster, and Markle 2020](#); [Langenmayr and Zyska 2021](#)).²¹

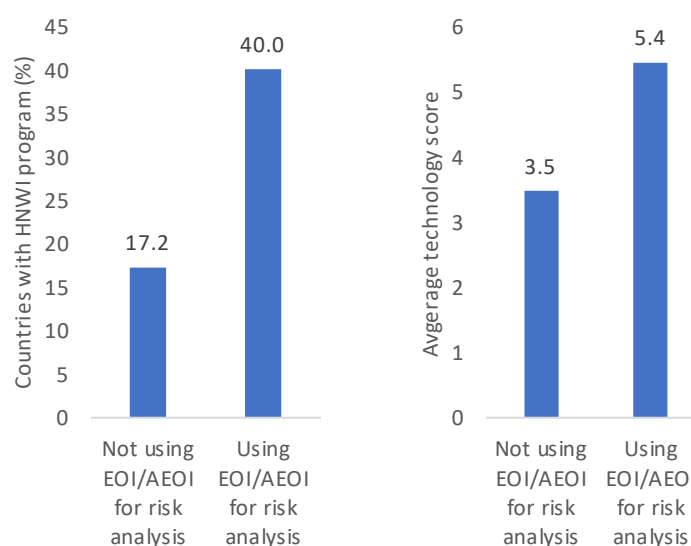
48. Some (especially low-income) countries have not yet realized the full benefits from exchange of information. Not only must information be available and an exchange agreement in place, but standards of confidentiality and data safeguarding also are necessary to prevent misuse or unauthorized disclosure of received information. For several low-income countries, this is the same obstacle as in the context of sharing information on multinationals’ country-by-country activities. Moreover, countries need a domestic legal framework that requires financial institutions to collect and report the information, and systems, as well as processes, for the information (including the appropriate information technology). All are nontrivial conditions for low-income developing countries to meet.

49. To better understand constraints on the effective use of exchanged information, IMF staff conducted a survey, for this chapter, covering tax authorities from 72 countries (of which 18 are not members of the Global Forum). Among the respondents, 9 countries did not receive information from abroad in 2019 through any channel, with another 20 countries having received no more than 10 incoming exchanges. Among those that received information, almost half responded that they did not use the information in their risk and tax enforcement analyses.

50. Capacity constraints in data analytics and knowledge

Figure 2.4. Use of Internationally Shared Information in Risk Analysis by Tax Authorities

Better technology and specialized tax units are correlated with the use of incoming information in risk analysis.



Source: IMF staff analysis based on a survey of 72 countries and the International Survey on Revenue Administration database, 2017.

Note: See Online Annex 2.3 for details on the survey of countries. A tax administration’s average technology score is the sum of 6 indices of technologies, scored from 0 (technology is not used) to 3 (technology is fully in place). The *p*-values of mean-differences tests are 0.03 (technology score) and 0.05 (HNWI program). (A)EOI = (automatic) exchange of information; HNWI = high-net-wealth individual.

²¹ Note that information sharing also entails compliance costs, especially for financial institutions ([Dhammapala 2016](#)).

management are an additional hurdle to overcome. The use of incoming information in compliance risk analysis is strongly correlated with tax administrations' adoption of adequate information technology (Figure 2.4). Furthermore, the use of incoming information is also significantly correlated with the presence of a dedicated unit in the tax administration focusing on enhancing tax compliance among high-net-worth individuals (Figure 2.4). Audits and compliance programs focusing on high-wealth individuals require specialized skills and training, and hence a permanent specialized group can help improve the use of available information and strengthen tax compliance (Buchanan and McLaughlin 2017).

51. Countries recognize the opportunities from exchange of information (along various dimensions in the survey, including reduced tax leakage and stronger enforcement capability). The Global Forum and other bodies are currently working to strengthen countries' capacity in this area.

52. Countries are also becoming increasingly aware of, and taking actions against, professional enablers (those that engage in illegal facilitation of tax crimes). Several avenues have been pursued, for example, communication with taxpayers and intermediaries (publishing alerts about arrangements that misapply the law), mandatory-disclosure rules (requiring taxpayers and intermediaries to report to the authorities arrangements with particular hallmarks), and fines for facilitators of breaches by taxpayers (OECD 2021b).

53. International cooperation is also essential for success in tackling enablers of tax crimes. For instance, five countries known as the J5 (Australia, Canada, The Netherlands, United Kingdom, and United States) formed an operational alliance in 2018 to pool resources, share intelligence, and unite investigators and data scientists. J5 investigations ultimately led to the prosecution of a fraudulent crypto-asset scheme in 2020 (OECD 2021b).

Improved Domestic Tax Policy through Transnational Enforcement

54. International coordination supports tax enforcement and compliance, thereby offering individual countries opportunities to strengthen personal taxation policy and thus address increasing income and wealth inequalities. There are arguments for a flat, low capital income tax rate—as is currently used in several countries—including the capital mobility and enforcement difficulties caused by offshore tax evasion and avoidance. Yet information sharing across borders would make it more difficult to use offshore structures to minimize taxes, and that can be complementary to high taxation at the top (Keen and Slemrod 2017). In countries where implementation capacity now constrains tax policy choices, better tax enforcement could allow policy to adjust, especially at the top of the income distribution. A distinct but related issue is that effective use of information can reveal tax loopholes that may not be illegal; hence, domestic tax laws can be upgraded to capture such loopholes, if this is the policy intention.

Personal Tax Implications of Geographic Relocation

55. Wealth mobility across borders for tax purposes is mainly—but not only—on paper, as opposed to the actual migration of wealth holders. The foregoing discussion, therefore, has focused on tax evasion and avoidance. There are, however, known (and certainly less-known) cases of high-wealth individuals' changing their country of residence for tax purposes (including prominent examples from the entertainment and sports professions).

56. Labor is generally less mobile than capital, exposing it less to tax competition. But physical mobility becomes more attractive when personal tax rates vary across countries and preferential tax regimes target specific groups from abroad, such as retirees, high-skilled workers, managers, and the superrich (such as citizenship by investment and other similar regimes). Keven and others (2020) find evidence that mobility decisions do respond to cross-border differences in personal taxation, while acknowledging that nontax factors also matter. Tax-induced mobility varies across occupations and across countries within an occupation, although it has been concentrated at the top of the income and wealth distributions.

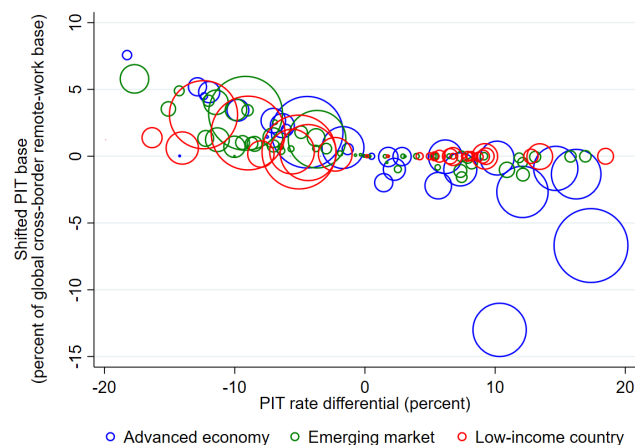
57. With expanding opportunities for cross-border remote work, a bigger segment of the labor income tax base has become more mobile. For example, since the onset of the COVID-19 pandemic, the number of countries offering digital-nomad visas, targeted at high-skilled individuals who can work remotely, has increased from 16 to 40. This development indicates that the tax elasticity of labor mobility could increase, thereby expanding international personal tax competition to more professions and income groups. Little is known thus far about the magnitude of the revenues at stake.

58. Rough estimates suggest that personal tax differentials across countries, coupled with the ease of remote work, reallocate annually about \$40 billion of personal income tax base globally (1¼ percent of the total personal income tax base in the sample; Online Annex 2.4). Country-specific estimates of the average potential revenue loss and gain are between 0.1 and 0.2 percent of GDP. Small emerging market economies with below-average tax rates and good remote work capability typically gain tax base (Figure 2.5). The estimates do not consider restrictions to international labor mobility, possible double taxation of income, and the potential for investment incomes to move with people.

59. The estimated tax revenue implications of cross-border remote work are small. Personal tax coordination will likely gain importance, however, raising issues not unlike those related to corporate taxation: Where is active labor income taxed? Is it the source country, where the employer resides, or the residence country, where the employee works remotely? Does the place of remote work constitute a physical presence of the employer in the employee's residence country? Issues of consistency of legal rules across countries and the avoidance of double taxation can come to the fore.

Figure 2.5. Effect of Cross-Border Remote Work on a Country's Personal Income Tax Base, by Income Group

Cross-border remote work potentially reallocates tax base to below-average tax rate countries; the aggregate effect is 1¼ percent of the global personal income tax base.



Source: IMF staff analysis.

Note: See Online Annex 2.4 for details on the analysis. PIT differential is a country's personal income tax (PIT) rate minus the world average PIT rate. Shifted PIT base is the estimated country-specific loss or gain due to cross-border remote work, as a share of globally affected PIT base. Marker weights express the loss (or gain) in terms of GDP.

Carbon-Pricing Coordination

At a Glance

- Global warming is threatening our planet, and the window of opportunity for containing climate change to manageable levels is closing rapidly. International coordination is urgently needed.
- An internationally coordinated carbon price floor among key large emitters—in the form of a carbon tax designed flexibly to accommodate equity considerations and constraints on national policies—can, in conjunction with Paris mitigation pledges, reduce emissions by 32 percent by 2030, thereby keeping warming below 2°C.
- A carbon price floor can readily accommodate emission-trading systems. The equivalent carbon price of other approaches (such as renewables policies, emission-rate standards, and feebates) can be mapped.
- In contrast to carbon pricing, other instruments do not trigger the full demand response to promote the whole range of mitigation opportunities.
- Unilateral border carbon adjustments would be far less effective at scaling up global mitigation than a more comprehensive carbon-pricing regime, as emissions in traded products are typically well below 10 percent of countries' total emissions.

60. Climate change is an existentially important global externality that requires carbon taxation or pricing and other tools tailored to country-specific circumstances to address it. But for individual countries, scaling up mitigation policy, including through taxation, can be difficult without international coordination, owing to concerns about competitiveness and uncertainty over trading partners' policies.

61. There remain critical gaps in both global mitigation *ambition* and *policy*. About 140 countries, representing more than 85 percent of greenhouse gas emissions, have now committed to net-zero emissions by around midcentury. But even if mitigation pledges were fully achieved, global carbon dioxide (CO₂) would be cut by only one-third to two-thirds of the reductions needed by 2030 to limit global warming to 1.5 to 2°C above preindustrial levels. Worse, there is an even larger gap in mitigation policy consistent with temperature goals. Measures equivalent to a global carbon price exceeding \$75 per ton are needed by 2030, whereas the global average emission price is currently only \$4 per ton per ton (Black and others 2022; High-Level Commission on Carbon Prices 2017).

62. An additional international mechanism to complement the Paris Agreement, with a concrete plan to deliver the required emission reductions in 2030, is critical. Without an urgent narrowing of mitigation ambition and policy gaps, a dangerous cliff edge for emission reductions for 2030–40 will emerge, greatly increasing transition costs and potentially putting temperature goals beyond reach.

63. Recent proposals have focused on coordinated carbon-pricing regimes. The IMF has suggested an international carbon price floor (October 2019 *Fiscal Monitor*; Parry, Black, and Roaf 2021), and in a similar vein, in August 2021, the German government called for an international climate club (BMF 2021). The chapter next discusses design issues for a coordinated carbon-pricing regime (potentially accommodating other measures like regulations), the effects of such a regime, and their relation to emerging instruments (border carbon adjustments).

Coordinated Carbon-Pricing Regime

64. The key element of an international carbon-pricing agreement is a *carbon price requirement for participants*, with prices set to align emissions with global temperature goals. The price of carbon emissions is an easily understood parameter. Carbon pricing would promote the full range of behavioral responses for reducing energy use and shifting to cleaner energy sources (if imposed comprehensively) and effectively address concerns about competitiveness and policy uncertainties (if internationally coordinated). A price *floor* requirement (drawing parallels with the Pillar 2 agreement on a minimum global corporate tax) is preferable, because it provides flexibility for countries to impose higher carbon prices if needed to meet their Paris mitigation pledges.

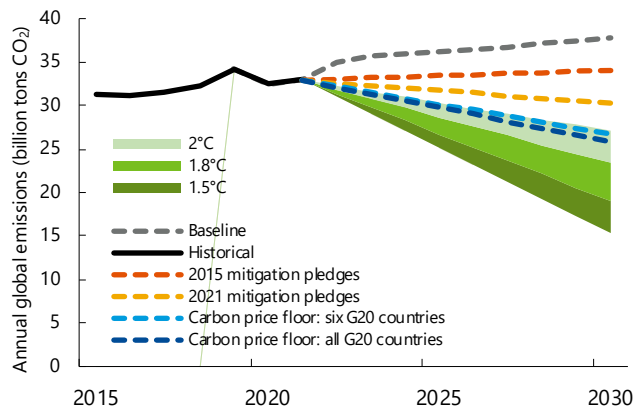
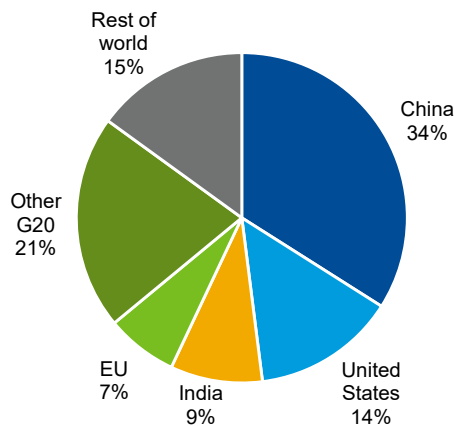
65. The agreement can allow countries to use carbon taxation or emission-trading systems. The negotiating parties should also retain flexibility for those countries that prefer to use alternative or complementary policies such as partial pricing, regulations, or fiscal incentives. If emission reductions from alternative policies can convincingly be assessed—and IMF and World Bank staff have developed a method that might be used for this purpose (Online Annex 2.5)—the equivalent economy-wide carbon price (that would deliver the same emission reduction) can be estimated using country-specific information on various emission sources and responsiveness to price changes. In this regard, carbon prices and their equivalents facilitate negotiations by serving as a common metric.

66. To further facilitate negotiation, a few key emitting parties could make a crucial start (though it is difficult to predict which coalition of countries might prove most feasible). For illustration, an agreement among China, the European Union, India, and the United States would cover 64 percent of baseline global CO₂ emissions in 2030, whereas an agreement among the G20 members (encompassing all European Union countries) would cover 85 percent (Figure 2.6).

67. Covered emission sources would need to be specified. The agreed-upon carbon-pricing regime might initially apply to CO₂ emissions from the power and industrial sectors, because these emissions are reliably measured and are generally the most responsive to pricing in the near term. The regime might then be extended to all fossil fuel CO₂ emissions and, as monitoring technologies evolve, broader emission sources (for example, agriculture and methane leaks from fuel extraction and distribution). Some countries may choose to rely, at least initially, on increases in existing energy taxes or taxes on specific items (for example, coal) rather than more comprehensive carbon pricing. In such cases, the effect on emissions can also be significant (Online Annex 2.5), and an equivalent carbon price can be computed for international comparisons.

Figure 2.6. Baseline CO₂ Emissions, Figure 2.7. CO₂ Emission Projections 2030

Group of Twenty (G20) countries will account for 85 percent of global carbon dioxide (CO₂) emissions in 2030. A carbon price floor can align emissions with keeping global warming below 2°C.



Source: IMF staff analysis.

Note: Baseline refers to projected emissions with no new, or tightening of existing, mitigation policy. EU = European Union.

Note: Fossil fuel carbon dioxide (CO₂) emissions shown exclude international aviation and maritime emissions. Six G20 countries refers to Canada, China, the European Union, India, the United Kingdom, and the United States. G20 = Group of Twenty.

68. The carbon-pricing regime would need to address the differentiated responsibilities of developing countries, potentially by differentiating price floor requirements according to a country’s level of economic development. Additional options include supplementary mechanisms for transferring

financial and technological assistance, a priority for low-income countries and emerging market economies.

Scenario of an International Carbon Price Floor

69. Reinforcing existing pledges with a (concrete example of a) price floor could cut global CO₂ emissions by 29 percent below baseline levels. The illustrative computation presented here is for an international carbon price floor on fossil fuel CO₂ emissions in 2030, which is aligned with keeping global warming below 2°C. It differentiates prices according to development level: \$75 per ton for advanced economies, \$50 per ton for high-income emerging market economies such as China, and \$25 per ton for low-income emerging market economies such as India. The simulation suggests that it is sufficient for only six G20 members to participate (Canada, China, the European Union, India, the United Kingdom, and the United States). When all G20 members participate in the price floor, global emissions decrease by 32 percent. In stark contrast, existing mitigation pledges would cut global CO₂ emissions in 2030 only by 20 percent below baseline (Figure 2.7).

70. Under this illustrative pricing regime (Figure 2.8), emission reductions are around 35–50 percent below baseline in 2030 for advanced economies and 20–30 percent for emerging market economies. The pricing floor (rather than the mitigation pledge) is binding for 6 out of 10 emerging market economies, but for only one advanced economy. Applying a dynamic computable general equilibrium model to a cooperative international pricing scenario, [Chateau, Jaumotte, and Schwerhoff \(2022\)](#) find that the GDP effects are modest, at least if revenues from carbon pricing are used productively and needed energy investments materialize. Thus, cooperation in carbon pricing and equivalent measures can keep global warming within an acceptable range at relatively small macroeconomic costs and is fully compatible with continued, healthy economic development.

71. Implementing carbon-pricing requirements would mobilize a significant source of new revenue, ranging between 0.7 and 2.9 percent of GDP, depending on the CO₂ price and the CO₂ intensity of GDP. Abatement costs (from reducing emissions) under the illustrative regime vary from 0.2 to 1 percent of GDP for most countries. Costs on average are highest for advanced economies and lowest for low-income countries and emerging market economies, with some exceptions—for example, costs are more than 1 percent of GDP in South Africa, reflecting high emission intensity of the country’s GDP. However, the domestic environmental cobenefits of carbon pricing—notably, reductions in mortality from local air pollution—can offset a large portion of these costs and substantially exceed them in several large emerging economies.

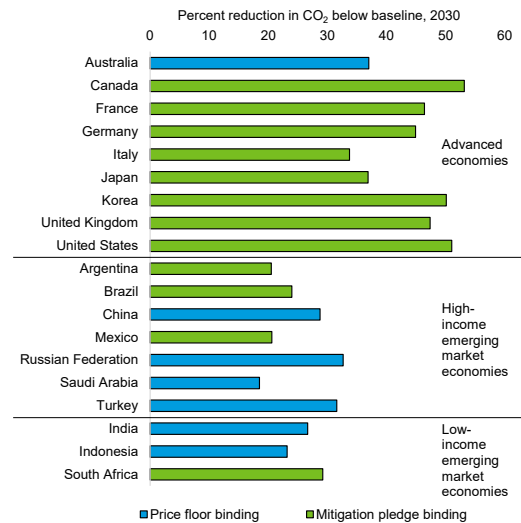
Carbon Taxes and Equivalent Measures under a Coordinated Regime

72. International pricing regimes can readily accommodate both carbon taxes and emission-trading systems. In the latter, the government sets a cap on allowed emissions, firms obtain permits for their emissions (from the government or through trading with other firms), and market trading ultimately

Figure 2.8. CO₂ Reduced below Baseline in Selected Countries, 2030

(Percent)

Emission reductions are 20–55 percent below baseline.



Source: IMF staff analysis.

Note: The carbon dioxide (CO₂) reductions shown result from either a country’s mitigation pledge or the illustrative carbon price floor, whichever is more stringent.

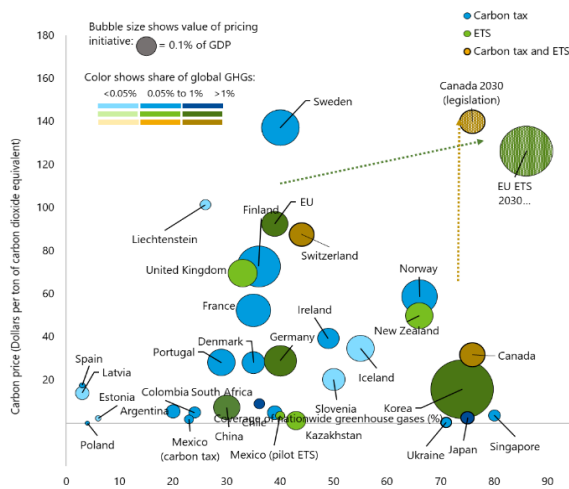
establishes the allowance or emission price. A domestic price floor mechanism or appropriate scaling of the cap can align domestic prices with international requirements.²² About 30 pricing schemes have been implemented at the European Union and national levels, although coverage rates vary (below 30 percent of greenhouse gases in some cases and above 70 percent in others), as do prices (below \$20 per ton in many cases but well above \$50 per ton in others) (Figure 2.9).

73. Further policy approaches can be accommodated if they yield emission reductions equivalent to those from carbon pricing. Some countries may eschew carbon pricing—perhaps because of opposition to higher energy prices—in favor of other measures. These include renewables policies, emission-rate standards, feebates, clean-technology subsidies, and taxes on individual fuels.

74. In contrast with carbon pricing, regulatory and fiscal instruments do not trigger the full demand response to promote the full range of mitigation opportunities. For example, adopting a vehicle standard for CO₂ per mile promotes sales of lower-emission vehicles but does not encourage people to drive less. Even so, a combination of policies could be calibrated to achieve economy-wide emission reductions equivalent to those through implementation of a carbon price.²³

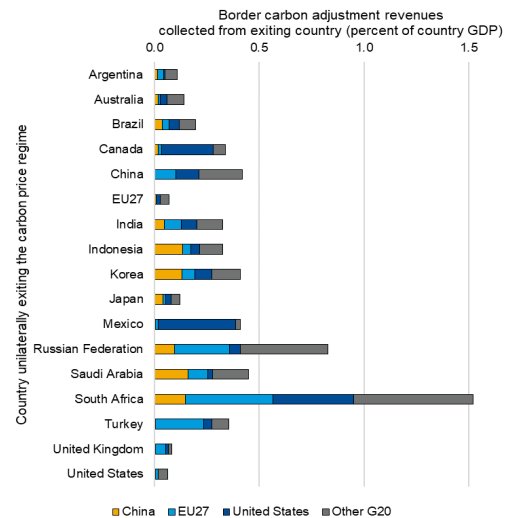
Figure 2.9. Selected Carbon-Pricing Initiatives, Figure 2.10. Penalties from Exiting Illustrative Carbon-Pricing Regime with a Border carbon adjustment, 2020

Pricing schemes are proliferating, but coverage rates and prices vary considerably.



Source: IMF staff update of Parry and others (2021), Figure 1. Note: ETS = emission-trading system; EU = European Union; GHGs = greenhouse gases.

Border carbon adjustment penalties create incentives for countries to remain in a carbon-pricing regime.



Sources: IMF, Climate Change Indicators Dashboard, 2022; OECD, Bilateral Trade Database by Industry and End-Use, 2022; and IMF staff calculations. Note: Embodied carbon data are for 2015, and trade flow data are for 2020 (except those for Saudi Arabia, which are for 2018). This figure assumes border carbon adjustment based on country-specific standards and a \$75 CO₂ price. EU-27 = 27 countries of the European Union; G20 = Group of Twenty.

²² Canada offers a prototype whereby the federal government sets the needed carbon price, while provinces and territories have the flexibility to meet the price through taxes or emission-trading systems (ECCC 2020).

²³ Online Annex 2.5 illustrates potential CO₂ reductions under alternative mitigation policies relative to those under carbon pricing.

Unilateral Border Carbon Adjustment

75. Without an international carbon-pricing regime, unilateral border carbon adjustments seem likely to emerge, especially given the recent European Union proposal.²⁴ A border carbon adjustment imposes charges (or allowance purchase requirements) on imports into a jurisdiction with carbon pricing for “embodied” carbon (i.e., the CO₂ emitted in the production of imports).²⁵ Such an adjustment is motivated by concerns about carbon leakage and competitiveness. Limiting an adjustment’s scope to energy-intensive, trade-exposed industries (such as iron, steel, aluminum, petroleum products, and cement) would focus it on sectors in which these concerns are most severe and would limit administrative burdens (in part because reasonably reliable measures of embodied carbon are available for these sectors).

76. Border carbon adjustments are, however, subject to legal, equity, and effectiveness concerns (Parry and others 2021). Uncertainties surround the compatibility of border carbon adjustments with World Trade Organization rules. Border adjustments may disproportionately affect developing countries’ competitiveness, not least because industries in large emerging market economies often have two to four times the embodied carbon of advanced economy industries—a possible response might be to base the adjustment on domestic industry emission rates for all trading partners. And border adjustments would be far less effective at scaling up global mitigation than a more comprehensive carbon-pricing regime, given they price emissions only in traded products, which are typically less than 10 percent of countries’ total emissions.

77. A border carbon adjustment can help create incentives for countries to remain in a pricing regime, rather than leave and subject their exports to the adjustment by those remaining in the regime. For example, if the United States unilaterally withdrew from a carbon-pricing regime in which all other G20 countries participated, then other countries would collect an estimated \$13 billion (0.06 percent of GDP) a year on imports from the United States (for a border carbon adjustment based on European Union carbon intensity and a \$75 per ton price). If China and India unilaterally withdrew, then revenue collections on their exports would be \$62 billion (0.42 percent of GDP) and \$9 billion (0.32 percent of GDP), respectively (Figure 2.10).

78. Aside from complicating negotiations, combining a carbon-pricing regime with a border carbon adjustment would raise two further issues:

- *All participants in the pricing regime would likely need to impose carbon pricing*, at least for domestic emissions from energy-intensive, trade-exposed industries. A country without these emission charges cannot, under World Trade Organization rules, impose charges on embodied emissions for imports.
- *A common external border carbon adjustment would need to be agreed upon*, which might limit the scope for varying the pricing of industrial emissions according to development levels.

79. Despite the recent proliferation of carbon-pricing schemes, such pricing remains difficult domestically in many countries, not least because of opposition to higher energy prices and the contraction of fossil fuel–reliant activities. A comprehensive strategy with supporting elements can enhance prospects for reform and is especially important in light of recent surges in energy prices. Supports might include, for example, reinforcing pricing with sectoral-based regulations and feebates (which have less impact on energy prices), the use of carbon-pricing revenues to equitably boost the economy, robust assistance measures for vulnerable groups, and gradual phase-in of reforms in

²⁴ The European Council (2022) reached an agreement in March 2022 on a “carbon border adjustment mechanisms” to function in parallel with the EU’s Emissions Trading System. The European Parliament is yet to confirm its position.

²⁵ Rebates might be provided to domestic exporters, perhaps tied to industry-level emission-rate benchmarks to avoid undermining firm-level mitigation incentives.

consultation with stakeholders (for case studies and analysis of distribution and political economy issues, see [IMF 2013](#); [October 2019 *Fiscal Monitor*](#)).

80. International policy coordination is, however, essential—and urgent—to overcome obstacles to unilateral action. The immediate priority is continued dialogue on, and supporting analysis of, potential coordination regimes. This dialogue could be conducted in parallel through multiple fora, such as the Group of Seven (G7) and G20 (currently under the German and Indonesian presidencies, respectively), the 27th United Nations Conference of the Parties (COP27), and the Coalition of Finance Ministers for Climate Action, as well as through bilateral discussions. Meanwhile, the type of price floor arrangement discussed here might also be implemented at the regional level (e.g., several countries in the Latin American region already have carbon taxes, and several countries in the Asia and Pacific region have implemented, or are considering, carbon pricing)—regional price floor arrangements could provide valuable experience for developing a global price floor arrangement.

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Online Annex 2.1. Estimating the Revenue Impact of Pillar 1 and 2

This annex describes the calculations for Figures 2.2 and 2.3 in Chapter 2. First, it describes the simplified empirical measures for decomposing multinationals' profits into 'normal' and 'excess' profits and then details the methodology used to estimate the static revenue impacts of Pillars 1 and 2 of the Inclusive Framework agreement, along with a sensitivity analysis.

Decomposing Total Profit

Total multinational profit is USD 7.9 trillion according to S&P Capital IQ's database on consolidated accounts of the largest 40,000 (public and private) multinationals.¹ Table 2.1.1 shows the dataset's coverage and profit by sector,² with the Industrials, Energy, and Financials earning the most profit, and Energy, Communication Services, and Utilities having the highest average profit per firm. Profit is concentrated in relatively few, very large firms—42 percent of profit is earned by the 400 firms with the highest earnings (1 percent of the sample) and 80 percent of total profit is earned by 4,000 firms (10 percent of the sample).

Online Annex Table 2.1.1. Total Multinational Profit by Sector

Sector	Total firms	Profit (USD millions)				
		Total	Average	Median	25th percentile	75th percentile
Energy	1,642	1,169,364	712	73	14	272
Financials	3,608	799,258	222	12	0	78
Communication Services	1,413	579,386	410	39	11	164
Consumer Discretionary	6,522	765,149	117	16	6	52
Consumer Staples	3,748	551,323	147	17	5	55
Industrials	10,094	1,319,351	131	20	7	62
Materials	4,068	663,407	163	27	10	90
Real Estate	1,800	392,115	218	75	25	177
Utilities	1,991	651,297	327	84	22	259
Health Care	2,257	454,890	202	23	8	69
Information Technology	3,025	560,789	185	19	8	54
Undefined	433	19,141	44	10	3	30
All	40,601	7,925,470	195	23	7	82

Sources: IMF estimates using S&P Capital IQ data.

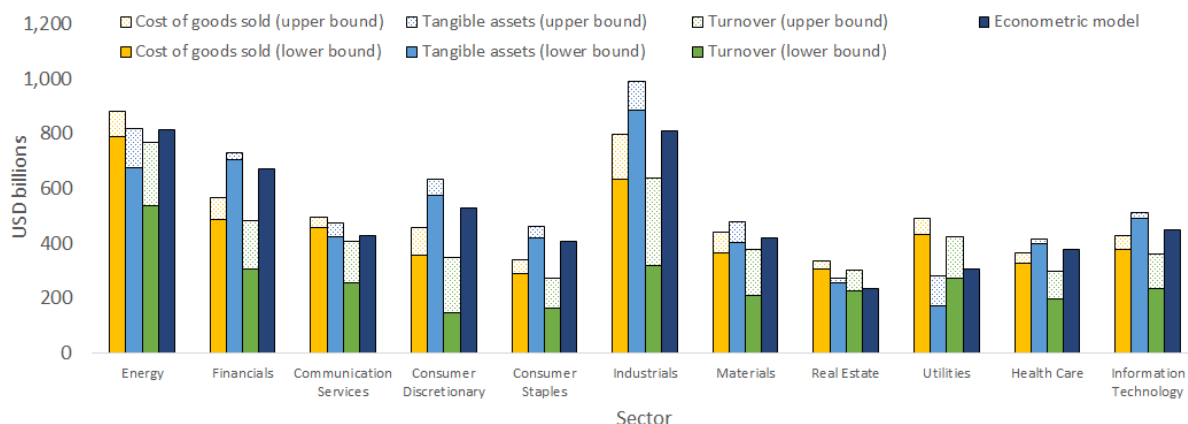
For each multinational, excess profit is computed as total profit minus normal profit, and then summed up for different groupings (e.g., headquarter country and sector), using four separate measures of normal profit: (i) 5-7.5 percent of the cost of goods sold, (ii) 5-7.5 percent of tangible assets, (iii) 5-10 percent of turnover, and (iv) an estimate based on an econometric model (described in Box 2.1.1).

Under all methods, the Energy, Industrials, and Financial sector have the largest excess profit, but the magnitude and order vary.

¹ Multinationals with negative profit and missing values for assets and/or payroll are excluded from the sample, reducing the dataset from 50,000 to 40,000 multinationals. The removed multinationals are relatively small.

² Profit is defined as earnings before interest and tax (EBIT). The aggregate across firms in the dataset for EBIT and EBT (earnings before tax) are similar (e.g., the difference is roughly 1 percent).

Online Annex Figure 2.1.1. Multinational Excess Profit by Sector



Sources: IMF estimates using S&P Capital IQ data.

Online Annex Box 2.1.1. Bottom-up Estimates of Residual Profits

The bottom-up estimates of residual profit at the firm-level are based on the following regression specification (Beer and Loeprick, forthcoming):

$$\ln(\pi_{its}) = \alpha_s \ln(\mu_{its}) + \beta_s \ln(1 + \rho_{its}) + \gamma'_s X_{its} + \varepsilon_{its}, \quad (\text{A.1})$$

where π_{ist} is earnings before taxation, $(\alpha_s, \beta_s, \gamma'_s)$ is an industry-specific vector of regression coefficients, μ_{its} is a firm-specific measure of output prices over marginal production cost in year t and industry s , computed following De Loecker and others (2020), ρ_{its} is a firm-specific measure of risk, computed using the firm's optimization condition for capital inputs when risk-premia vary (thus, here firm-specific risk is part of the normal return), and X_{its} is a vector of control variables that includes firm-specific productive inputs (assets, employees) and macro variables (including GDP, GDP growth, and inflation), and ε_{its} is an idiosyncratic residual that is uncorrelated with productive inputs, risk, and market power. We define routine profit as the earnings a subsidiary should expect in the absence of market power and risk. The average share of routine profit given a firm's tangible assets, k_{its} , on an industry-level, is defined as

$$P_s \equiv \frac{1}{N_s} \sum_{it} \frac{e^{(\hat{\gamma}'_s X_{its})} e^{\left(\frac{\sigma_s^2}{2}\right)}}{k_{its}},$$

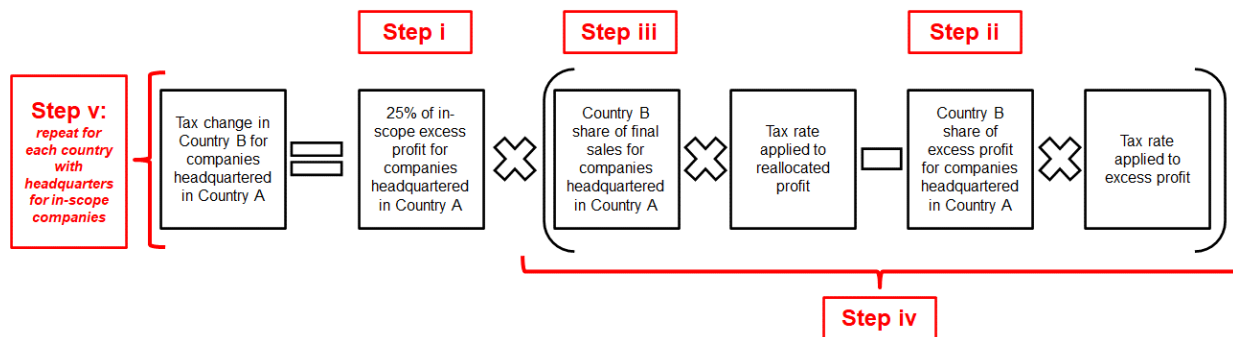
where $\hat{\gamma}'_s$ are estimated coefficients from equation (A.1), relying on a panel dataset of independent firms operating in industry s , comprising N_s observations, and σ_s^2 is the estimated variance of the residual in (A1). Estimates of routine and residual profit for MNEs' consolidated accounts follow from using $Routine_{is} = P_s k_{is}$, and $Residual_{is} = \pi_{is} - Routine_{is}$, where k_{is} are tangible assets and π_{is} is earnings before taxation as recorded in the S&P Capital IQ database.

Pillar 1: Static Revenue Estimate

Pillar 1 reallocates 25 percent of in-scope multinationals excess profit to the jurisdiction where multinationals make final sales (i.e., the market jurisdiction)—the amount of reallocated profit is called Amount A under Pillar 1. To estimate the revenue impact of Amount A for individual countries, the calculation uses five steps, which are described below and depicted in Figure 2.1.2.

- i. calculate 25 percent of the global excess profit for in-scope multinationals from a given headquarter country (e.g., 25 percent of global excess profit for in-scope multinationals from Country A),
- ii. determine the share of excess profit in each source country from a given headquarter country³ (e.g., the excess profit of multinationals from country A in country B as a share of global excess profits by country A's multinationals),
- iii. determine the share of final sales for each source country from a given headquarter country (e.g., the final sales of multinationals from country A in country B as a share of global final sales by country A's multinationals),
- iv. apply the rate applicable to currently taxed (step ii) and reallocated excess profit (step iii) to determine the gain/loss from Amount A of Pillar 1 for each source country from a given headquarter country (e.g., the increase/decrease in tax revenue of multinationals from Country A in Country B),⁴ and
- v. repeat steps (i) through (iv) for each headquarter country to calculate the total gain/loss from Amount A of Pillar 1.

Online Annex Figure 2.1.2. Methodology for Pillar 1 Static Revenue Estimate



Note: the above calculation is repeated for all headquarter countries and then summed together to determine the total revenue impact on Country B. The diagram is similar to Figure 2.1 in OECD 2020. Excess profit is defined as profits above 10 percent of turnover.

For step (i), the computation uses the S&P Capital IQ dataset and first excludes all out-of-scope firms (i.e., those with turnover below EUR 20 billion and those in the extractive or regulated financial sector) from our dataset. Next, the chapter calculates excess profit, assuming that excess profit is equal to profit above 10 percent of turnover.⁵

The method used to estimate excess profit reported in source-headquarter country pairs (step ii) varies by headquarter country, based on data availability. If the country has country-by-country (CBC) data with financial indicators reported for many source jurisdictions,⁶ then excess profit is calculated using CBC data at

³ The source country is the location in which a multinational produces goods and services, while the market jurisdiction is the location of final sales.

⁴ This approach generally follows that of the static revenue estimate in the OECD's Economic Impact Assessment (2020).

⁵ This results in around 140 companies with excess profit—they are headquartered in 25 countries (19 advanced and 6 emerging market countries), with 46, 12, 6, and 6 percent of excess profit from multinationals headquartered in the United States, China, United Kingdom, and Hong Kong SAR, respectively.

⁶ These headquarter countries are Australia, Bermuda, China, Denmark, France, Germany, India, Italy, Japan, Luxembourg, Mexico, South Africa, Spain, Switzerland, and United States.

the source-headquarter country level for multinational sub-groups⁷ with positive profit (e.g., total profit less 10 percent of turnover of country's A multinationals in country B). If the headquarter country's CBC data groups many countries together (e.g., profit reported for all of Asia or all foreign jurisdictions, without reporting for individual countries) or there is no CBC data, then the allocation of excess profits by source country is assumed to match the simple average for headquarter countries that report comprehensive CBC data.

The method to estimate final sales in source-headquarter country pairs (step iii) generally follows the methodology from (step ii), using CBC data and other data sources, such as the US Bureau of Economic Activity (BEA) survey on US Multinational Activities and the OECD's Activity of Multinational Enterprises (AME) dataset. These datasets report revenue by source country, which needs to be adjusted to account for revenue that is not connected to the market jurisdiction (i.e., related party sales). This adjustment is done by assuming re-export ratios that come from the US BEA and apportioning the re-exported revenue based on the source countries' bilateral trade destinations, coming from the World Bank's WITS database (e.g., re-exports from country A are allocated to individual countries based on the share of country A exports to each individual country). Final sales for each source country equal the multinational domestic sales to final consumers plus imports, stemming from re-exports.

In step (iv), the tax rate for current excess profits (step ii) and excess profits reallocated using sales by destination (step iii) must be defined. Reallocated excess profits are assumed to be taxed at the statutory corporate income tax (CIT) rate, while three separate methods are used for the tax rate applicable to the current excess profit since the statutory CIT rate does not apply in all cases (for example, when there are preferential regimes for foreign-sourced income). The separate methods for current excess profit serve as sensitivity analysis because there is no available data on the actual tax rate applied to these profits. The three excess profit tax rate methods are: (i) the statutory CIT rate, (ii) the source-headquarter country effective tax rate estimated using CBC data, with profit adjusted downward since dividends are included in profit in the CBC data (in some cases) and dividends are generally exempt or lightly taxed—profit is reduced by 17 percent for all countries, which matches the adjustment needed for Netherlands based on OECD 2020b,⁸ and (iii) the source country's effective tax rate estimated using US BEA data (profit from the US BEA is the profit-type return series and, therefore, excludes income from equity investment and does not require an adjustment to remove dividends).

Step (v) is to sum together the revenue gain/loss for a given source country because, up to this point, the chapter only computes the revenue gain/loss for each source-headquarter country pair. The result is the total revenue gain/loss from Amount A of Pillar 1.

Pillar 2: Static Revenue Estimate

Pillar 2 of the Inclusive Framework applies a top-up tax to profits of in-scope multinationals that are taxed below 15 percent in any given source country. A portion of profit is excluded from this minimum tax. This portion is called “substance-based carve-out” (a tax deduction for assets and payroll). It is calculated using the indicator for tangible assets from the CBC dataset and an estimate for payroll.⁹ Profit, assets, and payroll are adjusted downward to exclude the amounts attributed to the headquarter country, effectively removing any

⁷ A sub-group is composed of all entities located in a single jurisdiction that are owned by a single parent company.

⁸ OECD 2020b compared CBC profit with that reported in tax returns and found that 17 percent of profit was made up of dividends. See OECD 2021 for a full description of data limitations.

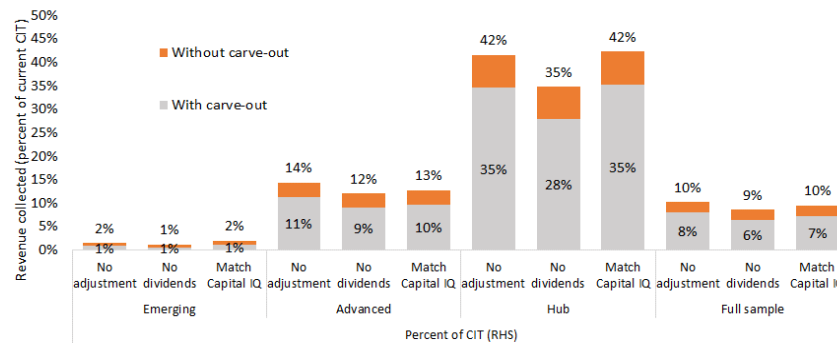
⁹ The CBC data only includes information on the total number of employees, not payroll. The annual wage paid to each employee was calculated for each source country using the US BEA data on payroll and employees.

revenue from Pillar 2 that could stem from profits taxed below 15 percent located in the headquarter country.¹⁰

To estimate the revenue implications of Pillar 2, two methodologies are used (depending on data availability for a given country)¹¹—depending on whether a country provides financial indicators based on the effective tax rate paid by multinational sub-groups.¹² For countries that provide these indicators (with the exception of Switzerland),¹³ the profit after carve-out was assumed to be taxed at 15 percent (for the negative income tax accrued bracket) and 10 percent (for the 0-10 percent tax rate bracket), with all other profit assumed to be taxed at more than 15 percent.¹⁴ For countries without these indicators, the effective tax rate is calculated for sub-groups with positive profits by source-headquarter country pair and then a top-up tax is applied to profit (after a deduction for the carve-out) in cases where the effective tax rate is less than 15 percent. Profits are adjusted downward to account for non-taxable dividends, as with the calculation for Pillar 1.

As a sensitivity analysis, three estimates are produced (Figure 2.1.3): (i) adjustments for dividends using the methodology applied for Pillar 1, (ii) no adjustment for dividends, and (iii) adjustment to profit so that aggregate profit for multinationals from each headquarter country matches that of in-scope profit from the S&P Capital IQ dataset. The various methods do not have a large impact on the results aggregated by country grouping. These estimates focus only on a top-up tax on in-scope multinationals without considering, for example, the revenue impact of raising the corporate income tax rate on non-multinational or out-of-scope multinational corporations.

Online Annex Figure 2.1.3. Pillar 2 Revenue Estimate, Sensitivity Analysis



Sources: IMF estimates using data from S&P Capital IQ, OECD CBC, US BEA, and other data sources.

Note: Carve-out refers to a deduction when calculating the tax base to which Pillar 2 applies. The deduction is equal to 10 percent of payroll costs and 8 percent of tangible assets.

¹⁰ Emerging market multinationals earn a large portion of their profit within the headquarter country. For example, 89, 83, and 80 percent of total profit for Chinese, Indian, and Brazilian multinationals was earned domestically (85 percent for emerging market multinationals on average), compared to 53 percent for advanced economies.

¹¹ Calculations are not done for jurisdictions without CBC reporting. In-scope MNEs in those jurisdictions represent 9 percent of total global in-scope profit, with the two most important, omitted jurisdictions being Hong Kong and Taiwan.

¹² Titled 'Table IV – Aggregate totals by tax rate of MNE sub-groups' in the 2017 OECD CBC dataset. Out of the 38 countries with CBC data, the only countries not providing Table IV are Bermuda, China, Latvia, Isle of Man, Romania, and Switzerland.

¹³ Switzerland uses the other method because profit reported under Table IV exceeds USD 500 trillion, which is far more than that reported under other tables.

¹⁴ Results are relatively insensitive to whether profit with effective tax rates of 10 to 20 percent is assumed to be undertaxed and, thus, subject to a small top-up tax.

Revenue estimates for Pillar 2 have been also reported in (OECD 2020a) and (Barake 2021; EU Tax Observatory). The chapter estimates that Pillar 2 revenue is 4.8 percent of total CIT collections compared to 7.4 percent in Barake (2021) for countries that overlap between both studies.¹⁵ In most cases, country-level estimates are similar (less than 5 percent difference), with the revenue gain significantly higher under Barake for a few select countries. OECD (2020a) estimates that total CIT collections for all countries (excluding the US) is 1.2-1.5 percent, while this chapter estimates it at 4.4 percent.¹⁶ The OECD used a similar methodology but with different data vintages (e.g., 2016 CBC data, rather than 2017) and some different assumptions (e.g., the assets portion of the carve-out equals to 10 percent as was proposed at the time). The chapter does not estimate the impact of Pillar 2 if source countries impose a top-up tax (rather than the headquarter country).

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¹⁵ Excluding a top-up tax on undertaxed profits earned domestically and the US. The US is excluded because the US has a minimum tax (so-called GILTI), which takes precedent and, therefore, Pillar 2 will likely not apply to the US if GILTI is changed to be computed on a country-by-country basis. Barake (2021) includes undertaxed domestic profit in its base case scenario but disaggregates undertaxed profits by domestic and foreign earned in the Appendix.

¹⁶ These estimates were extrapolating to all countries by assuming that countries without CBC reporting but with in-scope multinationals match the same pattern as those with CBC data.

Online Annex 2.2. Corporate Tax Rate Strategic Reaction

This annex presents estimates of the reaction of the corporate income tax (CIT) rate in one country to CIT rate changes in the rest of the world as referred to in Chapter 2. Specifically, a one percentage point change in the average foreign CIT rate leads the home rate to change by up to 0.6 percentage points in the same direction. To illustrate, if one country cuts its CIT rate, what is the best response of the others? Theoretically, this best response (or slope of the reaction function) can be positive or negative. Empirically, the magnitude of the slope has not been tied down with precision due to identification challenges, but overall existing empirical studies suggest that it is positive (that is, CIT rates are strategic complements)—as surveyed for example in Leibrecht and Hochgatterer (2012) and OECD (2020). Acknowledging the empirical challenges and building on the literature, this annex estimates the slope of the CIT rate reaction function and the likelihood of a discrete rate cut. The implicit assumption is that a government weighs unobservable and time-varying domestic preferences toward the CIT rate against the level of the average foreign CIT rate.

Empirical Specification

Changes to the domestic CIT rate of country i in year t (τ_{it}) occur endogenously at any time t^* when the deviation of the government's optimal CIT rate (a weighted-average of an unobservable domestic preference and the average foreign CIT rate) from the current rate is large enough.¹ The new tax rate is a function of the contemporaneous foreign CIT rate $\tau_{it^*}^f$ and past domestic and foreign tax rates at time $t^* - s^*$ (the last time when the domestic CIT rate was changed):

$$(1) \quad \tau_{it^*} = \beta_1 \tau_{it^*}^f + \beta_2 \tau_{it^*-s^*} + \beta_3 \tau_{t^*-s^*}^f + \epsilon_{it^*}.$$

The variable ϵ_{it^*} is an error term. A companion equation gives the probability, based on a logit discrete choice model, whereby a decrease in the domestic CIT rate is observed at time t

$$(2) \quad \log \frac{\pi_{it}}{1-\pi_{it}} = \gamma_1 \tau_t^f + \gamma_2 \tau_{it-s} + \gamma_3 \tau_{t-s}^f,$$

where π_{it} is the probability that a tax decrease is observed in year t . Note that while regression (1) is run only on sample years t^* where the CIT rate has a change, the logit model (2) is estimated using all years in the sample.

Equations (1) and (2) are estimated in two versions, one with only country fixed effects—that control for unobserved time-invariant heterogeneity across countries—and one that additionally includes a linear time trend. The linear trend addresses potential cross-country correlation of the shocks that drive the evolution of the latent domestic preference over the level of the CIT rate.² The sample includes 133 countries during 1960-2019. CIT rates have been falling with frequent discrete changes (Figure 2.2.1). Following the literature, $\tau_{it^*}^f$ is calculated as a weighted average of the CIT rate in all foreign countries, weighted by their inverse distance from the home country.

Results

Tables 2.2.1-2 report the estimation results for (1) and (2), respectively. Each table presents estimates for different samples and for the two versions of the model that we consider (with or without time trend). Overall, a 1 percentage point higher foreign CIT rate leads to an increase in the domestic CIT rate of between 0.25 and 0.60 percentage points, depending on the sample. This finding is in line with other estimates in the

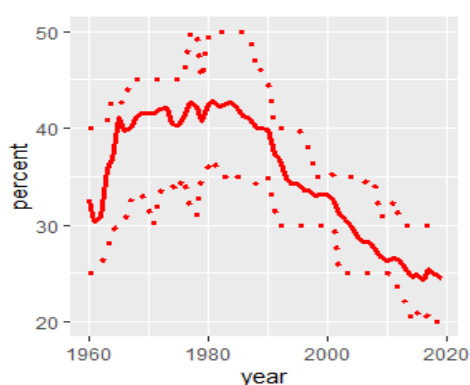
¹ For brevity, the annex reports only the equilibrium equations of the model without presenting their full derivation.

² The concern is that common shocks over time may have caused a simultaneous change across countries in their domestic preference for corporate income taxation.

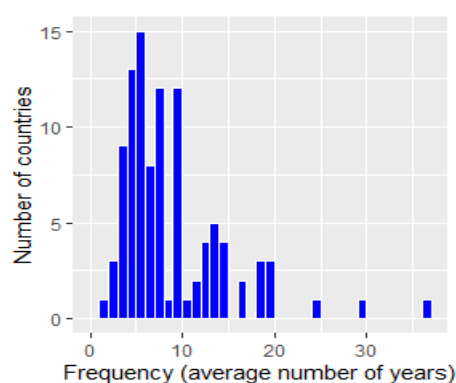
literature based on different methodologies. For example, Devereux and others (2008) find that a 1 percentage point cut in the average foreign statutory rate lowers the rate at home between 0.34 and 0.67 percentage points, in a sample of advanced economies. Crivelli and others (2016) estimate the effect at 0.25 to 0.3 points, in a sample that includes also developing economies. This means that if a binding minimum tax raises the rate of some countries, the others will likely react by raising their rates too (Hebous and Keen, 2021). If below-minimum countries raise their rates to the minimum—and in turn other countries raise their rates by 0.6 percentage points in reaction to each 1 percentage point increase in the world average rate—the average world corporate income tax rate would rise from 22.2 to 24.3 percent. This in turn increases global corporate tax revenues by about 8.1 percent (after removing the top-up tax base to avoid double counting). Finally, for further insights, Table 2.2.2 indicates that a 1 percentage point higher foreign CIT rate reduces the average probability of observing a decrease in the domestic CIT rate by between 0.8 and 1.2 percentage points per year. This translates into a probability of roughly 10 percentage points over 10 years.

Online Annex Figure 2.2.1. CIT Rates

1. Average CIT Rate Trend



2. Frequency of CIT Rate Changes (1960-2019)



Source: IMF staff estimates

Note: Lines in panel (a) indicate the mean and the top and bottom quartiles. Panel (b) depicts the number of countries that display a given frequency of CIT rate change, measured as the average number of years between two consecutive changes.

Online Annex Table 2.2.1. Estimates of the CIT Rate Reaction

Sample	Foreign t^*	Domestic $t^* - s^*$	Foreign $t^* - s^*$	Trend	R^2 adjusted	Obs.
All	0.591*** (0.059)	0.376*** (0.031)	-0.093 (0.06)		0.51	124
All	0.344*** (0.08)	0.382*** (0.031)	-0.1* (0.059)	-0.167*** (0.037)	0.52	124
OECD	0.559*** (0.086)	0.512*** (0.043)	-0.133 (0.092)		0.66	32
OECD	0.416*** (0.111)	0.513*** (0.043)	-0.133 (0.092)	-0.097** (0.047)	0.67	32
Non-OECD	0.603*** (0.081)	0.271*** (0.043)	-0.072 (0.078)		0.33	92
Non-OECD	0.248** (0.115)	0.288*** (0.042)	-0.089 (0.077)	-0.235*** (0.056)	0.36	92

Source: IMF Staff estimates.

Note: OLS regressions with country fixed effects and robust standard errors. The inclusion of standard macroeconomic controls has no impact on the estimates.

Online Annex Table 2.2.2. Likelihood of a CIT Cut (Average Marginal Effect)

Sample	Foreign <i>t</i>	Domestic <i>t_s</i>	Foreign <i>t_s</i>	Trend	Deviance	Deg. Freedom	Obs.
All	-0.012*** (0.002)	0.014*** (0.001)	0 (0.002)		2724	3780	3916
All	-0.008*** (0.002)	0.015*** (0.001)	0 (0.002)	0.002** (0.001)	2720	3779	3916
OECD	-0.013*** (0.004)	0.017*** (0.002)	-0.002 (0.004)		1124	1263	1298
OECD	-0.008* (0.005)	0.017*** (0.002)	-0.002 (0.004)	0.003 (0.002)	1122	1262	1298
Non-OECD	-0.011*** (0.002)	0.014*** (0.002)	0 (0.002)		1598	2514	2618
Non-OECD	-0.008*** (0.003)	0.014*** (0.002)	0 (0.002)	0.002* (0.001)	1594	2513	2618

Source: IMF staff estimates.

Note: Deviance and degrees of freedom correspond to the model in logit form, which is estimated via maximum likelihood, and includes country fixed effect. The inclusion of standard macroeconomic controls has no impact on the estimates.

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Online Annex 2.3. Survey of International Coordination and Tax Administration

This annex summarizes the results of a survey of 72 countries on the scope of international tax cooperation (ITC) that is used in Figure 2.4 in Chapter 2. The survey comprised nine questions, focusing on the number and types of tax cooperation relationships and exchanges, the use of the information by the tax administration, as well as the types of challenges encountered that may prevent the maximum benefit being realized from the tax cooperation arrangement.¹

ITC is increasingly used to improve revenue outcomes for tax administrations, enhance transparency, address information asymmetry between global taxpayers and national tax administrations, and deter offshore tax avoidance and evasion. The Global Forum on Transparency and Exchange of Information for Tax Purposes is the leading international body working on the implementation of global transparency and exchange of information standards. Information exchange mechanisms include bilateral and multilateral tax treaties, Tax Information Exchange Agreements² (TIEA—a bilateral agreement between two tax authorities to share information as defined in the agreement), and the Multilateral Competent Authority Agreement³ (MCAA—an agreement among multiple tax jurisdictions to share information), Common Reporting Standard (CRS—sets out the types of financial account and taxpayer information to be shared automatically by financial institutions, and specifies the methodology to ensure standardized content and format)⁴ and Country by Country Reporting (CBC—requires multinationals (with a global turnover exceeding €750 million) to prepare a CBC report of the global allocation of its income, assets, and other indicators among tax jurisdictions in which it operates).⁵

Types and Use of Information Exchanges

The survey identified the average number of information exchange relationships currently in place in the surveyed countries (Figure 2.3.1). Segmenting the information between EMEs, LIDCs, and AEs, a notable disparity among the groups is evident. The number of exchange relationships in place increases markedly from Low-Income Developing Countries (LIDCs) compared to Emerging Market Economies (EMEs) and further increases in Advanced Economies (AEs). Given the low number of AEs who responded to the survey, the results for this income group may not be representative, and any conclusions should be interpreted with caution. The number of exchange relationships reported in AEs is almost three times more than what is reported in EMEs. The same ratio is noted when reported exchange relationships in EMEs are compared against LIDCs.

Exchange of Information on Request (EOIR) is widely used and other newer types of EOI are increasingly being used. These newer types of EOI include EOIR-sharing of rulings, Automatic Exchange of Information – Country by Country Reporting (AEOI-CBC) and AEOI-Financial Account Information. As noted in Figure 2.3.1, the 2019/2020 data for LIDCs indicates incoming EOIR requests received by 40 percent of countries while outgoing requests were noted by 44 percent of LIDC countries. For EMEs, the percentage of countries reporting incoming requests is 74 percent, and for outgoing is 77 percent. All AE respondents participate in incoming and outgoing EOIR. High rates of usage for EOIR are expected as this type of exchange relates to a particular taxpayer and the information is typically used in connection with an ongoing

¹ The survey was administered in August 2021. Of the 72 countries who responded, 8 are from advanced economies (AE), 39 are from emerging market economies (EME) and 25 are from low income developing countries (LIDC). Results, as with any survey, should be interpreted with caution.

² <https://www.oecd.org/ctp/exchange-of-tax-information/taxinformationexchangeagreementstieas.htm>

³ <https://www.oecd.org/tax/transparency/documents/whatisthemultilateralcompetentauthorityagreement.htm>

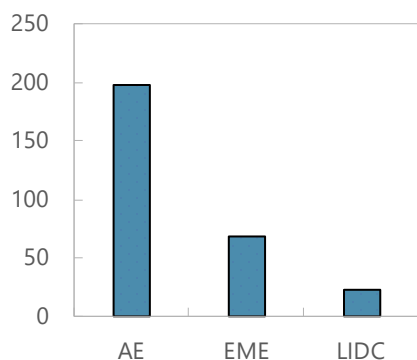
⁴ <https://www.oecd.org/tax/automatic-exchange/common-reporting-standard/>

⁵ The report is shared with tax administrations in these jurisdictions: <https://www.oecd.org/tax/beps/beps-actions/action13/>

audit in the requesting country. Given EOIR has been in existence the longest, the higher usage of this type of exchange is expected.

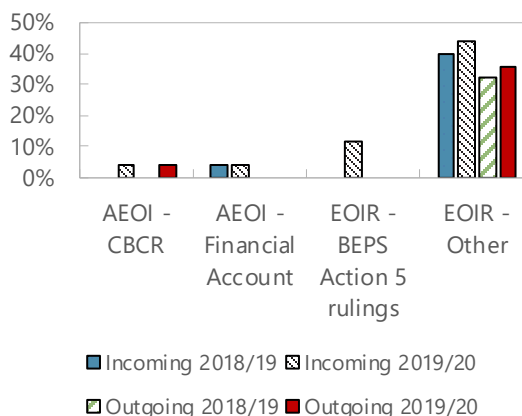
Online Annex Figure 2.3.1. Types and Usage of EOI by Income Classification⁶

1. Average Number of Information Exchange Relationships* by Income Classification

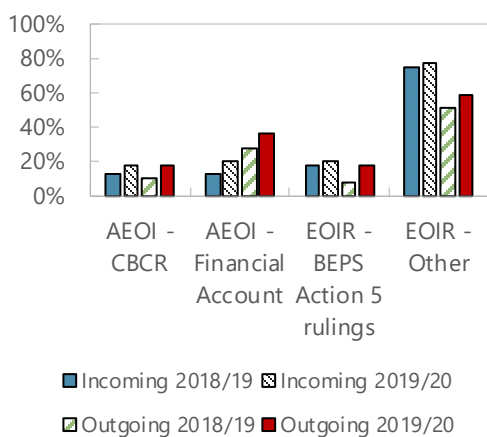


Note: *This includes multilateral treaties and bilateral relationships.

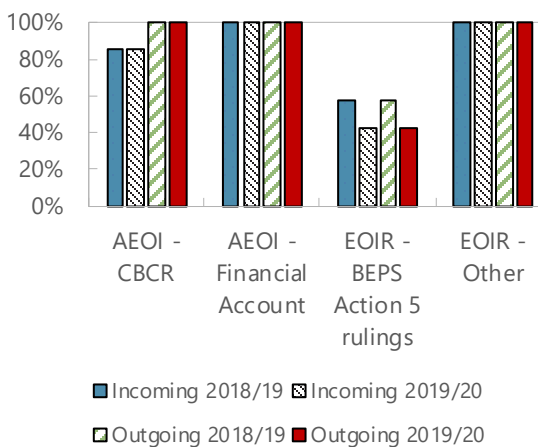
2. Share of LIDC engaged in Exchange of Information



3. Share of EME engaged in Exchange of Information



4. Share of AE engaged in Exchange of Information



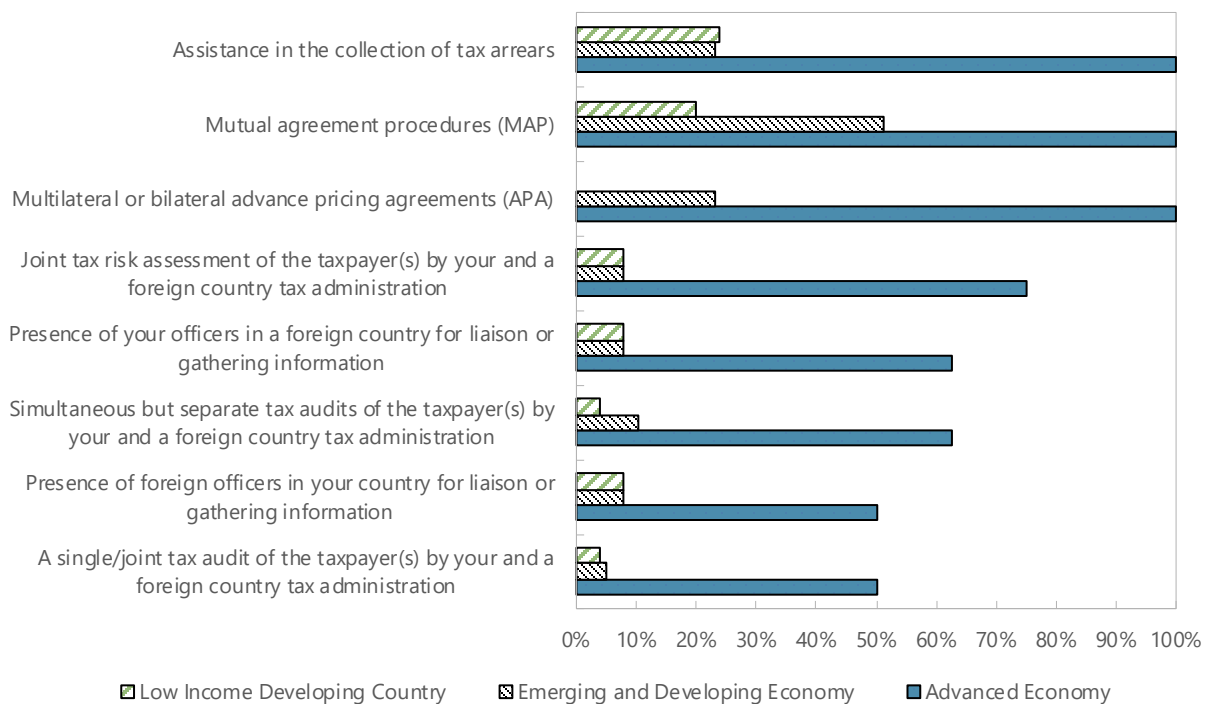
Source: Compiled by IMF staff based on a survey.

⁶ AEIOI on financial accounts is designed to identify global offshore tax evasion by a taxpayer holding financial assets in foreign countries (in foreign banks and other financial institutions). This is identified by requiring the annual exchange of predetermined information by countries on financial assets (e.g., interest, dividends, other income) held by foreigners in the country. EOI on Action 5 rulings is an important tool to prevent countries from providing preferential tax treatment in the form of rulings to MNEs, and it helps countries have a comprehensive view of a MNEs' global dealings and transactions.

Other Types of International Tax Cooperation

Beyond EOI, other methods of tax cooperation⁷ were found to be used less frequently. Of these types of tax cooperation, the most popular among AE countries is mutual agreement procedures (MAP)⁸, Advance Pricing Arrangements (APA)⁹, and collection of tax arrears, with 100 percent of AE countries indicating that they had participated in these three types of ITC. For LIDCs and EMEs, the most popular responses were MAP and assistance in collection of tax arrears. APAs were used by 23 percent of EME countries. As noted in Figure 2.3.2, other types of tax cooperation are less used by EMEs and LIDCs, with no more than 10 percent of countries indicating that they used any of the remaining other types of tax cooperation. ITC in all its forms is important as it represents peer to peer learning opportunities (joint and simultaneous audits and risk assessment), while MAP could provide tax certainty and help avoid disputes and double taxation.

Online Annex Figure 2.3.2. Share of Countries Using Other Types of ITC



Source: Compiled by IMF staff based on a survey.

Revenue Impact of International Tax Cooperation

As noted in Figure 2.3.3, 38 percent of AE countries impose additional tax, compared to 31 percent for EMEs and 20 percent for LIDCs. This gap in the rates of tax assessments among countries represents

⁷ Other methods of ITC include: (i) Joint tax risk assessment of a taxpayer; (ii) Presence of officers in a foreign country for liaison or gathering information; (iii) Presence of foreign officers in your country for liaison or gathering information; (iv) Simultaneous but separate tax audits of taxpayers; (v) A single/joint tax audit of a taxpayer; (vi) Assistance in the collection of tax arrears; (vii) Mutual agreement procedures (MAP); (viii) Multilateral or bilateral advance pricing agreements (APA).

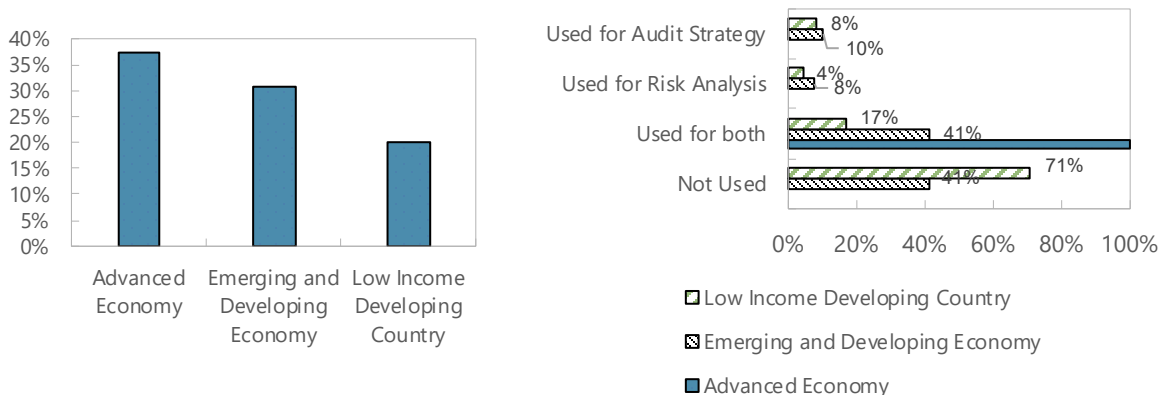
⁸ MAP is a negotiation between country authorities to resolve or prevent double taxation.

⁹ An APA is an agreement between the tax administration and the taxpayer that sets pricing for the related party transfer of goods and services for a defined period of time.

potential additional revenue for both EMEs and LIDCs. An opportunity exists to strengthen revenue further through enhanced usage of the information received. 41 percent of EMEs and 71 percent of LIDCs have not used the information received through exchange mechanisms to improve their risk assessment processes or their audit strategy (Figure 2.3.3). Data received from external sources provides a view of taxpayer risks and compliance levels that the tax administration otherwise would not have.

Online Annex Figure 2.3.3. Revenue Impact of ITC – Present and Future Potential

1. Share of Countries with Tax Assessments Resulting from ITC 2. Exchanged Information And Compliance



Source: Compiled by IMF staff based on a survey.

Challenges in Using Information Received through Information Exchange

To determine why the information may not have been used to its full potential, countries were asked to rate challenges¹⁰ related to the exchange and use of information. This feedback can help identify priorities for a country’s reform plan and identify capacity development opportunities. Among both EMEs and LIDCs, the biggest challenges in exchanging and using information were reported as inadequate information technology (IT) infrastructure, inadequate legal provisions to request information from other countries, and inadequate knowledge about the concept of EOI in the organization. For AEs, the challenges reported were rated low in comparison with other income classifications, with the biggest issues relating to quality of incoming data and long response times to requests. Figure 2.3.4 presents the results.

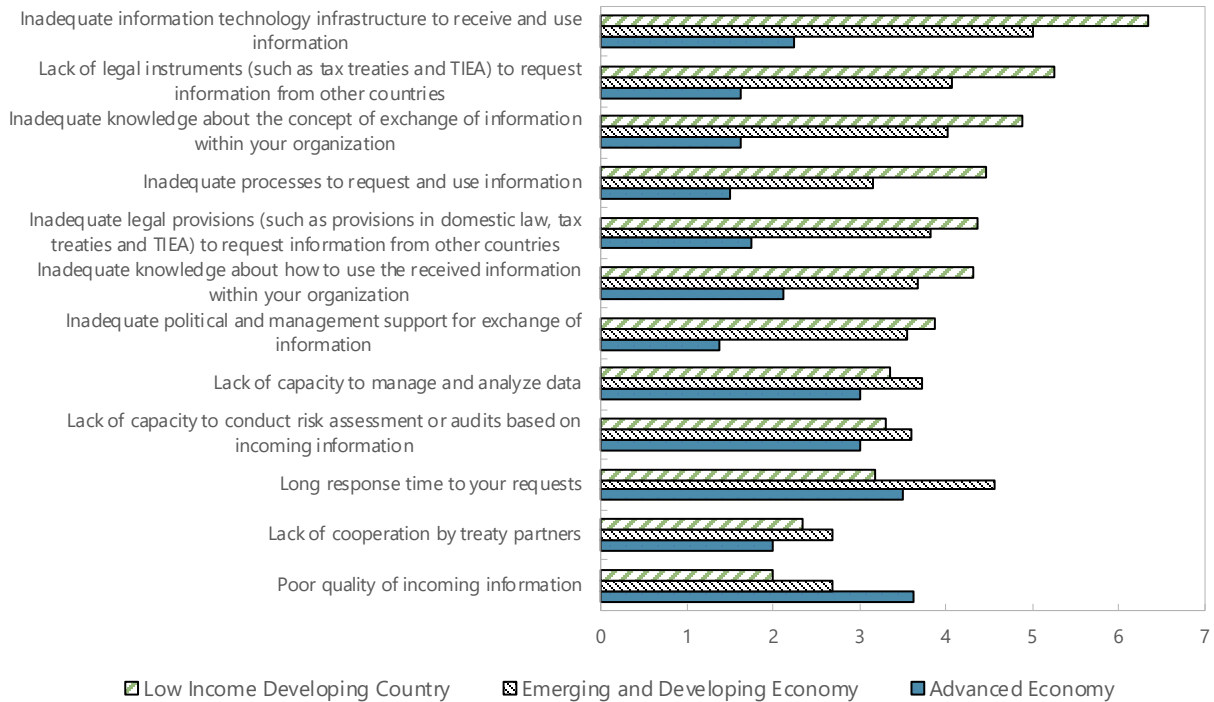
Opportunities Presented by International Tax Cooperation

Despite the challenges, countries can clearly see the benefits of ITC (Figure 2.3.5). Respondents were asked to rate, on a scale of 1 (not likely) to 10 (very likely) the opportunities presented by ITC. Both LIDCs and EMEs identified higher tax revenues, better relationships with foreign tax administrations, improved audit capabilities, and improved tax collection capabilities as key benefits. AEs reported the most significant

¹⁰ Potential challenges include: (i) Lack of legal instruments (such as tax treaties and TIEA) to request information from other countries; (ii) Inadequate legal provisions (such as provisions in domestic law, tax treaties and TIEA) to request information from other countries; (iii) Inadequate knowledge about the concept of exchange of information within your organization; (iv) Inadequate knowledge about how to use the received information within your organization; (v) Inadequate political and management support for exchange of information; (vi) Inadequate information technology infrastructure to receive and use information; (vii) Inadequate processes to request and use information; (viii) Long response time to your requests; (ix) Lack of cooperation by treaty partners; (x) Poor quality of incoming information; (xi) Lack of capacity to conduct risk assessment or audits based on incoming information; (xii) Lack of capacity to manage and analyze data. The rating scale was a range from 1 for ‘not a challenge’ through to 10 for ‘significant challenge’.

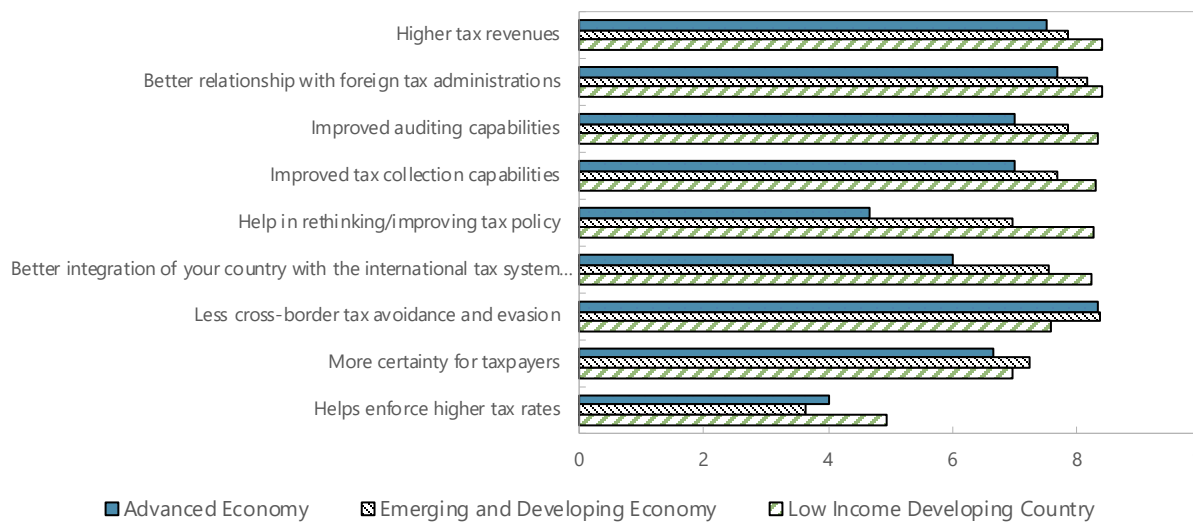
opportunities as reducing cross border tax avoidance and improved tax collection capabilities. Building on these positive views toward international tax collaboration, broader collaboration is expected to increase learning opportunities among peer administrations and further increase tax transparency and knowledge building internationally.

Online Annex Figure 2.3.4. Challenges in Using Exchanged Information



Source: Compiled by IMF staff based on a survey.

Online Annex Figure 2.3.5. Opportunities from ITC



Source: Compiled by IMF staff based on a survey.

Online Annex 2.4. Revenue Implications of Cross-border Remote Work

This annex presents the empirical methodology to quantify the impact of cross-border remote work on personal income tax revenues (Figure 2.5 in Chapter 2). Prior to the pandemic, many countries with relatively low tax rates offered citizenship or residency to high-net-worth individuals. Since the onset of the pandemic, the number of countries offering ‘digital nomad’ visas, targeted at high-skilled individuals who can work remotely, has more than doubled from 16 to 40. These visas ease some of the frictions associated with cross border remote work, and for some jurisdictions, digital nomad visas explicitly exclude personal income tax liability in the residence jurisdiction. Some high tax jurisdictions offer special tax regimes for foreigners or returning expats, providing a lower effective personal income tax rate for a limited period through either lower statutory rates or a discount on taxable income.

Methodology

The approach is similar to De La Feria and Maffini (2021) who estimate the potential PIT revenue loss for the UK from increased teleworkability enabling high-income individuals to move abroad. The methodology is a two-step baseline specification that mimics the approach of general equilibrium models of international trade and migration (Walmsley, 2002). First, it measures the probability and magnitude of personal income tax base erosion for countries with average effective tax rates (AETRs) above the world average. Second, it distributes the total pool of teleworking personal income tax base “diverted” among countries with below average AETRs and suitable teleworking conditions.

The cross-border telework share of personal income tax (PIT) base of country i is estimated as:

$$\text{teleworkable share of PIT base}_i = \theta_i \cdot \rho \cdot \text{PIT liability of higher rate taxpayers}_i,$$

where:

- θ_i : is the country-specific share of jobs that can be done remotely. This is measured as the “teleworkability” index for the top quintile, where available, or the mean teleworkability for the country, or a teleworkability share based on that country’s income level. The data is from the World Bank’s (2020) cross-country analysis covering 107 countries, building on Dingel and Neiman (2020) and Brussevich and others (2020).
- ρ is the share of employers set up for cross-border telework (PWC, 2020). Together with θ_i , it refines the likelihood of workers leaving and entering that country (i.e., given information communication technology infrastructure capacity, which affects a country’s probability as a source of and suitability as a destination for cross-border remote workers, keeping tax rates constant).
- The PIT liability of higher rate taxpayers is taken to be the share of PIT revenue collected from the top quintile of the income distribution in each country. For 18 countries, the actual PIT liability distributions have been used (augmenting the structural form of the estimates)¹, and next the exercise is extended to 124 countries using simulated income and tax distributions obtained from Vellutini and Benitez (2021). This tax liability is converted to the PIT base by dividing by each country’s top statutory PIT rate.
- A country loses PIT base if its tax rate (τ_i) is above the average AETR ($\bar{\tau}$) in all other countries for the average wage earner in the global teleworker population (i.e., if $\tau_i - \bar{\tau} > 0$). In particular,

$$(1) \text{ PIT revenue loss}_i = \varepsilon \cdot \frac{(\tau_i - \bar{\tau})}{(1 - \tau_i)} \cdot \text{teleworkable share of PIT base}_i \text{ if } \tau_i - \bar{\tau} > 0$$

¹ Data on the distribution of PIT liability by taxable income are sourced from PIT returns, which are then aggregated and published by national tax administration agencies or statistics agencies. For most countries, the data reflects PIT returns for the 2018 or 2019.

$$(2) \text{ PIT revenue gain}_i = \text{Likely share of net teleworker import}_i \cdot \text{aggregate pool of global PIT base in exodus} \cdot \tau_i \text{ if } \tau_i - \bar{\tau} < 0$$

where:

ε is a measure of the international mobility elasticity of high-income workers with respect to an AETR differential, taken to be one in this exercise based on the meta-analysis conducted by Stantcheva and others (2020). For the tax differential ($\tau_i - \bar{\tau}$), the average wage earner in the global teleworker population is assumed to be USD 75,000 in labor income per year (including allowances). The sensitivity analysis considers USD 100,000 and USD 200,000.²

- *Likely share of net teleworker import*_{*i*} = $\frac{(\tau_i - \bar{\tau})}{\sum_i (\tau_i - \bar{\tau})} \cdot \rho \cdot \theta_i$ is normalized to sum to 1.
- *The aggregate pool of global PIT base in exodus* is the total taxable personal income subject to “jurisdictional diversion” due to telework (i.e., the sum of personal income lost by countries with AETRs above average in (1)). Since the sample of 124 countries is smaller than the global population, an adjustment has been made for this estimated “lost pie” of taxable income for the missing share of world GDP.

Caveats: The estimates ignore restrictions to international labor mobility (e.g., visa-related) and constraints imposed by possible double taxation of PIT income. For simplicity, labor mobility across borders is assumed to be frictionless, with an elasticity that solely responds to tax differentials in this setting.³ In addition, the estimates capture only the taxation of salaries (without considering social security contributions or other sources of income). Incorporating capital income in the estimates (e.g., interest and dividends) would likely expand the size of revenue at stake given that many low-tax jurisdictions have favorable tax treatment of capital income, including as part of their preferential tax regime for foreigners. Similarly, the focus here is only on migration due to tax differentials, in practice individuals relocate for many non-tax reasons, which would have implications for tax revenue.

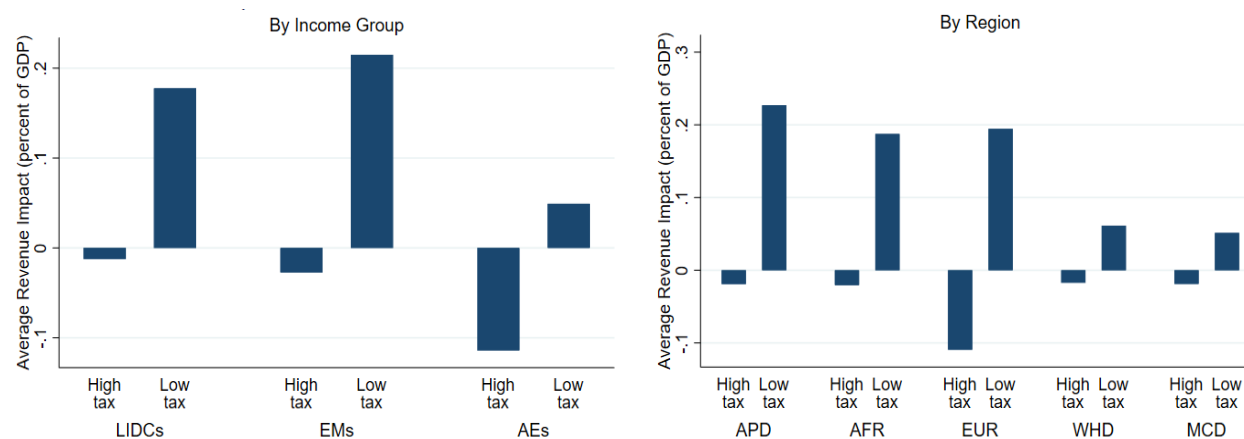
Results

While potential PIT revenue shift is significant for a handful of countries, the average loss is estimated to be less than 0.1 percent of GDP, whereas the average gain is 0.2 percent of GDP – since most high PIT rate countries also tend to be more advanced economies, with higher GDP per capita, the impact for “net exporting” countries is smaller than for the average “net importing” country in our sample (Figure 2.4.1).

² The average wage in the top quintile, weighted by the teleworkability, share is US\$68,414, while the average wage in the 95th percentile, weighted by teleworkability shares, is US\$76,670. This is broadly in line with data on the average wage of the current pool of international remote workers of US\$75,000 (e.g., Guiot, 2020, <https://www.arthurguiot.com/remote-work-salary/> or ZipRecruiter (2021) <https://www.ziprecruiter.com/Salaries/Telecommute-Salary>). As a robustness exercise, we estimate the same set of equations by adjusting τ_i for special personal income incentive regimes, where applicable to foreign sourced income of US\$75,000 per year: FRA, IDN, ISR, NZD, PRT to 0%; GRC to 0.5×ETR; ITA to 0.3×ETR; MLT to 15%; NLD to 0.7×ETR; PHL to 25%; SWE to 0.75×ETR; THA to 15%.

³ The analysis is applicable mostly to the multinationals’ setting, with local offices already established permitting individuals to move across countries without being subject to double taxation.

Online Annex Figure 2.4.1. PIT Revenue Impact of Tax Competition over Cross-Border Remote Work



Source: IMF staff estimates.

Small emerging economies, with below (but close to) average tax rates worldwide of 21 percent (for the representative remote worker) and high teleworkability indices are the typical winners in this zero-sum distribution. The overall base of taxable income at stake given current average effective tax rates and international teleworkability under conservative assumptions is estimated to be close to USD 40 billion. Considering special tax regimes in the effective tax rates used would cut this pool of potential losses by nearly half – suggesting they may be particularly attractive to relatively high tax countries. Nonetheless, increasing the average salary of the representative remote worker or the share of employers willing to offer international teleworkability options (and therefore the share of current high-income workers who may choose to move in this scenario) could considerably increase this figure. Table 2.4.1 shows sensitivity estimates for a range of alternative parameters and baseline assumptions. The estimated US\$40 billion is only 1¼ percent of the relevant tax base for high tax countries in the sample. However, more liberal assumptions could raise that figure tenfold, without even considering incentives for international remote work unrelated to tax differentials, suggesting that the magnitude of the revenue pool under potential competition could be much larger.

Online Annex Table 2.4.1. Sensitivity Estimates of Global PIT Tax Base at Stake

Share of employers offering international teleworkability	Salary (USD)		
	75,000	100,000	200,000
	Estimated global base effect (USD billion)		
$\rho = 0.26$	40	58	114
$\rho = 1$	154	223	436

Source: IMF staff estimates.

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Online Annex 2.5. Emissions Equivalence of Other Mitigation Approaches to Carbon-Pricing

To accommodate non-pricing and other approaches in an international carbon price agreement, recognition of the equivalence of such alternative approaches is needed. It is possible to assess the emissions reductions from other approaches (such as a regulation) and compare them with carbon-pricing, or to map these approaches to equivalent carbon prices, using a consistent framework applied to country-specific information on the sources of emissions and the responsiveness of emissions to prices. For example, if a country committed through a non-pricing measure that was deemed credibly to yield a given reduction in emissions, a methodology is available to compute the equivalent carbon price that would attain the same emissions reduction.

Instruments other than carbon-pricing do not promote the full range of mitigation opportunities—for example, within the transport sector a vehicle CO₂ per mile standard will promote sales of lower-emission vehicles but will not encourage people to drive less. In the power sector, an emission rate standard will promote switching among fuels to lower the emissions intensity of generation, but it will do little to exploit reductions in electricity demand as it does not involve the pass through of carbon-pricing revenues in higher electricity prices.

Moreover, taxes that apply only to a subset of energy products, for example, will have less comprehensive coverage and thus a lesser impact for a given tax rate. A tax on coal will reduce emissions from coal use but will not reduce emissions from oil products and natural gas. Even so, especially for countries that rely significantly on coal, the impact can be sizable, and can be computed using the same framework. In some cases, a variety of overlapping measures may be used to implement a sectoral target—for example, renewable generation tax credits, renewable portfolio standards, consumer tax credits, to promote renewable power generation, or building energy codes, incentives for clean heating equipment, appliance efficiency standards, insulation incentives to reduce energy use and CO₂ emissions from buildings. In these cases, it may be more practical to measure the carbon price equivalent of the sectoral clean energy or emissions targets rather than the effect of individual measures.

This Annex describes a methodology—based on the Climate Policy Assessment Tool (CPAT)—that provides consistent cross-country estimates of future emissions and that can be used to estimate the emissions impacts of various alternative mitigation instruments (Box 2.5.1).

For illustration, the first five columns in Table 2.5.1 show, using CPAT, the proportionate reductions in fossil fuel CO₂ emissions from tax policies applied to a narrower energy base relative to that of an economy-wide \$75 carbon price by 2030. For transparency, policies are scaled such that they impose an explicit or implicit \$75 per ton price on the emissions they cover (policies are gradually phased in from 2022-2030). The last column indicates emissions reductions if countries were to meet their pledges for renewable generation shares by 2030.

Some noteworthy points include:

- Coal taxes could achieve a substantial portion of the reductions in CO₂ compared with a carbon tax in large coal-consuming countries such as China, India, Indonesia, South Africa, and Germany. This is because the bulk of the CO₂ reductions under a comprehensive carbon tax in these countries would come from reduced use of coal given (i) the relatively high contribution of coal to CO₂ emissions in these countries and (ii) the much larger price increases for coal than for oil products and natural gas (due to the high carbon intensity of coal);
- Limiting carbon-pricing to the power and industry sectors results in emissions reductions that are typically around 50-80 percent of those under carbon-pricing;

- Taxes on electricity output (or consumption) can achieve about 10-30 percent of the emissions reductions from comprehensive carbon-pricing;
- Taxes on CO₂ emissions from power generation are significantly more effective at reducing emissions than taxes on electricity output as the former promotes fuel switching opportunities to lower the emissions intensity of generation as well as reductions in electricity demand;
- Road fuel taxes have limited mitigation potential, reducing CO₂ emissions by only around 5-20 percent of the reductions under comprehensive pricing as transportation emissions are a minor fraction of nationwide emissions and carbon-pricing causes only a relatively modest increase in retail fuel prices; and
- In many countries (especially where renewable targets are ambitious, and electricity is a sizeable portion of economywide emissions) achieving renewable energy pledges would achieve considerable emissions reductions (around 40 percent or more of those from a \$75 carbon price in ten cases).

Online Annex Table 2.5.1. Proportionate CO₂ Reduction from Alternative Policies Relative to Comprehensive \$75 Carbon Price, G20 Countries, 2030

Country	Coal tax	Carbon pricing for power/industry	Electricity output tax	Electricity CO ₂ tax	Road fuel taxes	Pledged renewables
Australia	0.80	0.85	0.36	0.44	0.03	n/a
Canada	0.28	0.41	0.03	0.34	0.06	0.60
France	0.41	0.22	0.00	0.56	0.33	0.14
Germany	0.72	0.58	0.08	0.50	0.18	1.04
Italy	0.40	0.46	0.10	0.46	0.23	0.26
Japan	0.72	0.68	0.26	0.47	0.02	0.32
Korea	0.84	0.72	0.21	0.55	0.01	0.42
United Kingdom	0.41	0.43	0.07	0.66	0.22	0.72
United States	0.52	0.70	0.23	0.36	0.05	0.03
Advanced econ. average	0.57	0.56	0.15	0.48	0.13	0.44
Argentina	0.04	0.47	0.17	0.27	0.03	n/a
Brazil	0.36	0.47	0.02	0.43	0.10	n/a
China	0.96	0.80	0.20	0.44	0.01	0.39
Mexico	0.20	0.61	0.31	0.40	0.09	0.68
Russia	0.39	0.46	0.14	0.24	0.01	n/a
Saudi Arabia	0.00	0.52	0.43	0.19	0.11	1.11
Turkey	0.76	0.65	0.17	0.59	0.02	n/a
High-inc. EME average	0.39	0.57	0.21	0.37	0.05	0.73
India	0.94	0.88	0.31	0.45	0.01	0.45
Indonesia	0.72	0.75	0.28	0.45	0.11	0.57
South Africa	0.97	0.74	0.27	0.17	0.01	0.46
Low-inc. EME average	0.88	0.79	0.29	0.36	0.04	0.49
G20 average	0.55	0.60	0.19	0.42	0.09	0.51

Source: IMF Staff analysis.

Note: The table shows proportionate reductions in fossil fuel CO₂ emissions from policies relative to that of an economy-wide \$75 carbon price by 2030, gradually phased in by 2030 (1 = same reductions as a carbon tax). All policies (except pledged renewables) are scaled such that they impose an explicit or implicit \$75 CO₂ price on the emissions sources they cover. The coal tax is a \$75 CO₂ price applied to coal but not to oil products or natural gas (the tax per ton of coal varies moderately across countries with differences in the carbon intensity of coal). Electricity output taxes are charged per kwh, unrelated to carbon, but causing the same increase in electricity prices as a \$75 carbon tax. Electricity CO₂ taxes are charged based on carbon content per kwh generated (this policy is equivalent to a carbon price restricted to fuels used in power generation). Road fuel taxes are increases in taxes on gasoline and diesel used in road transportation with taxes equal to CO₂ emissions per unit of fuel use times \$75 per ton. Pledged renewables policy assumes implementation of countries' pledges on shares of renewables in power generation. n/a denotes non-binding targets.

One further complication is that, after countries have implemented carbon-pricing, they may change pre-existing energy taxes in a way that partially offsets, or enhances, the effectiveness of a formal carbon-pricing scheme. In this case, it can make sense to track a country's 'effective carbon price', which takes account of energy taxes, as well as the possibility that formal carbon-pricing does not have complete coverage. The effective carbon price can be computed, using a CPAT type model, by estimating: (i) the increase in emissions that would result if formal carbon-pricing and energy taxes were removed; and (ii) the comprehensive carbon price that would reduce emissions back to their initial level.

There is little basis on economic efficiency grounds for equating effective carbon prices since these vary considerably across countries, and there are many other externalities beyond climate change (Parry and others 2021). Instead, countries might be required to increase their effective carbon price relative to its absolute value in a benchmark year. This would allow countries flexibility in meeting the requirement (e.g., through extending coverage of emissions pricing, raising preexisting fuel excises) but prevent relabeling of fuel taxes imposed for other reasons as carbon taxes. Benchmark prices might be defined excluding explicit carbon-pricing schemes to avoid penalizing those who have already acted.

Online Annex Box 2.5.1. Climate Policy Assessment Tool (CPAT) and its Parameterization

CPAT provides, among other metrics, projections of fuel use and CO₂ emissions by major energy sector—power generation, industry, transport, and buildings for over 200 countries. The tool observes recent fuel use and projects forward using: GDP projections; assumptions about the income elasticity of demand and price responsiveness of fuel use in different sectors; rates of technological change that affects energy efficiency of different energy sources; and future international energy prices. In these baseline projections, current carbon-pricing, non-pricing policies, and fuel taxes are (explicitly or implicitly) held fixed at their 2021 levels of stringency.

The impact of carbon-pricing on fuel use and emissions depends on: (i) the proportionate impact on future fuel prices in different sectors; and (ii) the price responsiveness of fuel use in different sectors. Proportionate fuel price increases depend on baseline prices, carbon emissions factors for fuels, and the pass through of carbon charges into fuel user prices.

In the power sector, fuel price responsiveness is determined by a model of dispatch and new investment in alternative generation technologies. In the residential sector, fuel and electricity demand are decomposed into responses reflecting changes in energy efficiency (e.g., insulation upgrades and adoption of energy efficient appliances in buildings) and behavioral changes (e.g., economizing on use of lighting, heating). The industrial sector is disaggregated into ten industries (e.g., iron and steel, machinery, cement). In each industry carbon-pricing reduces the emissions intensity of production (though adoption of cleaner or more energy efficient technologies) and reduces production levels as carbon charges are reflected in higher consumer prices. In the vehicle sector, fuel consumption from gasoline and diesel vehicles declines in response to higher prices as individuals switch to more fuel-efficient and zero emission vehicles and reduce vehicle miles travelled. Capital turns over gradually (explicitly in the power sector and implicitly in other sectors through fuel price elasticities that are more responsive in the longer term) so the full effect of policy changes occurs progressively over time. CPAT is populated using data compiled from the International Energy Agency (IEA) on recent fuel use by country and sector. GDP projections are from the latest IMF forecasts. Data on energy taxes, subsidies, and prices by energy product and country is compiled from publicly available and IMF sources, with inputs from proprietary and third-party sources. International prices for coal, oil, and natural gas (at the global level for oil and regional level for coal and gas) are projected forward using an average of IEA (which are rising) and IMF (which are flat) projections. Domestic energy prices are

projected using empirical estimates of the pass-through of changes in international energy prices into domestic fuel prices by country. Fuel and electricity price responsiveness is parameterized to be broadly consistent with empirical evidence and results from energy models (fuel and electricity price elasticities are typically between about -0.5 and -0.8). CO₂ and other GHG emissions factors by fuel product are from the International Institute for Applied Systems Analysis.

One caveat is that, while the assumed fuel price responses are plausible for modest fuel price changes, they may not be for larger price changes that might ultimately drive non-linear adoption of technologies whose future viability and costs are highly uncertain at present, like carbon capture and storage (that could be deployed in the power and industry sectors) and direct air capture.¹ We therefore assume a backstop technology that can be deployed at a constant unit cost of \$125 per ton of CO₂ reduced. In addition, fuel price responsiveness is approximately similar across countries—in practice, price responsiveness may differ across countries with the structure of the energy system and regulations on energy efficiency and emission rates. CPAT does not distinguish heterogeneity at the firm level in the power generation and industrial sectors—this distinction does not matter for our purposes however if behavioral responses at the industry level are appropriately parameterized. CPAT does not explicitly account for the impact on trade or changes in international fuel prices that might result from simultaneous climate or energy price reform in large countries. The model is parameterized, however, such that emissions projections and the price responsiveness of fuel use and CO₂ emissions is broadly consistent with that from far more detailed energy and computable general equilibrium models that, to varying degrees, account for these sorts of factors.

¹ In practice, scaling carbon capture and storage technologies has proven extremely difficult, hampered by fluctuating policy and financial support, in addition to difficult site-specific technical hurdles (Global CCS Institute 2021).

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