

## Globalization, Capital Taxation, and Development: Evidence from a Macrohistorical Database<sup>†</sup>

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*This paper builds and analyzes a new global macrohistorical database of effective tax rates on capital and labor in 154 countries. We establish a new stylized fact: While effective capital tax rates fell in developed countries between 1965 and 2018, they rose in developing countries after 1990. Multiple country-, sector-, and firm-level research designs suggest that trade openness contributed to this rise by increasing the share of output produced in corporations and larger firms, where effective capital taxation is higher. In contrast to a common view, globalization appears in many countries to have supported governments' ability to tax capital. (JEL F41, F62, H24, H25, O19, O23)*

**H**ow has globalization affected the relative taxation of capital and labor? Has it uniformly eroded the amount of taxes paid by capital owners, shifting the burden to workers? Or have some countries managed to increase effective capital tax rates, and if so, how? Answering these questions is critical to better understanding the macroeconomic effects and social sustainability of globalization in uncertain times (Goldberg and Reed 2023).

Based on a new long-run global database of effective tax rates on capital and labor, we document that in developing countries, effective capital tax rates have increased in the post-1990 era of hyperglobalization. Consistently across several

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research designs, we find that a significant share of this rise can be explained by trade openness. By expanding the share of economic activity occurring in the corporate sector—and within the corporate sector in larger firms—our results show that trade improves the effective collection of taxes, particularly corporate income taxes (CIT). Globalization has also had widely noted negative effects on capital taxation, due to international tax competition that applies downward pressure on corporate statutory tax rates. We find that the positive tax capacity effect of trade that we uncover prevailed in developing economies, causing openness to increase overall government tax revenues (as a percent of GDP). The revenue consequences of globalization have not been systematically investigated in developing countries due to limited data, and concerns over potential revenue losses have persisted as a key obstacle to further integration across borders (World Bank 2020). In contrast to a common view, our findings show that globalization has not uniformly eroded governments' ability to raise revenue and, instead, appears to have supported capital taxation in many countries.

To establish these results, this paper makes two contributions. The first is to build and analyze a macrohistorical database of effective tax rates on capital ( $ETR_K$ ) and labor ( $ETR_L$ ) covering 154 countries, with over half starting in 1965, until 2018. Each  $ETR$  divides all taxes collected on the factor by the national income that accrues to it; by relying on actual taxes collected,  $ETRs$  capture the net past effect of all tax rules and, importantly for developing countries, tax evasion and avoidance. Complementary to existing  $ETR$  series that focus on developed countries, our data provide a global coverage by digitizing and harmonizing thousands of historical and recent public finance records in developing countries. The global database allows us to systematically characterize the evolution of effective tax rates in developing countries and compare trends across development levels.

A novel fact emerges from this database: The evolution of capital taxation has been asymmetric across development levels. In high-income countries, effective capital tax rates declined, from a high of 38–39 percent in the late 1960s to 32–33 percent in the late 2010s. By contrast, in developing countries, effective capital tax rates have been on a rising trend since the beginning of the 1990s, albeit starting from a low level. Effective capital tax rates rose from 10 percent in 1989 to 18 percent in 2018, with more pronounced increases in larger economies. For example,  $ETR_K$  rose from 6 percent to 24 percent in China, 5 percent to 12 percent in India, and 7 percent to 27 percent in Brazil. The positive trend in capital taxation is driven by the corporate sector: The average effective corporate tax rate rose from 12 percent in 1989 to 20 percent in 2018.

This rise of capital taxation in low- and middle-income countries had not been noted in the literature before, due to a lack of data on the evolution of taxation globally. The finding appears robust. It holds: when we exclude China and oil-rich countries, with other approaches to computing capital and labor income in unincorporated businesses (where factor shares are not directly observable), and with alternative ways of splitting personal income tax (PIT) revenue between capital and labor.

Our second contribution is to formulate and test a hypothesis that sheds light on the rise of capital taxation in developing countries. We hypothesize that openness

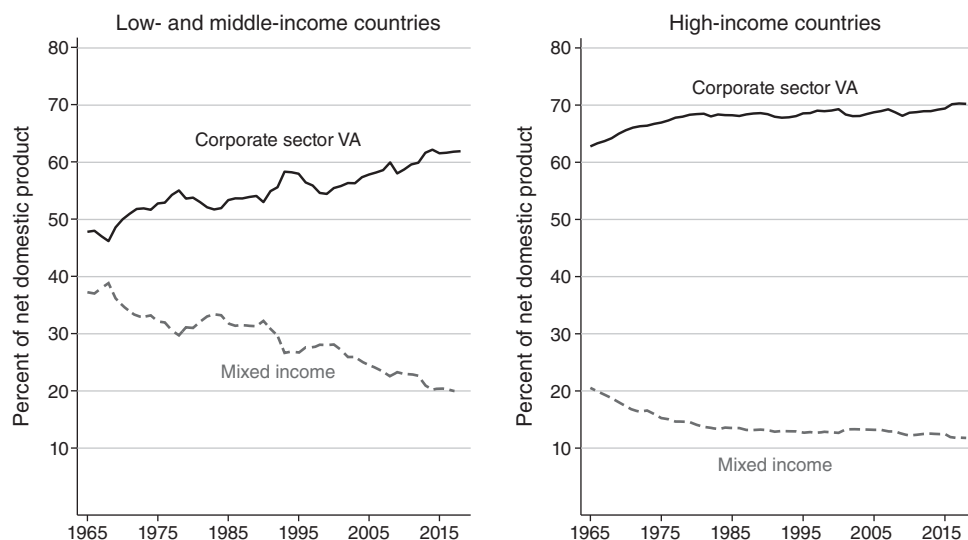


FIGURE 1. CORPORATE SECTOR INCOME AND MIXED INCOME (1965–2018)

*Notes:* These panels plot the time series of corporate sector income and of mixed income between 1965 and 2018 by level of development, from national accounts statistics. Both outcomes are expressed as a percent of net domestic product (NDP) and weighted by countries' NDP in constant 2010 US dollars. Corporate income is the sum of corporate profits and corporate employee compensation. Mixed income accounts for income from self-employed and unincorporated businesses. The left panel shows the results for low- and middle-income countries (observations = 117), and the right panel shows the results for high-income countries (observations = 37). The classification of countries into two development groups is defined in Section IIC.

exerts a positive effect on developing countries' capacity to tax, consistent with trade leading to the expansion of larger firms relative to smaller ones (Mrázová and Neary 2018) and firm-level effective taxation rising with size, due to better enforcement and higher statutory tax burdens (Almunia and Lopez-Rodriguez 2018; Best, Shah, and Waseem 2021).<sup>1</sup> Our hypothesis is motivated by the observation that the rise in  $ETR_K$  coincides with trade liberalization. Since the beginning of the 1990s, many developing countries opened their markets and reduced tariffs, leading to a boom in international trade that reshaped the economies of Mexico, India, and China among others (Goldberg 2023). By disproportionately benefiting larger firms, trade can increase the share of economic activity in corporations and more formal businesses, where effective taxation of capital (and labor) is higher.

To motivate the tax capacity hypothesis, Figure 1 shows that the share of domestic output from the corporate sector (profits and employee compensation) has grown over time in developing countries, at the expense of mixed income (income of self-employed and unincorporated businesses). While the corporate sector accounted for 53 percent of domestic output in 1989, prior to the hyperglobalization era, it grew to 62 percent by 2018; mixed income fell from 32 percent to 20 percent

<sup>1</sup> Higher effective taxation in the corporate sector stems from both stronger enforcement and higher statutory taxes than in the noncorporate sector. Our notion of tax capacity is that these codetermined forces jointly lead to higher  $ETR_K$  with firm size (where size is measured as firm output—in our case, revenue).

over the same period. Thus, developing countries have experienced a relocation of activity from a hard-to-tax sector to a sector with stronger effective taxation.

We establish the second contribution in two steps. First, we study the impact of trade on taxation in developing countries, with a focus on  $ETR_K$  and corporate taxes. Second, we study mechanisms that link trade to taxation, with a focus on the tax capacity channel.

We implement three research designs to study how trade impacts taxation. First, we estimate the nonparametric association within a country over time between  $ETR$  and trade openness. Second, we analyze major trade liberalization events that occurred in seven large developing countries, including China's World Trade Organization (WTO) accession in 2001, and caused sharp reductions in trade barriers (Brandt, Van Biesebroeck, Wang, and Zhang 2017; Goldberg and Pavcnik 2016). We use synthetic control methods and present event-study results. Third, we extend the trade instruments from Egger, Nigai, and Strecker (2019) to our sample.

All three designs show that, in developing countries, trade leads to a large increase in  $ETR_K$  and a smaller increase in  $ETR_L$ . The effect is sizable: Trade openness can account for 22–31 percent of the documented rise in  $ETR_K$  since 1989. Although studying macroeconomic outcomes presents identification challenges, the results are consistent across research designs, which differ in their identifying assumptions, and are robust to numerous sensitivity checks. Across the research designs, we also find that trade leads to an increase in total tax revenues (as a percent of GDP). Reflecting trade's positive impact on  $ETR_K$ , half of this increase comes from higher CIT, and a smaller share from PIT and payroll. Indirect taxes (combining tariff revenues and domestic consumption taxes) rise, but the coefficient is not significant.

We then turn to investigate mechanisms. In the IV and liberalization event studies, we find that trade increases the share of domestic output produced in the corporate sector, relative to the unincorporated business sector (mixed income).<sup>2</sup> Thus, output is expanded in the corporate sector where enforcement is stronger and effective taxation is higher (Slemrod and Velayudhan 2018). Moreover, within the corporate sector, we find that trade increases the average effective tax rate on capital, suggesting the expanded corporate output accrues to firms whose  $ETR_K$  increases with their output (our proxy for firm size). These two effects of trade are consistent with the tax capacity channel. Simultaneously, we find that trade reduces the statutory corporate tax rate, consistent with a tax competition channel where globalization pushes governments to reduce the statutory tax burden on capital. On net, the positive tax capacity impact outweighs the tax rate reduction in developing countries, causing trade to increase  $ETR_K$  at the country level.

In contrast, we find no tax capacity effect of trade in developed countries, but a stronger decrease in statutory corporate tax rates. These results help reconcile the asymmetric evolution of capital taxation in developing and developed countries.

We sharpen our mechanism analysis by conducting a firm-level investigation of the tax capacity channel. We merge multiple administrative datasets in Rwanda, which allows us to observe each firm's integration to international trade and corporate

<sup>2</sup>Trade leads to a sharp rise in corporate profits and an insignificant change in employee compensation.

tax payments. The integration measure accounts for the firm's indirect exposure to trade through its production network (Almunia, Hjort, Knebelmann, and Tian 2023). Rwanda provides an interesting setting: Starting from a relatively low share of domestic output, the corporate sector has grown significantly since the 1990s, in tandem with a rise in trade openness and tax collection. Using the shift-share design of Hummels, Jørgensen, Munch, and Xiang (2014) for identifying variation, we find that trade integration increases both a firm's  $ETR_K$  and its size. Though limited to a single country, these firm-level results provide micro-evidence for trade's positive impact on  $ETR_K$  and support the tax capacity mechanism whereby trade's impact is mediated by a positive firm size- $ETR_K$  gradient.

Finally, we study sources of heterogeneity in the pro-tax impact of trade. During our sample period, developing countries have invested in domestic tax enforcement, such as large taxpayer units (Basri, Felix, Hanna, and Olken 2021). We find that trade's impacts on the tax capacity mechanism and on  $ETR_K$  hold in the absence of these enforcement policies and, more generally, outside of periods of significant fiscal pressure (Cagé and Gadenne 2018). Thus, trade's pro-tax impact appears to be a broad feature of the globalization process that does not hinge on governments' initial enforcement and revenue needs. At the same time, we find that openness' pro-tax impact depends on the nature of the trade shock, in ways that are consistent with recent theoretical work on trade and formalization (Dix-Carneiro, Goldberg, Meghir, and Ulyssea 2024).

Combining multiple empirical strategies, our results at the country, corporate sector, and firm levels consistently suggest that trade openness increases  $ETR_K$  and contributed to the newly documented rise of  $ETR_K$  in developing countries since the early 1990s. Based on a new global database, our findings show that globalization has supported effective capital taxation and overall revenue collection in many countries around the world.

Section I discusses related literature. Section II describes the methodology and data. Section III presents findings on the long-run evolution of  $ETR$ . Section IV analyzes trade's impact on  $ETR$ , and Section V investigates the mechanisms. Section VI concludes.

## I. Related Literature

*Globalization and Tax Structure.*—Our paper contributes to the macro literature on globalization and tax structure (Alesina and Wacziarg 1998, reviewed in Adam, Kammas, and Lagou 2013). The “race to the bottom” hypothesis posits that governments reduce taxes on factors that become more mobile (e.g., capital) following trade liberalization (Slemrod 2004). To achieve revenue neutrality, governments raise taxes on less mobile factors (e.g., labor).<sup>3</sup> The “social insurance” hypothesis postulates that governments raise revenue to insure workers displaced by international competition, often via social security and payroll taxes (Rodrik 1998). These

<sup>3</sup>Within labor in OECD countries, Egger, Nigai, and Strecker (2019) find that globalization in the post-1994 era led to a reduction in income taxes for the top 1 percent of workers and increased income taxes for middle-class workers.

studies mainly focused on high-income countries. By expanding the scope to developing countries, we formulate and test a new mechanism, where trade increases *ETR* by expanding activity in firms with higher effective tax collection. Our results suggest that globalization has supported the ability of governments to tax capital in many countries.

Our results are based on a new global database of effective tax rates, which complements existing datasets (including Carey and Rabesona 2004; Kostarakos and Varthalitis 2020; McDaniel 2007) by expanding coverage to developing countries (details in Section II).<sup>4</sup> Our backward-looking *ETR* measure is complementary to the literature on forward-looking capital tax rates (including Devereux and Griffith 1999), which models in detail the statutory tax burden a firm would face under different conditions. This literature finds that the statutory tax burden on capital has fallen in developed and developing countries, consistent with the “race to bottom” mechanism (including Devereux, Griffith, and Klemm 2002; Kumar and James 2022; Steinmüller, Thuncke, and Wamser 2019).

*Effective Taxation and Trade in Developing Countries.*—Our paper contributes to the micro-oriented literature on trade and public finance in developing countries. Many studies focus on *border taxes* and evasion (e.g., Fisman and Wei 2004; Javorcik and Narciso 2017; Sequeira 2016) or cross-border income-shifting (e.g., Bilicka 2019; Londoño-Vélez and Tortarolo 2022; Wier 2020). We focus instead on trade’s impacts on the *domestic tax bases* of capital and labor and domestic economic structure.<sup>5</sup> Our results are intuitive when considering that the trade literature finds positive effects of openness on domestic outcomes, including market shares (McCaig and Pavcnik 2018), firm size (Alfaro-Ureña, Manelici, and Vasquez 2022), and local development (Méndez and Van Patten 2022), which the public finance literature has separately identified as determinants of effective taxation (Besley and Persson 2014; Best, Shah, and Waseem 2021).<sup>6</sup> We contribute by linking these two bodies of work and directly studying trade’s impacts on domestic tax bases at the country, sector, and firm levels.

By incorporating domestic tax bases, we can comprehensively study the total tax revenue impacts of globalization. Previous studies on trade’s revenue impact in developing countries have produced mixed findings, possibly due to differences in sample, methods, and tax base focus (including Baunsgaard and Keen 2010; Buettner and Madzharova 2018; Cagé and Gadenne 2018). We contribute by implementing multiple identification strategies in the largest sample to date and find that trade’s impacts on domestic tax bases are sufficiently large that openness increases total tax revenue (as a percent of GDP).

<sup>4</sup>We complement other work in economic history on taxation (including Cogneau, Dupraz, Knebelmann, and Mesplé-Somps 2021) by providing long-run measures of factor effective tax rates.

<sup>5</sup>The theoretical literature has focused on trade’s impact on the optimal indirect tax mix between border and consumption taxes in developing countries (e.g., Emran and Stiglitz 2005) and mainly abstracted from direct taxes. Benzarti and Tazhitdinova (2021) study the impact of indirect taxes on trade flows.

<sup>6</sup>Our results, which focus on the corporate output share, are compatible with findings from trade-formalization studies, which instead focus on the share of formal workers or firms (Section V).

These impacts of trade are mediated by the tax capacity mechanism, which is rooted in two distinct insights from the trade and public finance literatures. First, a large class of models predicts that trade leads to the expansion of large firms relative to small firms (Mrázová and Neary 2018); for empirical evidence, see Bernard, Redding, and Schott (2007). Second, in developing countries, small firms are mainly informal, and effective taxation increases with firm size (measured as firm revenue);<sup>7</sup> this positive gradient arises because effective tax collection is higher in larger firms and corporations due to their visibility, complex production structures, and employment of many workers (Almunia, Hjort, Knebelmann, and Tian 2023; Waseem 2020). The resulting information trails improve enforcement (Naritomi 2019; Pomeranz 2015), though with limits (Carillo, Pomeranz, and Singhal 2017).<sup>8</sup> The positive size gradient also arises because the tax code in developing countries often leads to higher statutory tax burdens for larger firms and corporations (Kumar and James 2022): Bachas, Brockmeyer, Dom, and Semelet (2025) find a positive size–statutory tax gradient among corporations in 16 countries. Our mechanism is motivated by Abbas and Klemm (2013), who hypothesize that the corporate sector expansion could explain why the reduction in statutory corporate tax burdens in developing countries has not led to a reduction in CIT revenue (percent of GDP).<sup>9</sup> The mechanism also relates to studies in high-income countries that link CIT collection to the corporate sector’s statutory burden, output share, and profitability (Clausing 2007; Griffith and Miller 2014; Sørensen 2007).

We focus on a mechanism based on firm size, but many links between trade, firm structure, and taxation remain to be explored (Atkin and Khandelwal 2020; Parenti 2018).

## II. Construction of Effective Tax Rates

This section presents a new database of effective tax rates (*ETR*) on labor and capital, which covers 154 countries, starting in 1965 when possible, until 2018. We first outline the conceptual framework to build *ETR*, then present the data sources, and finally discuss the sample coverage. Further details are in Supplemental Appendix B.

### A. Methodology

*Effective Tax Rates.*—We compute macroeconomic effective tax rates following the methodology of Mendoza, Razin, and Tesar (1994). The effective tax rate on labor, denoted  $ETR_L$ , is the total amount of taxes effectively collected on labor divided by total labor income in the economy; similarly for capital, denoted  $ETR_K$ :

$$(1) \quad ETR_L = \frac{T_L}{Y_L} \text{ and } ETR_K = \frac{T_K}{Y_K}.$$

<sup>7</sup> See also Kopczuk and Slemrod (2006); Kleven, Knudsen, Kreiner, Pedersen, and Saez (2011); La Porta and Shleifer (2014); Bachas, Fattal Jaef, and Jensen (2019); and Best, Shah, and Waseem (2021).

<sup>8</sup> In developed countries, including the United States, the large corporate sector is considered an important determinant of effective tax collection (Kleven, Kreiner, and Saez 2016; Slemrod and Velayudhan 2018).

<sup>9</sup> See also Quinn (1997); Kumar and Quinn (2012); and Abramovsky, Klemm, and Phillips (2014).

To construct the numerators, each type of tax revenue is assigned to labor or capital:

$$(2) \quad T_L = \sum_j \lambda_j \cdot \tau_j \text{ and } T_K = \sum_j (1 - \lambda_j) \cdot \tau_j,$$

where  $\lambda_j$  is the allocation to labor of each type  $j$  of tax  $\tau_j$ . Types of taxes  $j$  follow the OECD revenue classification. We allocate taxes as follows: (i) CIT, wealth taxes, and property taxes are allocated to capital; (ii) payroll taxes and social security payments are allocated to labor; (iii) PIT are allocated partly to labor and partly to capital, in a country-time-specific manner (details below). Indirect taxes are neither assigned to labor nor to capital (but analyzed directly in Section IVC). Supplemental Appendix Table B2 provides a detailed allocation summary.

To construct the denominators, we decompose net domestic product (NDP) as follows:

$$(3) \quad Y = Y_L + Y_K = \underbrace{CE + \phi \cdot OS_{PUE}}_{Y_L} + \underbrace{(1 - \phi) \cdot OS_{PUE} + OS_{CORP} + OS_{HH}}_{Y_K}.$$

Labor income  $Y_L$  equals compensation of employees ( $CE$ ) plus a share  $\phi$  of mixed income (operating surplus of private unincorporated enterprises,  $OS_{PUE}$ ). Capital income  $Y_K$  equals the remaining share  $(1 - \phi)$  of mixed income, plus corporate firms' profits net of depreciation (operating surplus of corporations,  $OS_{CORP}$ ), plus actual and imputed rental income (operating surplus of households,  $OS_{HH}$ ).<sup>10</sup>

We also measure the effective tax rate on corporate profits,  $\overline{ETR}_C^K$ , as the ratio of CIT to corporate profits. This is an average effective tax rate at the corporate sector level; in Section V, we analyze the firm-level corporate effective tax rate.

These macroeconomic *ETRs* rely on several conventions and assumptions (see Carey and Rabesona 2004). First, as is done in the literature, they do not factor in economic incidence, in that the economic cost of taxes is not “shifted” from one factor of production to another: All labor taxes are allocated to labor, and all capital taxes are allocated to capital. Second, the tax revenue streams need to be comparable to their macroeconomic tax bases measured in national accounts. This generates two key challenges for our *ETRs*: (i) in the numerator, what share of PIT revenues to allocate to capital versus labor and, (ii) in the denominator, what share of mixed income to allocate to capital versus labor. We outline our benchmark assumptions below (detailed discussion is in Supplemental Appendix B.2).

*Allocation of Personal Income Taxes (PIT).*—The main empirical difficulty in assigning taxes to labor and capital concerns the allocation of PIT. A naïve procedure allocates 70 percent of the PIT to labor and 30 percent to capital, roughly matching the labor and capital shares of domestic product. In practice, however, recent work

<sup>10</sup> We decompose NDP, which subtracts consumption of fixed capital from GDP. NDP is lower than GDP, by 10 percent on average. We exclude capital depreciation since it does not accrue to any factor of production and is usually tax exempt. Factor incomes also exclude indirect taxes (which are also excluded in the numerator of *ETR*).

highlights that not all labor and capital income is subject to PIT, since not all individuals are required to file PIT, and exemptions apply to some income types (Jensen 2022). Exemptions for capital (e.g., imputed housing rents, undistributed profits) are typically larger than for labor (e.g., pension contributions). Further, labor and capital income might not face the same tax rate: Dual-income tax systems tax labor income with progressive rates but capital income with flat rates. In the United States, Piketty, Saez, and Zucman (2018) use detailed tax and national accounts data to measure that 75 percent of labor income is subject to PIT, versus 33 percent of capital income. This suggests allocating approximately 15 percent of PIT to capital and 85 percent to labor.<sup>11</sup>

Starting from this baseline where 15 percent of PIT revenues derive from capital, we perform two country-year adjustments: (i) We raise capital revenues for country-years with a high PIT exemption threshold in the income distribution (Jensen 2022), and (ii) we lower it in country-years where dividends face lower taxes than wages. The resulting capital share of PIT revenue varies between 7 percent and 32 percent across country-years. Over time, this share falls from a global average of 19 percent in 1965 to 14 percent in 2018, due to a reduction in PIT exemption thresholds and increased prevalence of dual tax systems.

In the absence of detailed tax records in every country and year, these adjustments provide a helpful but imperfect approximation of the true capital share of PIT. We therefore implement two simple robustness checks where the share allocated to capital is fixed over time at either 0 percent or 30 percent, representing low- and high-end scenarios.

*The Labor Share of Mixed Income.*—The labor share of mixed income (unincorporated enterprises) is hard to measure.<sup>12</sup> For our benchmark series, we assume  $\phi = 75\%$ , i.e., 25 percent of mixed income is considered capital income.<sup>13</sup> In the absence of a consensus over alternatives, this assumption has the advantage of being transparent, though factor shares are unlikely in practice to everywhere be time and country invariant. We therefore implement two robustness checks, which create time and year variation in  $\phi$ . The first method, based on ILO (2019), uses micro-data to estimate the country-specific labor income of self-employed based on the observable characteristics of these workers and their comparison with employees.<sup>14</sup> Second, we assign to  $\phi$  the observed country-year labor share of the corporate sector (as in Gollin 2002).

<sup>11</sup> If 75 percent of labor income is taxable and labor income is 70 percent of national income (resp. 33 percent and 30 percent for capital income), then  $75\% \times 70\% / (75\% \times 70\% + 33\% \times 30\%) = 84\%$  of the PIT is labor income.

<sup>12</sup> The United Nation's national accounts framework outlines the combination of multiple methods to overcome challenges of measuring the *level* of mixed income in economies with widespread informality. While information on the methods used is not available on a country-year basis, an inspection of the published frameworks suggests no change in methodologies for mixed income over time.

<sup>13</sup> This is below the 30 percent used in Distributional National Accounts (DINA) guidelines (Chancel et al. 2025), but since the global average of the corporate sector's capital share is 27 percent, assuming a lower capital share for unincorporated enterprises seems reasonable (see Guerriero 2019).

<sup>14</sup> Details are in Supplemental Appendix B.2. A challenge with this method is that it can create implausibly large estimates of the level of mixed income compared to their values in national accounts. We implement an adjustment to help with this limitation, but for this reason we choose to use ILO (2019) only for robustness.

The exact *ETR* formulas which include the above adjustments are in Supplemental Appendix B.2.

*Usefulness and Limitations of ETR.*—Since national account statistics are compiled following harmonized guidelines, *ETRs* are conceptually comparable over time and across countries, though the data limitations described above should be kept in mind. By relying on taxes actually collected, the *ETRs* incorporate tax avoidance and evasion behavior as well as the net past effects of all tax policies, including rates, exemptions and credits. This is particularly relevant in a development context, where due to widespread evasion, knowledge of statutory tax rules only provides a partial picture of effective tax burdens.

The *ETRs* are backward-looking measures that comprehensively capture how much capital and labor have effectively paid in taxes. They are helpful for three reasons. First, knowing how much in revenues is effectively collected from each factor is important when governments face fiscal pressure (Besley and Persson 2014): This is characteristic of most developing countries, where potential revenue losses or gains are a key policy determinant. Second, the level of the *ETR* and its deviation from a statutory rate is frequently an input into policymaking to understand the size of tax gaps (e.g., the recent focus on the firm-level *ETR* in the global minimum tax agreements). Finally, the tax burden levied on each factor is an important starting point to determine the economic incidence of a tax system.

A limitation of macroeconomic *ETRs* is that they are impacted by both the tax code and economic changes. Thus, studying *ETRs* is most helpfully done in combination with analyzing its mechanisms, which we focus on in Section V. Related, we emphasize that the *ETR* should not be interpreted as a proxy for the statutory tax burden. An important complementary body of work carefully measures legal tax burdens (Devereux and Griffith 1999), by constructing forward-looking average tax rates on capital based on the simulated present value of returns and costs of a new investment. Driven by differing objectives, the backward-looking and forward-looking measures are related, yet distinct.<sup>15</sup>

## B. Data Sources

*National Accounts.*—To measure factor incomes for 154 countries since 1965 when possible, we create a panel of national accounts using data from the System of National Accounts (SNA) produced by the United Nations. We first use the 2008 SNA online repository that has global coverage for recent decades. In turn, the UN Statistics Division provided us with access to the 1968 SNA offline data, which cover historical data from the 1960s and 1970s. To the best of our knowledge, our paper is the first to harmonize and integrate the 2008-SNA and 1968-SNA datasets.<sup>16</sup> Estimating factor incomes requires information on all the components

<sup>15</sup>This is particularly the case for  $\overline{ETR}_C^K$ ; see Supplemental Appendix for a detailed discussion. Our measure of  $\overline{ETR}_C^K$  also relates to the CIT-efficiency measure by IMF (2014).

<sup>16</sup>Relative to recent work (including Guerriero 2019; Karabarbounis and Neiman 2014), our data expand coverage in space and time, mainly to developing countries, and systematically attempts to measure factor incomes for total domestic output (versus only for the corporate sector).

of national income (equation (3)). Whenever we have national income for a country-year but information on a component is missing, we attempt to recover it with information from the second SNA dataset, as well as by using national accounting identities with nonmissing values for the other income components. In the remaining cases, we impute component values following DINA guidelines (Chancel et al. 2025), with details in Supplemental Appendix B.1.

*Tax Revenue.*—We construct a new tax revenue dataset that disaggregates taxes by type following the OECD Revenue Statistics classification of taxes. Our database includes all taxes—on personal and corporate income, social security and payroll, property, wealth and inheritance, consumption, and international trade—at all levels of government. We ensure a systematic separation of income taxes into personal and corporate income. We collect new archival data and integrate them with existing data sources.

When available, OECD Revenue Statistics data are the preferred source, as they cover all types of tax revenues and go back to 1965 for OECD countries. They account for 2,879 country-year observations (42.34 percent of the sample). Their drawback is their limited coverage of non-OECD countries, as they cover 93 countries in total and only cover developing countries more recently. We add data from the International Centre for Tax and Development (ICTD) (<https://www.ictd.ac/dataset/grd/>). ICTD includes most developing countries, with coverage that starts in the 1980s. ICTD sometimes combines PIT and CIT, and sometimes lacks social security. ICTD adds 1,263 country-year observations (18.58 percent of the sample).

To complement these existing sources, we conducted archival data collection to digitize records from government budgets and national statistical yearbooks. This adds 2,475 new country-year observations.<sup>17</sup> We supplemented these archival records with countries' online publications and offline data from the IMF Government Finance Statistics (1972–1989). In total, this data collection adds 2,657 observations (39.08 percent of the sample).

Building a dataset based on newly digitized historical sources necessarily requires making a number of decisions. To increase the credibility of our data, we follow four guiding principles. First, we seek to build long historical time series that overlap in years with existing sources. We aim to only use two data sources per country, but use the overlapping years between multiple sources to corroborate that they are comparable in levels of tax revenue and types of taxes in place.<sup>18</sup> For this reason, a switch in data source rarely leads to a significant change in trend. Second, for the historical periods without overlap with existing data, we corroborate the levels of tax to GDP with academic and policy studies. Third, we draw on historical studies to verify that large changes in revenues collected reflect policy, economic, or political changes rather than data artifacts. Fourth, we aim to be conservative and therefore

<sup>17</sup> The archives were accessed in the Government Section of the Lamont Library (<https://library.harvard.edu/collections/data-and-government-information-collections>).

<sup>18</sup> OECD is the preferred starting point, and archival data are initially second in priority since they often disaggregate tax types and go back far in time, but we revise this based on the source that best matches the OECD data. The Supplemental Appendix summarizes the data sources used for each country.

exclude countries in time periods where concerns exist about data quality, due to the economic and political context.

To help assess our approach, the Supplemental Appendix provides additional material. We provide a table that outlines, in each of the 154 countries, the main considerations and our choices relating to the four guiding principles. The table emphasizes the uncertainty surrounding specific countries and time periods, and flags instances where the data appear worthy of inclusion but should be interpreted with caution. Moreover, we provide in-depth country case studies with direct links to the initial archival sources; the case studies currently cover all countries with more than 15 million inhabitants but will ultimately expand to cover all 154 countries. We invite comments from researchers to help improve the accuracy of the series as we continuously update the data.

### *C. Data Coverage of Effective Tax Rates*

The final *ETR* sample contains 6,799 country-year observations in 154 countries (Supplemental Appendix Figure A1). The number of countries starts at 78 in 1965 and grows to 110 by 1975 (due to independence or country creation). The key jump in coverage—from 117 to 148—corresponds to the entry of ex-communist countries in 1994, including China when it arguably built a modern tax system (Supplemental Appendix B.1). The data are effectively composed of two quasi-balanced panels. The first covers 1965–1993 and excludes communist regimes, accounting for 85–90 percent of world GDP. The second covers 1994–2018 and includes ex-communist countries, accounting for 97–98 percent of world GDP.

We classify countries into two groups, which we respectively call throughout the paper developing countries, or low- and middle-income countries (LMICs), and developed countries, or high-income countries (HICs). Our definition of developed countries corresponds to the 37 countries that as of 2018 are both high-income, following the World Bank income threshold (12,000 in GDP per capita), and members of the OECD, with the addition of Singapore and Taiwan. Developing countries correspond to the remaining 117 countries.<sup>19</sup> Our final sample contains 5,036 observations in LMICs and 1,763 observations in HICs. Supplemental Appendix Figure A1 shows coverage by development level. The list of countries in each group is provided as Table O4 in the Supplemental Appendix.

*Comparison with Existing Datasets.*—Our database complements previous *ETR* series by expanding coverage to LMICs. Supplemental Appendix Table B.2 summarizes the coverage of existing *ETR* series, which focus on HICs (Carey and Rabesona 2004; Kostarakos and Varthalitis 2020; McDaniel 2007; Mendoza, Razin, and Tesar 1994). Our benchmark *ETRs* rely on specific choices: Table B.2 summarizes the methodological differences with existing *ETR* series, which relate mainly

<sup>19</sup>Our definition of developing countries thus includes a few non-OECD but high-income countries: This restricted set contains a few oil producers (e.g., Qatar, Saudi Arabia) and a few known financial centers (e.g., Bahamas, Cyprus). The results shown below are robust to changes in our classification.

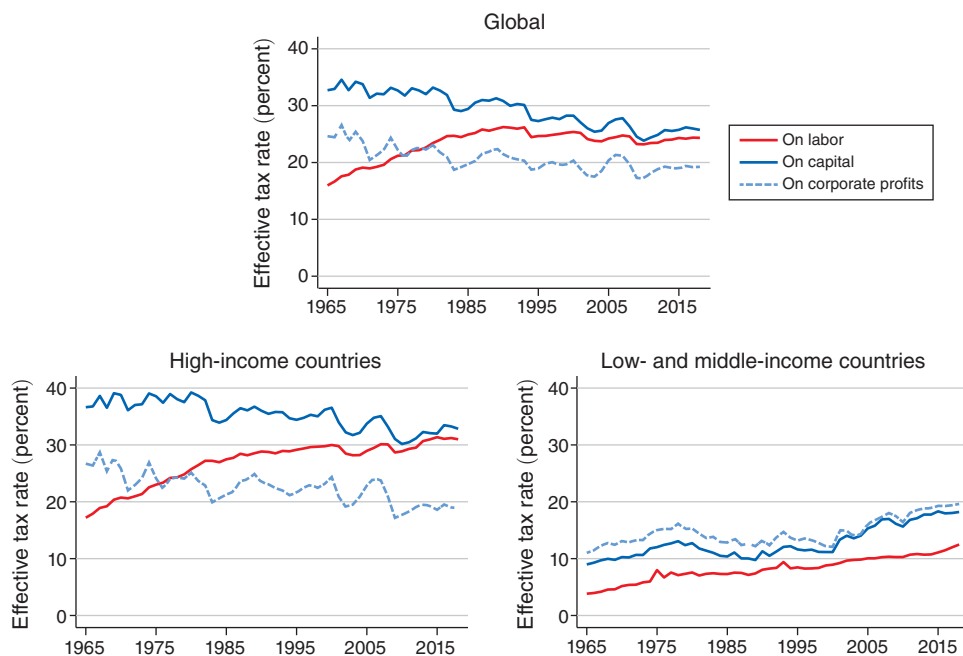


FIGURE 2. EFFECTIVE TAXATION OF CAPITAL AND LABOR (1965–2018)

*Notes:* This figure plots the time series of average effective tax rates on labor (red) and capital (blue), as well as the average effective tax rate on corporate profits (blue dashed line). The top panel corresponds to the global average, weighting country-year observations by their share in that year's total factor income, in constant 2019 US dollars (observations = 154). The bottom-left panel shows the results for high-income countries (observations = 37), and the bottom-right panel for low- and middle-income countries (observations = 117). The classification of countries into two development groups is defined in Section IIC. The dataset is composed of two quasi-balanced panels. The first covers the years 1965–1993 and excludes communist regimes. It accounts for 85–90 percent of world GDP during those years. The second covers 1994–2018 and integrates former communist countries—in particular, China and Russia—and accounts for 97–98 percent of world GDP. This figure is discussed in Section IIIA.

to allocating capital to both mixed income and PIT.<sup>20</sup> The alternative choices are covered by the robustness checks of Section IIA, which are implemented in Section IIIB.

### III. Stylized Facts on Global Taxation Trends

#### A. Evolution of Effective Tax Rates on Capital and Labor

Figure 2 documents the evolution of effective tax rates on capital and labor from 1965 to 2018. Aggregates are dollar weighted; i.e., the global effective tax rate on capital equals worldwide capital tax revenues divided by worldwide capital income. These series can thus be interpreted as the average tax rate on a dollar of

<sup>20</sup> A comprehensive discussion of the methodological differences is provided in the Supplemental Appendix.

capital income derived from owning an asset representative of the world's capital stock. The top panel shows global trends, and the bottom panels separate HICs and LMICs.

Globally, effective tax rates on labor and capital converged between 1965 and 2018, due to a rise in labor taxation and a drop in capital taxation. The global  $ETR_L$  rose from 16 percent in the mid-1960s to 25 percent in the late 2010s, while  $ETR_K$  fell from 32 percent to 26 percent.

The global trends mask heterogeneity by development levels. While labor taxation rose everywhere, the decline in capital taxation only occurred in HICs: The effective capital tax rate fell from 38–39 percent to 32–33 percent between the late 1960s and late 2010s, fueled by a large reduction in effective corporate tax rates, which fell from 27 percent to 19 percent. In contrast, starting from a low level,  $ETR_K$  increased in LMICs, with the rise happening entirely since the beginning of the 1990s.  $ETR_K$  started at 10 percent in the mid-1960s and was at the same level in 1989; in between, there was a rise and decline in the late 1970s, but this temporary change was fully driven by resource-rich countries (Figure 4). From 10 percent in 1989,  $ETR_K$  saw a sustained increase over the next two decades that reached 18 percent in 2018. The rise in capital taxation is partly driven by higher effective taxation in the corporate sector: The effective corporate tax rate rose from 12 percent to 20 percent between 1989 and 2018 in LMICs.<sup>21</sup>

### B. The Rise of Capital Taxation in Developing Countries

The secular decline in  $ETR_K$  in HICs has been documented before (Dyreng, Hanlon, Maydew, and Thornock 2017; Garcia-Bernardo, Janský, and Tørsløv 2022), but the rise in  $ETR_K$  in LMICs starting at the beginning of the 1990s is novel. We therefore need to establish that this result is robust to the assumptions we used to construct the  $ETR$  series.

The  $ETR$  series depends on four main methodological decisions: (i) how to assign PIT revenue to capital versus labor, (ii) how to allocate mixed income to capital versus labor, (iii) balanced versus unbalanced panel, and (iv) weights to aggregate countries. Our benchmark series (i) assigns PIT to capital versus labor for each country-year using data on PIT exemption thresholds and the tax treatment of dividends relative to wages, (ii) allocates a fixed 25 percent of mixed income to capital, (iii) consists of two quasi-balanced panels before and after 1994 (when China, Russia, and other former command economies enter the sample), and (iv) weighs countries by their share of worldwide factor income in each year. We assess how results change when varying one, several, or all of these choices at the same time.

<sup>21</sup> Supplemental Appendix Figure A2 shows that both corporate tax revenues and corporate profits increased since 1989 but that the former outpaced the latter, causing  $\overline{ETR}_C^K$  to rise. Corporate profits and tax revenue are the largest components that determine changes in  $ETR_K$ . Smaller contributions to  $ETR_K$ 's rise come from the decline in mixed income and the steady increase in property and wealth taxes, which outpaced income from rents, albeit starting from a very low level (0.3 percent of NDP in 1989).

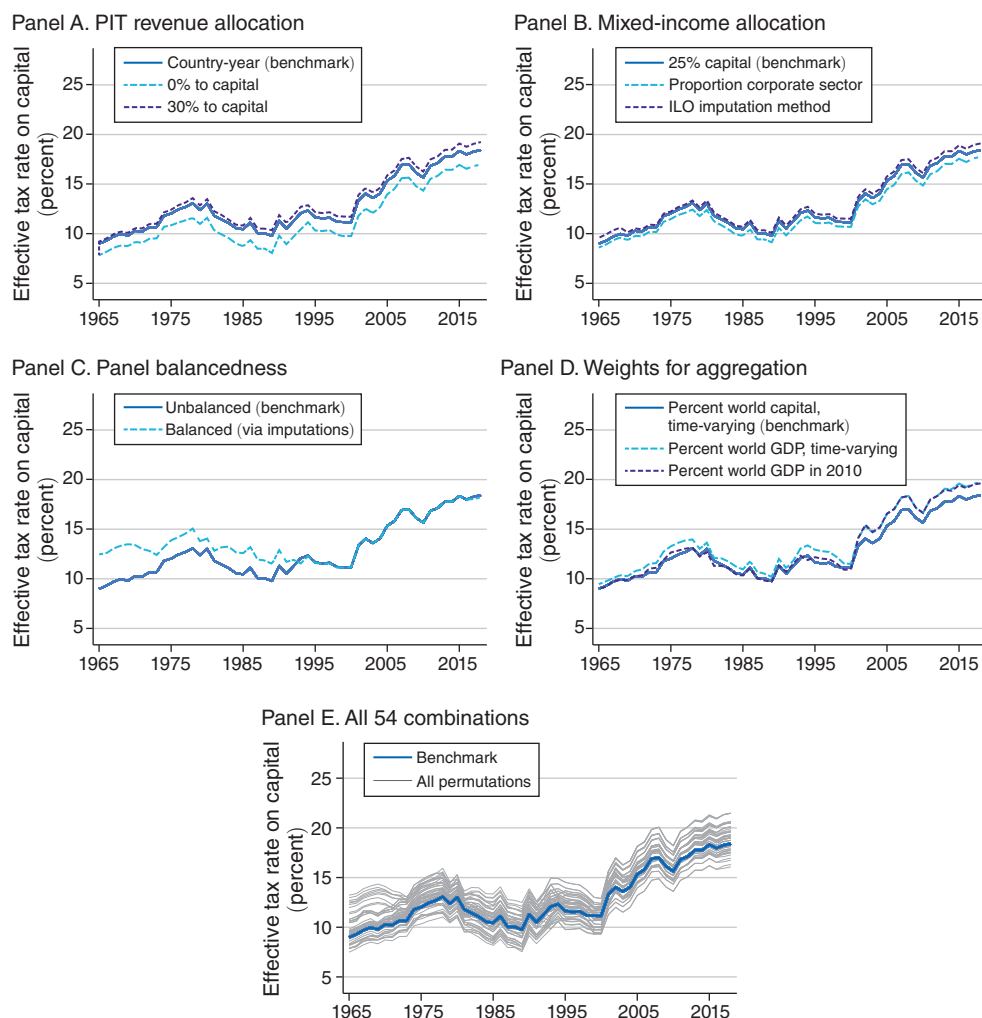


FIGURE 3. ROBUSTNESS OF EFFECTIVE CAPITAL TAXATION IN DEVELOPING COUNTRIES

*Notes:* These panels show trends in the effective tax rate on capital in the 117 developing countries in our sample. The panels vary our four key methodological choices: the allocation of PIT revenue to capital versus labor (panel A), the allocation of mixed income to capital versus labor (panel B), presenting results for an unbalanced panel of countries versus a balanced panel via imputations (panel C), and the use of weights to aggregate individual countries' time series (panel D). Panel E shows all 54 possible combinations that can be constructed by combining these choices. In all panels, the blue line corresponds to our benchmark series. Developing countries are defined in Section IIC. This figure is discussed in Section IIIB.

Figure 3 investigates the robustness of the  $ETR_K$  trend in LMICs.<sup>22</sup> Panel A varies the allocation of PIT revenue. Our benchmark follows a data-driven country-year assignment; instead, we consider two simpler scenarios where the share allocated to capital is fixed, at either 0 percent or 30 percent (low- and high-end scenarios).

<sup>22</sup>The robustness for  $ETR_L$  in LMICs and for  $ETR_L$  and  $ETR_K$  in HICs are shown in the Supplemental Appendix.

Due to high PIT exemption thresholds in LMICs, the benchmark country-specific assignment is closer in levels to the 30 percent than to the 0 percent scenario. Though the capital share allocated to PIT slightly changes over time (Section IIA), the time-invariant robustness series track the trends in the benchmark series closely. This is because the PIT remains limited in LMICs, such that its split into labor versus capital is of minor consequence.

Panel B varies the assignment of factor shares in mixed income. We implement two robustness checks, creating mixed income labor shares that vary at the country level based on the ILO (2019) method and at the country-year level based on the observed corporate labor share. Both alternative series are very similar to the benchmark.

Panel C quantifies the effect of country entry into the panel. In our benchmark, China, Russia, and other former command economies enter in 1994. In this robustness check, we balance the panel by imputing missing observations between 1965 and 1993; we use the observed  $ETR_K$  value for that country in 1994 and the trends in  $ETR_K$  observed for other LMICs in 1965–1993. The imputation raises  $ETR_K$  between 1965 and 1993 because Russia had both a high  $ETR_K$  and a high weight when entering the sample in 1994.<sup>23</sup>

Panel D aggregates countries using NDP instead of capital income weights. The NDP weights are either time varying or fixed in 2010. These alternative weighting procedures suggest a slightly higher increase in  $ETR_K$  over time.

Finally, panel E plots all 54 combinations of the four methodological choices. The rise in  $ETR_K$  in LMICs between 1989 and 2018 is clearly apparent in each of the 54 series. How wide is the range of increases and how does our benchmark series compare? Computing the 1989–2018 change in the 54 series, we obtain a fairly tight range of  $ETR_K$  increases, between 6.4 percentage points and 10.3 percentage points. Our benchmark is at 8.7 percentage points, which is close to the mean increase of 9.2 percentage points; there are larger increases than our benchmark in 43 series and smaller increases in 10.<sup>24</sup> Our benchmark series corresponds to an 86 percent increase in the effective tax rate on capital in LMICs since 1989, reflecting both the strong growth and low baseline.

*Comparison with Previous Studies.*—Preexisting  $ETR$  series mainly cover HICs, which limits the comparison to our sample. In HICs, our benchmark  $ETR$  trends are comparable to previous studies, but the levels differ by 16.5 percent on average (Supplemental Appendix Figure B1). This difference is primarily due to methodological assumptions about the allocation of capital to mixed income and PIT (Supplemental Appendix Table B.2). However, the alternative methodologies from the preexisting series are contained within the range of  $ETR$  trends produced by our

<sup>23</sup> The imputation allows us to keep a sample with all developing countries, but other sample choices could be made. Supplemental Appendix Figure A3 shows the evolution of effective taxes for two alternative balanced samples of developing countries: The first starts in 1973 (observations = 72); it excludes ex-communist countries such as China and Russia. The second starts in 1994 and contains all major countries (observations = 106).

<sup>24</sup> Setting 1989 as the base year is partly arbitrary, but it allows us to fix a starting level for  $ETRs$  immediately before the period of strong trade liberalization in LMICs. If we instead compute the change in  $ETR_K$  between 2018 and the lowest point in a given series, the range of changes is 6.8–11.3 percentage points across the 54 series, with a mean at 9.6 percentage points and our benchmark at 9.4 percentage points.

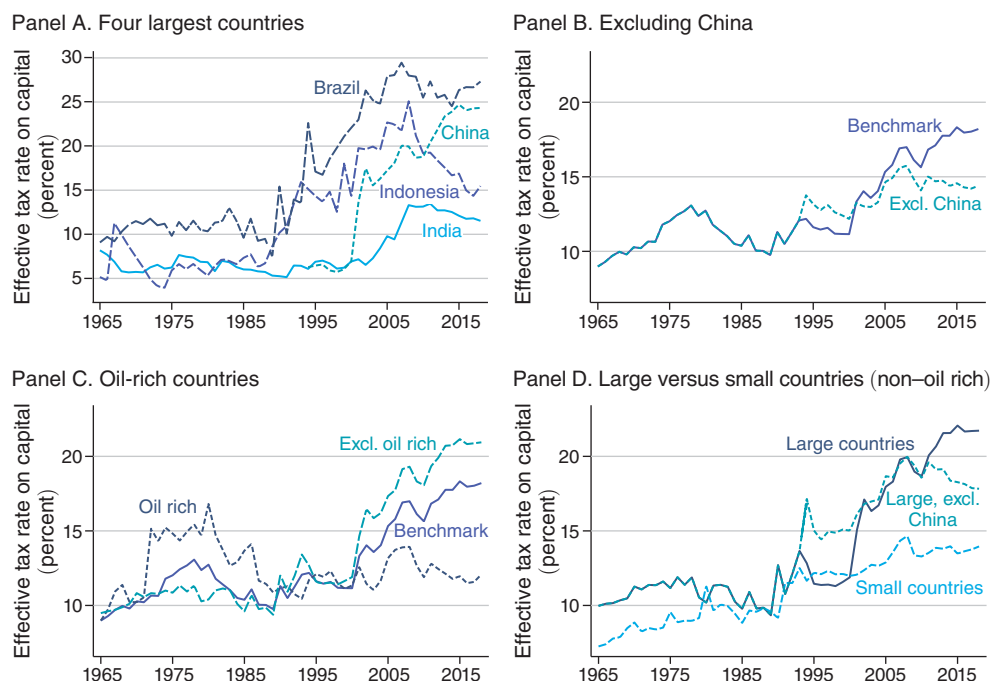


FIGURE 4. HETEROGENEITY OF EFFECTIVE CAPITAL TAXATION IN DEVELOPING COUNTRIES

*Notes:* These panels show the evolution of the effective tax rate on capital,  $ETR_K$ , for major developing countries and subsamples of developing countries. Developing countries are defined in Section IIC. Panel A plots the  $ETR_K$  series for the four largest (most populous) developing countries: Brazil, China, India, Indonesia. Panel B compares our benchmark series to the series that excludes China. Panel C plots the  $ETR_K$  series for a sample of oil-rich countries (countries with more than 7 percent of GDP from oil in 2018), and the benchmark  $ETR_K$  series without these countries. Within the sample of non-oil-rich developing countries, panel D compares large countries to small countries. Large countries are defined as having a population above 40 million in 2018. This figure is discussed in Section IIIC.

robustness checks. In HICs, that range of  $ETR_K$  trends is indeed wide (due to the quantitative importance of the PIT) ( $ETR$  series in the Supplemental Appendix). However, the range of  $ETR_K$  trends in LMICs is comparatively tighter (Figure 3); this is because the rise in  $ETR_K$  in LMICs is primarily driven by the corporate sector (Supplemental Appendix Figure A2), which is not strongly affected by the methodological differences between our study and preexisting studies.

### C. Where Has Capital Taxation Risen?

Figure 4 shows the  $ETR_K$  series for subsamples of countries. Panel A plots  $ETR_K$  series for the most populous LMICs: Brazil, China, India, and Indonesia. All display a marked  $ETR_K$  rise over time. Starting in 1989 (1994 for China) until 2018,  $ETR_K$  rose from 7 percent to 27 percent in Brazil, 6 percent to 24 percent in China, 5 percent to 12 percent in India, and 9 percent to 15 percent in Indonesia.

China's weight and fast-rising capital taxation imply that it plays a key role in the aggregate  $ETR_K$  trend in LMICs. Panel B shows that when excluding China, the rise in  $ETR_K$  is half as large (from 10 percent to 15 percent), and a more significant part of the rise occurred earlier in the 1990s. Panel C shows that oil-rich countries, measured as deriving more than 7 percent of GDP in oil in 2018, have been on a completely distinct path. Reflecting the oil commodity shocks, their  $ETR_K$  rose in the 1970s but fell in the 1980s and have stayed flat since. Excluding oil-rich countries yields a more pronounced  $ETR_K$  rise, from 9 percent in 1989 to 21 percent in 2018, and a flat  $ETR_K$  series from 1965 to 1989. If we exclude both China and oil-rich countries, we observe a rise in  $ETR_K$  from 9 percent in 1989 to 17 percent in 2018, which is similar in magnitude to the benchmark series.

Panel D reveals that among non-oil-rich countries, the  $ETR_K$  rise is stronger in large LMICs, defined as the 19 countries with a population above 40 million in 2018. Even when excluding China, the  $ETR_K$  of the other 18 most populated countries rose from 9 percent to 18 percent between 1989 and 2018; in smaller countries,  $ETR_K$  rose from 10 to 14 percent over the same period. The  $ETR_K$  has risen by more than 5 percentage points in 13 of the 19 largest LMICs since 1989 and has only fallen in 1 country (Russia).<sup>25</sup>

In short, the rise in effective capital taxes is more pronounced in larger countries, including China, but is a general pattern in developing countries, except for oil-rich ones.

#### D. Suggestive Evidence for the Role of Globalization

We saw that  $ETR_K$  fell in HICs but rose in LMICs. Importantly, the rise in LMICs starts in the early 1990s, which coincides with the onset of the period of "hyper-globalization" that could a priori have made capital more mobile and harder to tax.<sup>26</sup> Instead, could trade globalization have caused  $ETR_K$  to rise in LMICs? Here we take a first pass at investigating this question. We create 5-year growth rates within countries in trade and  $ETRs$ . We plot binned scatters of  $ETR$  against trade openness (measured as the share of imports and exports in NDP), after residualizing all variables against year fixed effects. Figure 5 depicts these within-country associations, which condition on global time trends. Mirroring the heterogeneity in long-run trends, we observe differences by development level in the association between trade and  $ETR_K$ : openness is associated with increases in  $ETR_K$  in LMICs, but with decreases in  $ETR_K$  in HICs.<sup>27</sup> In sum, from a global and historical perspective, the correlational evidence suggests that trade may have contributed to the newly documented rise in  $ETR_K$  in developing countries.

Naturally, LMICs experienced large developments since the 1960s and their growth also likely contributed to the long-run rise in  $ETR_K$ . In the Supplemental

<sup>25</sup> The Supplemental Appendix shows the individual countries'  $ETR_K$  and  $ETR_L$  time series.

<sup>26</sup> Individual trends in the four largest LMICs (Figure 4) also suggest an association between liberalization episodes and an uptick in  $ETR_K$  (Brazil in 1988, China in 2001, India in 1991, Indonesia in the mid-1980s).

<sup>27</sup> The Supplemental Appendix further shows that early globalized LMICs saw trade and  $ETR_K$  rise in tandem prior to the 1990s and stagnate thereafter. By contrast, LMICs that participated in the second wave of globalization post-1990 saw a rise in trade and  $ETR_K$  in the 1990–2018 period.

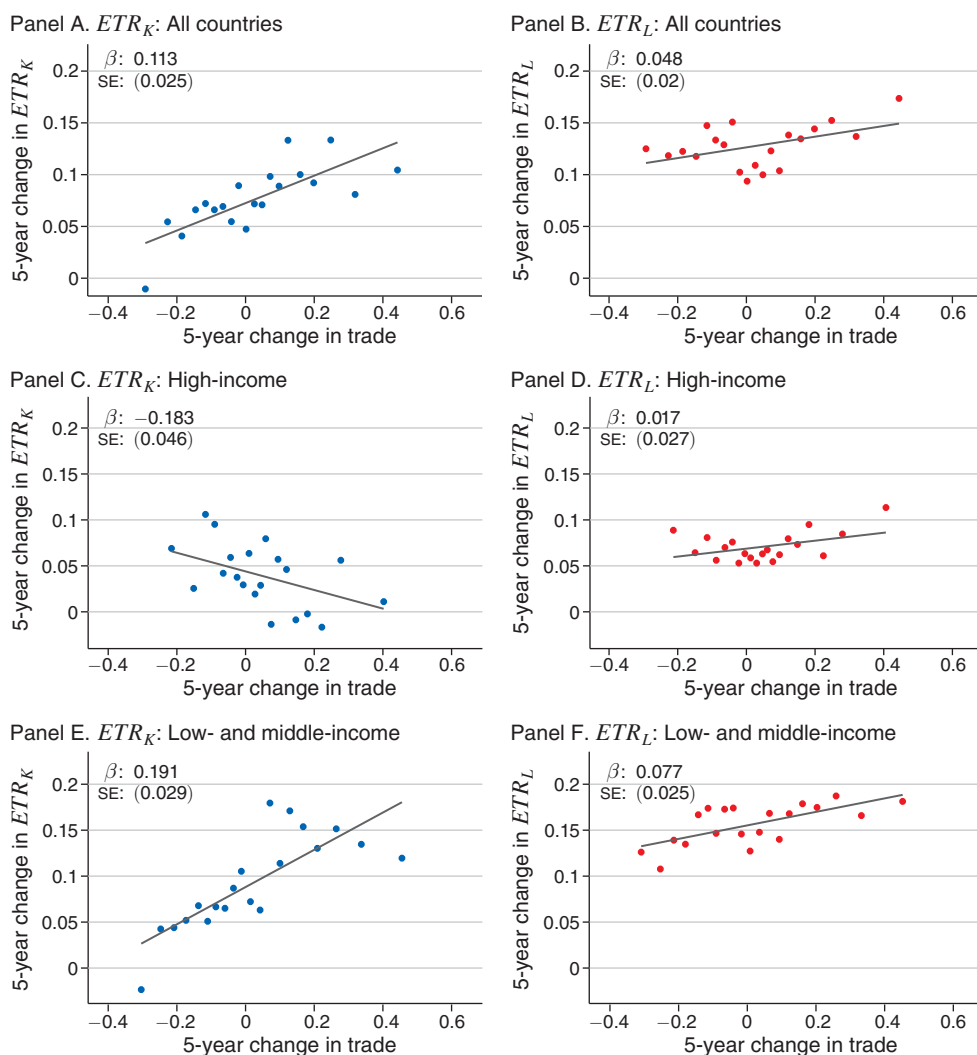


FIGURE 5. WITHIN-COUNTRY ASSOCIATIONS BETWEEN EFFECTIVE TAX RATES AND TRADE

*Notes:* These panels show the association between trade and effective tax rates. The outcome is the effective tax rate on capital,  $ETR_K$ , and on labor,  $ETR_L$ , in the left-side and right-side panels, respectively. The top panels show the associations in all countries; the middle panels show the associations in high-income countries; the bottom panels show the associations in low- and middle-income countries. The classification of countries into two development groups is defined in Section IIC. Trade is measured as the sum of import and exports as a share of net domestic product. Both the x-axis and y-axis are measured as within-country percent changes over five years. Each graph shows binned scatterplots of each outcome against trade, after residualizing all variables against year fixed effects. Each dot corresponds to a ventile (20 equal-sized bins) of the residualized trade variable, with average values of trade and  $ETR$  calculated by ventile. In each graph, the line represents the best linear fit based on the underlying country-year data, with the corresponding slope coefficient and standard error reported in the top-left corner. For more details, see Section IIID.

Appendix, we show that the associations in Figure 5 hold in LMICs when controlling for GDP per capita growth. This correlational evidence, combined with the observation that although globalization is a major process in LMICs, its revenue

impacts are not established (see the introduction), motivate us to investigate trade as a determinant of *ETR* and study its mechanisms.<sup>28</sup>

#### IV. Trade Globalization and Capital Taxation

In this section, we implement two distinct research designs to investigate the impact of trade openness on capital and labor taxation in developing countries.

##### A. Event Studies for Trade Liberalization

*Empirical Design.*—In the first design, we implement event studies of trade liberalization policy events in key developing countries. To discern sharp breaks from trends in our outcomes, we selected events that caused large trade barrier reductions and have been studied in the literature. This led us to select the six events from the review papers by Goldberg and Pavcnik (2007, 2016) (Colombia in 1985, Mexico in 1985, Brazil in 1988, Argentina in 1989, India in 1991, Vietnam in 2001) and add the well-known event of China's accession to the WTO in 2001 (Brandt, Van Biesebroeck, Wang, and Zhang 2017). These liberalization events led to large reductions in tariffs: from 59 percent to 15 percent in Brazil, 80 percent to 39 percent in India, and 48 percent to 20 percent in China. We can rely on preexisting narrative analyses to discuss threats to identification and interpretation of results.<sup>29</sup> Supplemental Appendix C.1 provides more details.

For each of the seven treated countries and outcomes, we construct a synthetic control country as a weighted average over the donor pool of never-treated countries (Abadie, Diamond, and Hainmueller 2010).<sup>30</sup>

We match on the level of each outcome in seven years prior to the event, while minimizing the mean squared prediction error between the event-country and the synthetic control.<sup>31</sup> This time range ensures that our *ETR* outcomes are well defined in all treated countries, as China and Vietnam enter the *ETR* sample in 1994 and have their event in 2001. We plot the average levels of the outcome for treated and synthetic control countries by relative time to the event. Moreover, we estimate the event-study model in seven years both before and after the events:

$$(4) \quad y_{ct} = \sum_{e=-7, e \neq -1}^7 \beta_e \cdot \mathbf{1}(e = t) \cdot D_c + \theta_t + \kappa_c + \pi_{Year(t)} + \epsilon_{ct},$$

<sup>28</sup> Trade may alter the final incidence of capital taxation. By increasing the mobility of capital, it might lead to a higher share of taxes borne by less mobile factors (workers, consumers, land) at the benefit of shareholders. While our study does not focus on the final incidence of taxes, the veracity of this hypothesis remains debated (Toder 2023).

<sup>29</sup> The reductions in trade barriers are sometimes implemented over several years. To be conservative, we focus on the earliest start year for each event as defined in published studies.

<sup>30</sup> For each country-event, we can include eventually treated countries in the donor pool (excluding those with treatment within five years of the event); results remain similar.

<sup>31</sup> The Supplemental Appendix lists the countries included in the synthetic control for each event and each outcome.

where we include fixed effects for event time  $\theta_t$ , country  $\kappa_c$ , and calendar year  $\pi_{Year(t)}$  (the latter control for shocks that correlate with events clustered in calendar time).  $D_c$  is a dummy equal to one if country  $c$  is treated. The coefficient  $\beta_e$  captures the difference between treated and synthetic control countries in event time  $e$ , relative to the prereform year  $e = -1$  (omitted period). Standard errors are clustered at the country-event level. We calculate imputed treatment effects based on Borusyak, Jaravel, and Spiess (2021), which addresses challenges from two-way fixed effects and heterogeneous event times. Supplemental Appendix Table A1 reports the difference-in-differences estimate of the average treatment effect.

*Event-Study Results.*—Figure 6 displays the event studies in levels (left-hand panels) and the dynamic regression coefficients (right-hand panels). The top panels show that, as expected, trade openness rises in the years post-event by close to 10 percentage points, and its trend changes in postreform years compared to preliberalization years.<sup>32</sup> The middle panels show that  $ETR_K$  followed stable pre-trends and sharply rises postliberalization, by 4 percentage points. The bottom panels show that  $ETR_L$  also rose, but only by 2 percentage points. Despite the small sample size, the dynamic posttreatment coefficients for each period are often significant at the 5 percent level. The dynamic coefficients seem to indicate that the increase in  $ETR_K$  precedes the increase in trade by one year. However, the “levels” panels reveal that this is driven by fluctuations in the control group,<sup>33</sup> which may reflect the small sample size; relative to stable pre-trends, the levels of  $ETR_K$  and trade both see a break from trend immediately following the liberalization event. Panel A of Supplemental Appendix Table A1 reports the difference-in-differences results, which are more significant when estimated from imputed treatment effects. Panel B shows that results are comparable when we jointly match on all outcomes.

The identifying assumption is that there are no changes in confounding determinants of  $ETR$  that coincide with the liberalization events. The breaks from stable pre-trends imply that confounding changes would have to sharply coincide with the event onset. Narrative analyses of the timing for each event (Supplemental Appendix C.1) do not suggest obvious concurrent changes. Moreover, using data from Wacziarg and Wallack (2004), we verify that other cross-border reforms (e.g., capital liberalization) or domestic reforms (e.g., privatization) do not occur in the same year as the trade events.<sup>34</sup> However, reforms sometimes occur some years later: For example, Mexico joined NAFTA and removed capital inflow restrictions, Argentina and Brazil joined Mercosur, and India liberalized its foreign direct investment rules (Supplemental Appendix C.1). These reforms occurred several years post-trade liberalization, but  $ETRs$  sharply rise in the immediate post-event years. This discussion highlights that the causal interpretation of trade-centered macroeconomic reforms requires caution. A plausible interpretation is that the short-run rise in  $ETRs$  with sharp breaks from stable pre-trends reflects the impact of trade

<sup>32</sup> The absence of a prereform dip limits concerns about intertemporal substitution, although some of the liberalization events may have been predictable, including China's WTO accession.

<sup>33</sup> Trade and  $ETR_K$  temporarily increase and decrease, respectively, in the liberalization year (when  $e = 0$ ).

<sup>34</sup> Only Mexico had a concurrent domestic reform, and results hold without it; see the Supplemental Appendix.

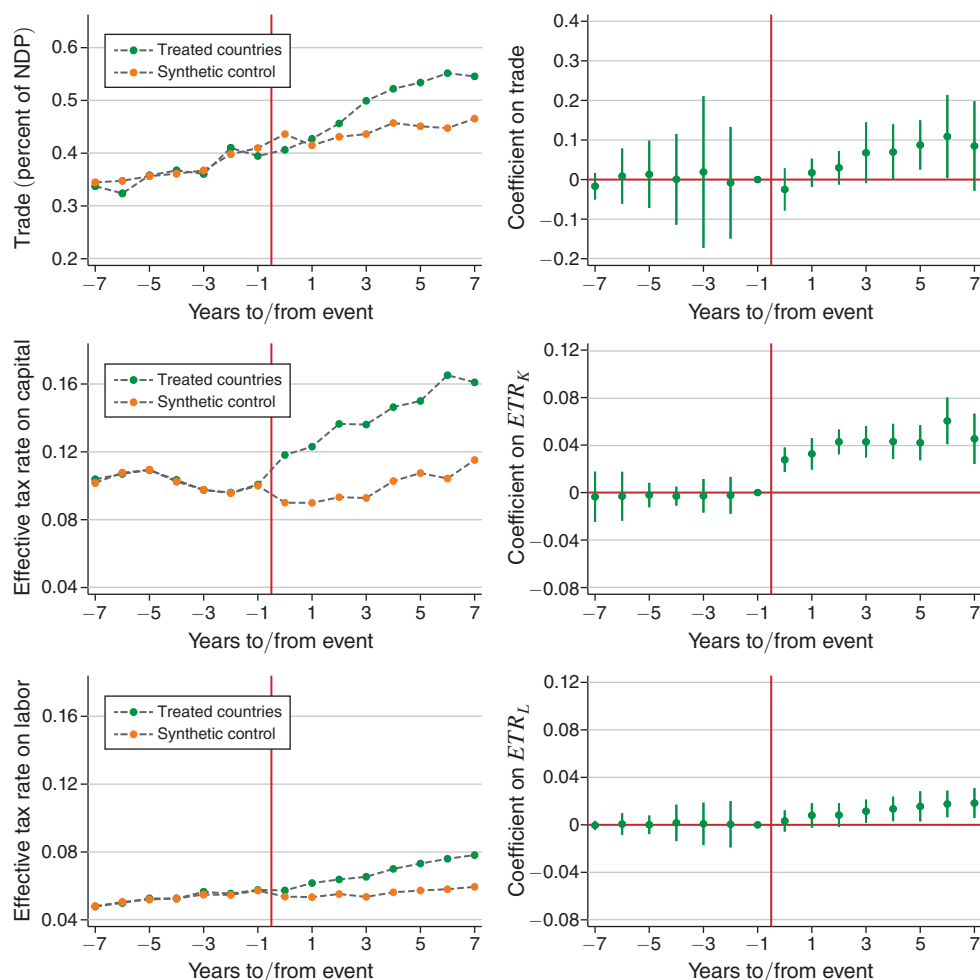


FIGURE 6. EVENT STUDY OF TRADE LIBERALIZATION REFORMS

*Notes:* These figures show event studies for trade liberalization in seven large developing countries: Argentina, Brazil, China, Colombia, India, Mexico, and Vietnam. The panels correspond to different outcomes: trade (top panels), effective tax rate on capital (middle panels), effective tax rate on labor (bottom panels). The left-side graphs show the average level of the outcome in every year to/since the event for the treated group and for the group of synthetic control countries. The right-hand graphs show the  $\beta_e$  coefficients on the to/since dummies, based on estimating the dynamic event-study regression in equation (4). The bars represent the 95 percent confidence intervals. Standard errors are clustered at the country-event level. Details on methodology and estimation in Section IVA.

reforms, but that the medium-run coefficients also reflect the impacts of additional, mainly cross-border reforms.

Our results are based on a (small) sample of liberalization events that satisfied specific criteria. In Supplemental Appendix C.3, we study the robustness to using very different selection criteria for trade liberalization. Specifically, we reestimate the event study using the 68 liberalization events in LMICs from Wacziarg and

Welch (2008). We find very similar impacts of trade on *ETR* using this alternative and expanded set of liberalization events.

We further probe the identification and robustness of our results. First, given the limited number of liberalization events, we investigate whether the average effects are influenced by one particular event. Removing one treated country at a time, we find that the dynamic treatment effects for all subsets of events are similar to the full sample (Supplemental Appendix). Second, Table A1 addresses concerns related to the control group. We find similar results when we remove from the donor pool each liberalizing country's five major export and import trading partners (measured in the immediate pre-event years), alleviating concerns of spillovers to countries in the control group.<sup>35</sup> Results are comparable when the donor pool excludes already liberalized countries (based on Wacziarg and Welch 2008), to guard against the concern that the trends in the synthetic control group reflect the longer-run effects of the treatment (liberalization). To lessen the concern that treated and control countries experience different unobservable shocks, we find similar results when the donor pool for each treated country is restricted to the same region (or to LMICs only).

### B. Regressions with Instrumental Variables for Trade

*Empirical Design.*—Our second design employs instrumental variables for trade. One attractive feature is that the IV provides causal estimates under different identifying assumptions than the event study. We estimate the following model in developing countries:

$$(5) \quad y_{ct} = \mu \cdot trade_{ct} + \Theta \cdot X_{ct} + \pi_c + \pi_t + \epsilon_{ct},$$

where  $y_{ct}$  is the *ETR* (or another outcome) in country  $c$  in year  $t$ ,  $trade_{ct}$  is the share of imports and exports in NDP, and  $\pi_c$  and  $\pi_t$  are country and year fixed effects, respectively.<sup>36</sup> We cluster  $\epsilon_{ct}$  at the country level.  $X_{ct}$  contains confounding determinants of *ETR*: the exchange rate, gross capital formation, log of population, and capital openness (Chinn and Ito 2006; Rodrik 1998). *ETR* time series are sometimes volatile (Figure 4), and we verify the robustness of results to winsorizing *ETR* at the 5–95 percent level by year, separately for LMICs and HICs.

OLS estimation of equation (5) may be biased due to reverse causality and unobservable confounding factors that correlate with trade. To try to address these issues, we use the two instruments for trade from Egger, Nigai, and Strecker (2019). The first instrument, denoted  $Z^{gravity}$ , relies on the structure of general equilibrium models of trade. Under the standard gravity model assumptions, it uses the average bilateral trade frictions between exporting and importing countries as variation (aggregated

<sup>35</sup> We also verify that none of the main countries in the synthetic control (see Supplemental Appendix) had external or domestic reforms in the event-year or in the post-event periods (using the data in Wacziarg and Wallack 2004). Consistent with this, the levels of the outcomes in the synthetic control are relatively stable throughout the event periods. Finally, note that if the spillovers correspond to coordination of policies, this would likely bias our estimation toward finding null effects.

<sup>36</sup> We include fixed effects for imputed and interpolated values (Section IIB) to ensure results are not driven by changes to data quality. Results hold without imputed values and within each data source (Supplemental Appendix Table A3).

to the country-year level). This instrument is valid if the distribution (not the level) of trade costs among individual country-trading pairs is not influenced by *ETRs* in the import or export country. The second instrument, denoted  $Z^{oil-distance}$ , interacts time series variation in global oil prices with a country-specific measure of access to international markets. Access is captured by the variance of distance to the closest maritime port for the three most populated cities. This time-invariant measure captures the internal geography of a country and impacts transportation costs: Following a global shock to oil prices, transportation costs will be higher in countries with less concentrated access to ports, leading to a larger drop in imports and exports. This instrument is valid if the interaction between global oil prices and country-specific measures of spatial concentration is uncorrelated with changes in *ETRs*. Conceptually, both instruments capture variation in trade costs driven by economic forces that are plausibly exogenous to *ETRs* and their determinants (details in the Supplemental Appendix).

In LMICs, the first stage is stronger in the 2000s and at higher income levels for  $Z^{oil}$  and in earlier periods and at lower income levels for  $Z^{gravity}$  (see Supplemental Appendix). Restricting the analysis to subsamples where one of the instruments has a strong first stage introduces bias (Mogstad, Torgovitsky, and Walters 2021). Instead, we combine the two instruments to estimate a local average treatment effect that is representative of LMICs across income levels and time periods. Supplemental Appendix Table A2 shows the first stage.<sup>37</sup>

*Instrumental Variable Results.*—Table 1 presents the results in LMICs for  $ET R_K$  in panel A and  $ET R_L$  in panel B.<sup>38</sup> In column 1, the OLS uncovers positive, significant associations between trade and both *ETRs*. In column 2, we employ the two instruments. The first-stage Kleibergen-Paap  $F$ -statistic is 23.02. The IV shows that trade causes an increase in both effective tax rates, and the coefficient for  $ET R_K$  (0.150) is three times larger than it is for  $ET R_L$  (0.048). These magnitudes are economically meaningful: Moving from the twenty-fifth to the seventy-fifth percentile of trade openness in LMICs would cause an 8.5 percentage point increase in  $ET R_K$ .

The remaining columns of Table 1 present two sets of robustness checks. In the first set (columns 3 to 7), we modify the specification. The most notable difference is that the coefficient on  $ET R_K$  increases (to 0.186,  $p$ -value = 0.101) when we weigh the regression using NDP (column 4), thus putting more weight on the variation in larger developing countries. The results hardly change when we use nonwinsorized *ETRs* (column 3); include controls (column 5); allow oil-rich countries to be on a separate nonparametric time path (column 6), which addresses the concern that the identifying variation for  $Z^{oil-dist}$  is correlated with trends in *ETRs* specific to oil-rich countries (Figure 4); or winsorize trade openness (column 7).

In the second set of robustness checks of Table 1 (columns 8–9), we estimate IVs using each instrument separately. The first-stage  $F$ -statistic is 41.78 for  $Z^{gravity}$  and

<sup>37</sup> Supplemental Appendix Table D1 shows that the instruments impact imports and exports, as well as trade in intermediate goods-services (G-S) and final G-S. Thus, our IV estimates comprehensively reflect the impacts of trade through rises and falls in final and intermediate goods and services that flow both in and out of the country.

<sup>38</sup> Relative to *ETR* coverage, the sample size drops by 4.5 percent due to the data availability of instruments.

TABLE 1—TRADE IMPACTS ON EFFECTIVE TAXATION OF CAPITAL AND LABOR IN DEVELOPING COUNTRIES

|                                    | Benchmark        |                  | Robustness: Specification and covariates |                  |                  |                                             | Robustness: Individual instruments |                      |                       |
|------------------------------------|------------------|------------------|------------------------------------------|------------------|------------------|---------------------------------------------|------------------------------------|----------------------|-----------------------|
|                                    | (1)              | (2)              | (3)                                      | (4)              | (5)              | (6)                                         | (7)                                | (8)                  | (9)                   |
| <i>Panel A. <math>ETR_K</math></i> |                  |                  |                                          |                  |                  |                                             |                                    |                      |                       |
| Trade                              | 0.049<br>(0.014) | 0.150<br>(0.049) | 0.147<br>(0.044)                         | 0.186<br>(0.113) | 0.141<br>(0.055) | 0.136<br>(0.047)                            | 0.159<br>(0.048)                   | 0.147<br>(0.049)     | 0.353<br>(0.122)      |
| <i>Panel B. <math>ETR_L</math></i> |                  |                  |                                          |                  |                  |                                             |                                    |                      |                       |
| Trade                              | 0.009<br>(0.005) | 0.048<br>(0.017) | 0.052<br>(0.017)                         | 0.053<br>(0.040) | 0.038<br>(0.020) | 0.050<br>(0.017)                            | 0.050<br>(0.016)                   | 0.045<br>(0.017)     | 0.229<br>(0.078)      |
| Specification                      | OLS              | IV               | IV                                       | IV               | IV               | IV                                          | IV                                 | IV                   | IV                    |
| First-stage                        |                  | 23.02            | 23.02                                    | 37.85            | 14.14            | 21.74                                       | 34.76                              | 41.78                | 10.78                 |
| Kleibergen-Paap                    |                  |                  |                                          |                  |                  |                                             |                                    |                      |                       |
| $F$ -statistic                     |                  |                  |                                          |                  |                  |                                             |                                    |                      |                       |
| Modifications to                   |                  |                  | $ETR$                                    | NDP              | Include          | Include                                     | Winsorize                          | Only use             | Only use              |
| IV in column 2                     |                  |                  | winsorize                                | weights          | country-year     | $\mathbf{1}(\text{oil-rich}) * \text{year}$ | trade                              | $Z^{\text{gravity}}$ | $Z^{\text{oil-Dist}}$ |
|                                    |                  |                  |                                          |                  | controls         | fixed effects                               |                                    | instrument           | instrument            |
| Observations                       | 4,862            | 4,862            | 4,862                                    | 4,862            | 3,938            | 4,862                                       | 4,862                              | 4,862                | 4,862                 |

Notes: This table presents results from estimating the effect of trade on effective tax rates in developing countries (defined in Section IIC). The outcome is the effective tax rate on capital,  $ETR_K$ , in panel A and the effective tax rate on labor,  $ETR_L$ , in panel B. Trade is measured as the sum of exports and imports divided by net domestic product (NDP). Column 1 presents the OLS results from estimating equation (5). All other columns use IV; at the bottom of each column, we report the first-stage Kleibergen-Paap  $F$ -statistic. The benchmark IV specification is in column 2, with the corresponding first-stage regression reported in Supplemental Appendix Table A2. The remaining columns modify the benchmark specification of column 2. In column 3, the outcome is winsorized, while in column 4 we include country-year NDP weights. In column 5, we include the country-year controls described in Section IVB. In column 6, we include interactive fixed effects between a dummy for oil-rich countries and year dummies. Oil-rich countries derive more than 7 percent of GDP from oil in 2018. In column 7, we use the trade variable, which is winsorized at the 5–95 percent percentile on a yearly basis. In columns 8–9, we estimate the IV using the individual instruments  $Z^{\text{gravity}}$  and  $Z^{\text{oil-distance}}$ , respectively. For more details, see Section IVB. Standard errors in parentheses are clustered at the country level.

10.78 for  $Z^{\text{oil}}$ . The IV estimates are comparable, though larger when based on  $Z^{\text{oil}}$ . Leveraging the opposite sign effects of the two instruments on trade, the reduced-form results (Supplemental Appendix Table A2) suggest that openness effects are symmetric: Increased trade increases both  $ETR_L$  and  $ETR_K$ , while reduced trade decreases both  $ETRs$ .

In another set of robustness checks, we implemented the alternative capital and labor assignments to PIT and mixed income described in Section IIIB. In our benchmark, the capital share of mixed income is time invariant, but we allow that trade may cause factor shares to change. We allowed factor shares to respond to trade by implementing the two methods that create country-year-varying capital shares of mixed income: The results are comparable. They also remain similar when we fix the capital share of PIT at 0 percent or at 30 percent in all countries over time.

Finally, our results are based on an unbalanced panel combining several data sources (Section IIB–IIC). Supplemental Appendix Table A3 shows that the results are qualitatively similar within each data-source for taxes (newly digitized government records, OECD, ICTD) and national accounts (SNA1968, SNA2008), as well as in both quasi-balanced panels (pre- and post-1994) and in a strongly balanced panel (1965–2018).<sup>39</sup>

<sup>39</sup> Variation between coefficients may reflect data quality or first-stage and treatment heterogeneity.

*Quantifying the Role of Trade.*—How much of the  $ETR_K$  rise in LMICs since 1989 can be accounted for by rising trade? Between 1989 and 2018,  $ETR_K$  in LMICs rose by 8.7 percentage points (Section IIIB) and trade openness by 14.6 percentage points. Using the benchmark IV estimate trade's impact (column 2 of Table 1), we calculate that trade openness accounts for 25 percent of the rise in  $ETR_K$  ( $0.150 \times 0.146 / 0.087 = 0.250$ ). Considering all estimates in Table 1 generates a range of 22–31 percent, with the estimate based on  $Z^{\text{oil-distance}}$  an outlier at 59 percent.<sup>40</sup>

### C. Impacts of Trade Openness on Total Tax Revenues

We find positive effects of trade on capital and labor taxation, but how does trade impact *overall* tax revenues, including indirect taxes? This is a relevant question, as trade-induced tax losses from liberalization remain an important concern for policymakers (Hallaert 2010; World Bank 2020). Table 2 presents the OLS and the IV estimation of the effect of trade on total taxes (percent of NDP), in LMICs, and on individual tax revenue streams. Total taxes include direct taxes on capital and labor, as well as indirect taxes (sum of taxes on trade and domestic consumption).<sup>41</sup>

The trade coefficient for total tax collection is positive and significant in both the OLS and the IV. The IV coefficient (0.105) is economically large: Moving from the twenty-fifth to the seventy-fifth percentile of openness in LMICs would cause a 5.7 percentage point increase in total taxes (the unweighted average tax/NDP ratio in LMICs is 17.8 percent). This result is mainly driven by higher CIT, which account for half of the increase in total taxes, and to a lesser extent by social security and PIT.<sup>42</sup> Trade has a positive but statistically insignificant effect on indirect taxes.

Trade's impact on total taxes is robust to using NDP weights, including controls, winsorizing trade, and using each instrument separately (Supplemental Appendix Table A4).

We can also study the impact of the trade liberalization events from Section IVA on total tax revenue. Panel A of Supplemental Appendix Figure A4 shows that the trade events led to an increase in overall tax collection, with a break from the stable pre-trend.

One limitation is that we do not separately study trade's impact on tariff revenues versus domestic consumption taxes, as our data do not contain a systematic breakdown between these two indirect taxes. This reflects our initial focus on direct capital and labor taxes, but additional data work would permit a separation of these indirect taxes.<sup>43</sup>

Both the event study and the IV indicate that trade leads to higher overall taxation in LMICs. This finding relates to the literature on the net impact of openness on tax revenues, which finds mixed results due to differences in sample, empirical

<sup>40</sup> For reasons discussed in Section IVA, we do not use the event-study estimates for this exercise.

<sup>41</sup> Long-run trends in taxation by type and development level are in the Supplemental Appendix.

<sup>42</sup> CIT grew significantly, as a share of NDP, between 1989 and 2018: see Supplemental Appendix Figure A2.

<sup>43</sup> While the sign of openness's impact on tariff revenue could in principle differ depending on whether the reduction in trade costs is initially due to economic forces (as in the IV) or policy changes (as in the event study), we find positive impacts in both cases on domestic capital and labor taxes and on total taxes.

TABLE 2—TRADE IMPACTS ON TYPES OF TAXES (PERCENT OF NDP) IN DEVELOPING COUNTRIES

|                     | Total taxes<br>(1) | CIT<br>(2)       | Property and wealth<br>(3) | PIT<br>(4)       | Social security<br>(5) | Indirect<br>(6)  |
|---------------------|--------------------|------------------|----------------------------|------------------|------------------------|------------------|
| <i>Panel A. OLS</i> |                    |                  |                            |                  |                        |                  |
| Trade               | 0.038<br>(0.011)   | 0.019<br>(0.003) | −0.001<br>(0.001)          | 0.003<br>(0.002) | 0.002<br>(0.002)       | 0.012<br>(0.006) |
| <i>Panel B. IV</i>  |                    |                  |                            |                  |                        |                  |
| Trade               | 0.105<br>(0.034)   | 0.051<br>(0.015) | 0.003<br>(0.003)           | 0.010<br>(0.006) | 0.015<br>(0.007)       | 0.024<br>(0.024) |
| Observations        | 4,862              | 4,862            | 4,862                      | 4,862            | 4,862                  | 4,862            |

*Notes:* This table shows the impacts of trade on collection of types of taxes, expressed as a percent of net domestic product (NDP), in developing countries. OLS results are in panel A, and IV results are in panel B. Developing countries are defined in Section IIC. Trade is measured as the sum of exports and imports divided by NDP. All regressions in panel B are based on the IV model described in Section IVB. The corresponding first-stage regression is reported in Supplemental Appendix Table A2. The outcome differs across columns: Column 1 is total taxes, which is the sum of direct taxes on capital and labor and indirect taxes on trade and domestic consumption; column 2 is corporate income taxes (CIT); column 3 is taxes on property, wealth, and inheritance; column 4 is personal income taxes (PIT); column 5 is social security and payroll; column 6 is indirect taxes, which combine trade taxes and domestic consumption taxes. For more details on these types of taxes, see Supplemental Appendix B.1 and Table B2. For more details on the IV, see Section IVB. Standard errors in parentheses are clustered at the country level.

strategy, and definition of openness (Section II);<sup>44</sup> moreover, some of these studies focus on the net impact of trade on indirect taxes and abstract from direct domestic taxes. We contribute by comprehensively studying the total tax impact of openness, based on implementing several identification strategies in the largest sample of developing countries to date.

## V. Mechanisms

### A. Outlining the Tax Capacity Mechanism

The *tax capacity* mechanism combines two distinct insights from the trade and public finance literature (Section I): First, trade expands activity in corporate structures and larger firms relative to smaller businesses and self-employment; second, effective taxation increases with firm size. To fix ideas, consider the following decomposition of  $ETR^K$ :

$$\begin{aligned}
 (6) \quad ETR^K &= \int_{i \in C} ETR_i^K f(i) di + \int_{i \in NC} ETR_i^K f(i) di \\
 &= \mu_C^K \cdot \overline{ETR}_C^K + (1 - \mu_C^K) \cdot \overline{ETR}_{NC}^K.
 \end{aligned}$$

<sup>44</sup> In an important study in this literature, Baunsgaard and Keen (2005, 23) write in the conclusion, “it is possible that indirect effects operating through higher levels of openness and income consequent upon trade reform have more than offset the direct loss of revenue identified here.”

This decomposition shows that the effective tax rate on capital  $ETR^K$  is composed of two parts.<sup>45</sup> The first part captures capital taxation within the corporate sector. It is the product of the corporate sector's share of capital income,  $\mu_C^K$ , and the average effective tax rate on capital in the corporate sector,  $\overline{ETR}_C^K$ . The latter is computed as the ratio of CIT revenue to corporate profits. In the second part,  $\overline{ETR}_{NC}^K$  measures the effective tax rate on capital in the noncorporate sector; it is multiplied by the noncorporate sector's capital income share,  $1 - \mu_C^K$ .<sup>46</sup>

In LMICs,  $\overline{ETR}_C^K$  is almost 50 percent larger than overall  $ETR^K$  (19.8 percent versus 13.6 percent). This stems from both stronger enforcement and higher statutory tax burdens in the corporate sector.<sup>47</sup> Hence, the expansion of the corporate sector relative to the noncorporate sector (i.e., an increase in  $\mu_C^K$ ) could increase  $ETR^K$ .

The conjecture that trade exerts a tax capacity effect is rooted in the literature on trade and firm size (described in Dix-Carneiro, Goldberg, Meghir, and Ulyssea 2024). First, trade can lead to increased market opportunities that disproportionately benefit large exporters (Melitz 2003). Second, trade can expand the availability of intermediate goods and lower their prices, which could disproportionately benefit initially larger firms (for example, due to fixed costs, as in Kugler and Verhoogen 2009). Through these two channels, trade could expand the corporate sector's share of capital income ( $\mu_C^K$ ) and national income ( $\mu_C$ ), as larger firms are more likely to be incorporated.<sup>48</sup> Moreover, by benefiting initially larger firms or leading to firm size growth within the corporate sector, trade could also increase the average effective corporate tax rate,  $\overline{ETR}_C^K$ . This effect would be driven by a positive firm size- $ETR_i^K$  gradient, where size is measured as firm revenue. The positive gradient arises because compliance and enforcement increase with size.<sup>49</sup> It also arises because the tax code in LMICs often leads to higher statutory tax burdens for larger firms (Kumar and James 2022): Using administrative tax data, Bachas, Brockmeyer, Dom, and Semelet (2025) show a positive association between firms' size and their statutory effective tax rate in 16 LMICs.<sup>50</sup>

Based on the prior literature, we emphasize the size-based mechanism for trade's impact on effective taxation, but there are two additional, enforcement-related mechanisms that are conceptually plausible. First, conditional on size, trade may improve enforcement as the flow of imports through customs creates additional information trails on the firm's activities (Cagé and Gadenne 2018; Emran and Stiglitz 2005). While this prediction is consistent with the third-party literature

<sup>45</sup> In this section, capital taxation is denoted with a  $K$  superscript to accommodate additional notation.

<sup>46</sup>  $\overline{ETR}_{NC}^K$  is measured as the ratio of tax revenue from property and wealth, self-employment, and the PIT assigned to capital, over capital mixed income and the surplus of the household sector. It is thus composed of a mix of variables, which are arguably not as well measured as those from the corporate sector.

<sup>47</sup> The ability to levy higher tax rates is endogenous to enforcement (Bergeron, Tourek, and Weigel 2024). Our notion of tax capacity is that these codetermined forces jointly contribute to effective taxation.

<sup>48</sup> Equation (6) refers to  $\mu_C^K$ , but we will analyze trade's impact on the corporate share in overall income,  $\mu_C$ .

<sup>49</sup> See Section I. For example, Best, Shah, and Waseem (2021) show a negative size-evasion gradient using random audits on Pakistani firms; further size is the best predictor of evasion. Models of tax compliance micro-found the negative size-evasion gradient (including Kleven et al. 2016; Kopczuk and Slemrod 2006).

<sup>50</sup> The gradient is positive everywhere except at the very top of the size distribution, where it becomes negative. The gradient is driven by tax incentives and reduced tax rates for smaller firms.

(Kleven et al. 2016), the (limited) empirical evidence is mixed.<sup>51</sup> Notwithstanding, as it is challenging to perfectly untangle trade's impacts on taxation through size versus through information trails, the latter mechanism may also be reflected in our results. Second, (exogenous) increases in trade openness may prompt tax authorities to invest in enforcement tools; we investigate this in Section VD.

### B. Results on Mechanisms: Tax Capacity and Race to the Bottom

We investigate mechanisms relating trade to  $ETR$ , focusing on the tax capacity and “race to the bottom” channels. In the race to bottom, international tax competition leads governments to reduce statutory corporate tax rates, which would reduce  $\overline{ETR}_C^K$  (Section I). We study both mechanisms in LMICs with the empirical strategies of Section IV.

Table 3 shows the OLS (panel A) and the IV (panel B) from equation (5). Consistent with race to the bottom, column 1 shows that trade causes a significant decrease in the statutory CIT rate.<sup>52</sup> The CIT rate is an imperfect proxy of firms' tax incentives as it ignores the tax base (Abbas and Klemm 2013), but it can be measured in our full sample.

In line with the tax capacity mechanism, trade raises the corporate share of domestic output ( $\mu_C$ ) and reduces mixed income by an equivalent magnitude.<sup>53</sup> This is consistent with the conjecture that trade disproportionately benefits larger firms, which are more likely to be incorporated. Trade also raises  $\overline{ETR}_C^K$  (column 6), consistent with the trade-induced corporate output accruing to firms whose  $ETR^K$ -size gradient is positive.

How is the additional income of the corporate sector allocated between capital and labor? Columns 4–5 show that the corporate sector rise is entirely driven by higher corporate profits, while the change in employee compensation growth is small and statistically insignificant.<sup>54</sup> This in turn causes trade to expand the capital share, both of national income and of the corporate sector (columns 7–8).<sup>55</sup>

<sup>51</sup> In Costa Rica, Alfaro-Ureña, Manelici, and Vasquez (2022) find that becoming a domestic supplier to multinational corporations does not impact third-party reporting quality. In Uganda, Almunia, Hjort, Knebelmann, and Tian (2023) find that reports of the same transaction from the buyer and seller are more consistent when one report is from customs (versus when both reports are from the domestic VAT); at the same time, there are discrepancies in the amount reported for 48 percent of reports that compare an import transaction report at customs versus the *same firm's* report of the *same transaction* in its domestic VAT records.

<sup>52</sup> The outcome is the first-differenced tax rate (Romer and Romer 2010). Supplemental Appendix Table A4 shows results with an alternative CIT specification. We combine data from Vegh and Vuletin (2015); Egger, Nigai, and Strecker (2019); the Tax Foundation (<https://taxfoundation.org/data/all/global/corporate-tax-rates-by-country-2022/>); and country-specific sources. A next step could be to study trade's impact on the more detailed statutory measures (Section I). The downward trend in CIT rates in LMICs (Supplemental Appendix) is related to, but does not fully capture, changes over time in the detailed statutory measures.

<sup>53</sup> The quality of data sources used by national statistics offices can affect the measurement of mixed income in LMICs, but we find no impact of trade on countries' statistical capacity (World Bank, <https://datacatalog.worldbank.org/search/dataset/0037854/data-on-statistical-capacity>).

<sup>54</sup> There is also a null effect of trade on households' operating surplus  $OS_{HH}$  (result not shown).

<sup>55</sup> This could occur due to an increase in markups. De Loecker and Eeckhout (2021) find that markups have risen in most regions over the past 40 years. De Loecker, Goldberg, Khandelwal, and Pavcnik (2016) and Goldberg (2023) study the impact of trade on markups. Gupta (2023) and Atkin et al. (2015) find that markups increase with firm size in India and Pakistan, respectively. The rise in corporate profits and limited change in employee compensation may also arise if trade raises firms' labor market power (Felix 2022). Finally, it may arise if trade benefits more capital-intensive production in developing countries, including through a reduction in CIT rates (Kaymak and Schott 2023).

TABLE 3—TRADE IMPACTS ON MECHANISM OUTCOMES IN DEVELOPING COUNTRIES

|                     | First-diff.<br>CIT rate<br>(1) | National income components          |                                     |                             |                                 | Corporate<br>$ETR_K$<br>(6) | Factor shares                           |                                         |
|---------------------|--------------------------------|-------------------------------------|-------------------------------------|-----------------------------|---------------------------------|-----------------------------|-----------------------------------------|-----------------------------------------|
|                     |                                | Corporate<br>total<br>income<br>(2) | Household<br>mixed<br>income<br>(3) | Corporate<br>profits<br>(4) | Employee<br>compensation<br>(5) |                             | Capital<br>share nat'l<br>income<br>(7) | Capital<br>share corp.<br>sector<br>(8) |
| <i>Panel A. OLS</i> |                                |                                     |                                     |                             |                                 |                             |                                         |                                         |
| Trade               | −0.003<br>(0.001)              | 0.037<br>(0.014)                    | −0.013<br>(0.011)                   | 0.026<br>(0.009)            | 0.006<br>(0.011)                | 0.076<br>(0.020)            | 0.019<br>(0.008)                        | 0.029<br>(0.013)                        |
| <i>Panel B. IV</i>  |                                |                                     |                                     |                             |                                 |                             |                                         |                                         |
| Trade               | −0.014<br>(0.007)              | 0.176<br>(0.046)                    | −0.179<br>(0.042)                   | 0.177<br>(0.037)            | −0.012<br>(0.038)               | 0.168<br>(0.078)            | 0.148<br>(0.035)                        | 0.190<br>(0.052)                        |
| Observations        | 4,862                          | 4,862                               | 4,862                               | 4,862                       | 4,862                           | 4,862                       | 4,862                                   | 4,862                                   |

*Notes:* This table presents results from estimating the effects of trade on mechanism outcomes in developing countries. Developing countries are defined in Section IIC. Trade is measured as the sum of exports and imports divided by net domestic product (NDP). Panel A presents OLS results, and panel B presents the IV results, based on the instruments described in Section IVB. The corresponding first-stage regression is reported in Supplemental Appendix Table A2. Across the columns, the outcome differs: Column 1 is the first-differenced statutory corporate income tax (CIT) rate; column 2 is the corporate income share of NDP, where corporate income is the sum of corporate profits and corporate employee compensation; column 3 is the mixed income share of NDP; column 4 is the corporate profit share of NDP; column 5 is the employee compensation share of NDP; column 6 is the average effective tax rate on corporate profits; column 7 is the capital share of NDP; column 8 is the capital share of corporate income. For sake of space, we omit showing the insignificant impact of trade on  $OS_{HH}$ , the remaining component of national income. For more details on the outcomes, see Section IIA and Section VB. For more details on the instrumental variables, see Section IVB. Standard errors in parentheses are clustered at the country level.

The mechanism IV results are robust to several checks (Supplemental Appendix Table A4): using NDP weights; including controls; winsorizing the trade variable; and estimating IVs separately based on each instrument. The CIT rate result remains less robust than the tax capacity results.

Supplemental Appendix Figure A4 studies the same mechanism outcomes, but using the event-study design (Section IVA). The trade liberalization events led to a decrease in the CIT rate and raised both corporate income ( $\mu_C$ ) and the effective corporate tax rate ( $\overline{ETR}_C^K$ ). The individual event-time coefficients are more precisely estimated for  $\overline{ETR}_C^K$  than for  $\mu_C$ . Although they are based on different identifying variation in trade, the event-study and IV results are therefore both consistent with the existence of the tax-capacity and race-to-the-bottom mechanisms in developing countries.

*Discussion: Link to Trade and Public Finance Literatures on Firm Size.*—This subsection has provided empirical results that are consistent with the tax capacity hypothesis that trade’s impact on  $ETR_K$  is mediated by its impact on firm size. An alternative way to gauge the plausibility of the hypothesis is to ask whether the estimated impact of trade on  $ETR_K$  in our setting is consistent with estimates from the literature on trade’s impact on firm size and on the size-compliance gradient. Details of this exercise are in Supplemental Appendix D. We use estimates from recent structural trade models (with a focus on Dix-Carneiro, Goldberg, Meghir, and Ulyssea 2024) which provide counterfactual simulations that quantify the magnitude

of trade openness's impacts on the formal, corporate share and on average firm size inside the corporate sector. We combine these estimates with firm-level results from public finance (with a focus on Bachas, Fattal Jaef, and Jensen 2019) that estimate the impact of firm size on the effective tax rate. This exercise reveals that when based on prior work from public finance and international trade, the size-based tax capacity mechanism can account for approximately 75 percent of our estimated impact of trade on  $ETR_K$  (based on the IV coefficient in column 2 of Table 1).

### *C. Firm-Level Investigation of Tax Capacity Mechanism in Rwanda*

The tax capacity mechanism is based on a firm level channel, combining a positive impact of trade on firm size with a positive firm size– $ETR^K$  gradient. While the macro-results on  $\mu_C$  and  $\overline{ETR}_C^K$  in the previous subsection are consistent with it, in this subsection we directly investigate the tax capacity mechanism at the firm level.

*Setting.*—We conduct the analysis in Rwanda between 2015 and 2017, where we leverage multiple administrative datasets to observe formal Rwandan firms' exposure to trade and domestic tax payments. To our knowledge, there is limited firm-level evidence in LMICs on how trade impacts firms' domestic effective tax rates. Rwanda presents an interesting setting: Its corporate sector, starting from a low output share, has grown significantly since the 1990s, in tandem with a rise in trade openness and tax revenues.

*Data and Measurement.*—We use CIT returns to measure each firm's effective tax rate  $ETR_i^K$ , as the ratio of corporate taxes paid divided by reported net profit. Net profit is revenue minus material, labor, operational, depreciation, and financial costs. In Rwanda, the firm-level  $ETR_i^K$  varies due to firm characteristics (including revenue, our proxy for size), reduced rates, and exemptions. The  $ETR_i^K$  can vary due to avoidance, since the denominator is based on tax returns, but will not capture outright evasion. For this reason, we emphasize that  $\overline{ETR}_C^K$  measured in national accounts (Section II to Section VB) differs from the corporate  $ETR_i^K$  measured in tax returns in this subsection.<sup>56</sup> The corporate  $ETR_i^K$  in Rwanda is positively associated with size (revenue), apart from in the top percentile (Bachas, Brockmeyer, Dom, and Semelet 2025).

We merge the CIT returns with customs data to record firms' direct exposure to trade. Following recent work (reviewed in Atkin and Khandelwal 2020), we measure a firm's total exposure to trade by accounting for the firm's direct and indirect exposure via its linkages to domestic suppliers using imported goods in their production. We merge administrative data that record transaction linkages between formal firms (details in Supplemental Appendix D.2). To measure a firm's total trade exposure in a network setting, we follow the methodology in Dhyne, Kikkawa, Mogstad, and Tintelnot (2021). We define firm  $i$ 's total foreign input share as the share of inputs

<sup>56</sup>They also differ because of conceptual differences in the measurement of profits; see the Supplemental Appendix for a detailed discussion.

that it directly imports ( $s_{Fi}$ ), plus the share of inputs that it buys from its domestic suppliers  $l$  ( $s_{li}$ ), multiplied by the total import shares of those firms:

$$(7) \quad s_i^{Total} = s_{Fi} + \sum_{l \in V_i} s_{li} \cdot \left[ s_{Fl} + \sum_{r \in V_l} s_{rl} \cdot (s_{Fr} + \dots) \right],$$

where  $V_i$  is the set of domestic suppliers of firm  $i$  and  $V_l$  the set of domestic suppliers of firm  $l$ . The denominator of the input shares is the sum of imports and purchases from other firms. We limit the recursive calculation in (7) to inputs from a firm's immediate suppliers  $l$  and the suppliers to their suppliers  $r$  (adding more levels only marginally raises  $s_i^{Total}$ ). Inspecting  $s_i^{Total}$  and  $s_{Fi}$  reveals that while just under 30 percent of Rwandan formal firms import directly, 93 percent rely on imported inputs directly or indirectly. Most firms are thus dependent on foreign trade, but only a few are dependent via direct imports. The median total foreign input share is 48 percent.

*Estimation.*—We estimate regressions for corporate firms of the form

$$(8) \quad ETR_{it}^K = \mu \cdot s_{it}^{Total} + \pi_t + \pi_i + \epsilon_{it},$$

where  $ETR_{it}^K$  and  $s_{it}^{Total}$  are the corporate effective tax rate and total trade exposure of firm  $i$  in year  $t$ , and  $\pi_t$  and  $\pi_i$  are year and firm fixed effects.  $\epsilon_{it}$  is clustered at the firm level. We winsorize all variables at the 1–95 percent level, separately by year.

Since we are interested in trade's impacts on both  $ETR_{it}^K$  and revenue, and both variables feature zeros in administrative data, we estimate the regression using Poisson pseudo-maximum likelihood (PPML).<sup>57</sup> Many firms in developing countries are registered for taxes but are “nil filers” that report zero activity in administrative returns (Kanbur and Keen 2014). By using PPML, we can estimate  $\mu$  in a sample containing all data points and thus capture both the extensive and intensive margins of response; moreover, as the estimates are semi-elasticities, no transformation or scaling is needed for interpretation and comparison across outcomes (Chen and Roth 2024).

We implement an instrumental variable strategy to generate firm-level variation in trade exposure using the shift-share design from Hummels, Jørgensen, Munch, and Xiang (2014). The identifying variation is trade shocks from changes in the world export supply of specific country-product combinations in which a Rwandan firm had a previous import relationship. Specifically, the direct import trade shock for firm  $i$  in year  $t$  is

$$(9) \quad \log M_{it}^D = \log \sum_{a,c} s_{ic,t-1}^{a,M} \cdot WES_{a,c,t},$$

where  $s_{ic,t-1}^{a,M}$  is the share of imports of firm  $i$  in year  $t - 1$  that falls on product  $a$  from country  $c$ , and  $WES_{a,c,t}$  is the world export supply (excluding sales to Rwanda)

<sup>57</sup> We add 1 to the denominator in  $ETR_{it}^K$ , in order to not implicitly condition the sample on firms with strictly nonzero reported profits.

of country  $c$  for product  $a$ . Product  $a$  is measured at the detailed six-digit HS level. Rwandan firms import over 3,510 distinct products from 174 different countries of origin.

The shocks to Rwandan firms' trading environment are time varying and specific to each partner-country  $\times$  product being traded. They capture transportation costs and worldwide shocks to export supply for the relevant country  $\times$  product, and contain granular variation across products and countries. The identification strategy rests on the joint hypotheses that the shocks are exogenous to Rwandan firms' trading environment and that they are heterogeneous across Rwandan firms because they have few imports in common: If only one Rwandan firm imports metal-cored wires from Turkey, then an idiosyncratic shock to Turkey's export supply of those wires will affect (directly) just one firm. Note also that to construct the trade shocks, we rely on prior information about importers' sourcing patterns, which removes concerns over contemporaneous shocks affecting both the choice of imported goods and firm outcomes.

We build the trade shocks for all firms. In turn, the first-stage instruments are the firm's own trade shocks, as well as the trade shocks to its suppliers and to the suppliers of its suppliers. Specifically, the first-stage regression is

$$(10) \quad s_{it}^{Total} = \beta_1 \cdot \log M_{it}^D + \beta_2 \cdot \log M_{it}^S + \beta_3 \cdot \log M_{it}^{SS} + \kappa_t + \kappa_i + \epsilon_{it},$$

where  $\log M_{it}^D$ ,  $\log M_{it}^S$ , and  $\log M_{it}^{SS}$  are the trade shocks to firm  $i$ , to firm  $i$ 's suppliers, and to the suppliers of firm  $i$ 's suppliers. We construct weighted averages of trade shocks in the supplier network using the recursive formulation in (7).

*Results.*—Column 1 of Table 4 shows that trade, instrumented with trade shocks to the supplier network, causes an increase in a firm's effective capital tax rate.<sup>58</sup> Column 2 augments the regression by controlling for year-by-industry and year-by-geography fixed effects and the firm's time-varying number of suppliers and clients. The results are similar, which supports the exclusion restriction. Columns 3 and 4 of Table 4 show that trade (instrumented) also causes an increase in the firm's size, with or without extra controls. Finally, columns 5–6 reveal a positive association between firm size and  $ETR_i^K$ , within firm over time, though we cannot use the instruments in this regression due to the exclusion restriction.

Although the analysis in Rwanda is based in a single country and over a limited time range, it supplements the macro-results in two ways. First, it provides firm-level identified evidence that trade exerts a positive impact on effective corporate taxation in a developing country. Second, by showing that trade increases firm size and that size is positively associated with  $ETR^K$ , it supports the tax capacity mechanism interpretation that trade's impact on  $ETR^K$  is mediated by a positive size- $ETR^K$  gradient.

<sup>58</sup> As PPML is not compatible with IV, we estimate 2SLS and report bootstrapped standard errors.

TABLE 4—FIRM-LEVEL REGRESSIONS IN RWANDA:  $ETR^K$ , TRADE, AND SIZE

| Outcome:                    | $ETR^K$          |                  | Revenue          |                  | $ETR^K$          |                  |
|-----------------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|                             | (1)              | (2)              | (3)              | (4)              | (5)              | (6)              |
| $S^{Total}$                 | 1.501<br>(0.485) | 1.490<br>(0.474) | 1.713<br>(0.312) | 1.775<br>(0.294) |                  |                  |
| Revenue                     |                  |                  |                  |                  | 0.343<br>(0.086) | 0.339<br>(0.086) |
| Bootstrapped SE             | [0.677]          | [0.672]          | [0.448]          | [0.407]          |                  |                  |
| First-stage $F$ -statistic  | 129.34           | 143.37           | 129.34           | 143.37           |                  |                  |
| Firm FEs                    | X                | X                | X                | X                | X                | X                |
| Year FEs                    | X                |                  | X                |                  | X                |                  |
| Year $\times$ industry FEs  |                  | X                |                  | X                |                  | X                |
| Year $\times$ geography FEs |                  | X                |                  | X                |                  | X                |
| Firm controls               |                  | X                |                  | X                |                  | X                |
| Observations                | 19,270           | 19,270           | 19,270           | 19,270           | 19,270           | 19,270           |

*Notes:* This table presents firm-level regression results from corporate firms in Rwanda between 2015 and 2017. The outcome differs across columns: In columns 1–2 and 5–6, it is the effective tax rate on corporate profits,  $ETR_t^K$ ; in columns 3–4, it is annual revenue. All regressions are estimated based on the PPML estimator, with standard errors clustered at the firm level and reported in parentheses. All variables are winsorized at the first and ninety-ninth percentiles, separately by year. In columns 1 to 4, the total foreign input share ( $S^{Total}$ ) is instrumented with trade shocks to firms and their supplier network based on the shift-share design of Hummels, Jørgensen, Munch, and Xiang (2014). These regressions are estimated as two-stage least squares, with bootstrapped standard errors reported in brackets. The first-stage  $F$ -statistic is reported in the middle part of the table. In columns 5–6,  $ETR_t^K$  is directly regressed on revenue. All columns include firm fixed effects. Given the estimation method, to maintain ease of comparability across columns, we standardize revenue in columns 5–6. Odd-numbered columns include year fixed effects, while even-numbered columns include year  $\times$  industry fixed effects (20 industry categories), year  $\times$  geography fixed effects (5 provinces), and firm-year controls (the firm's total number of suppliers and clients).

*Discussion: Links to Trade-Formality Literature.*—At the firm, sector, and country levels, we find positive effects of trade on outcomes related to formalization. Recent studies focused on the number of formal versus informal firms or formal versus informal workers, and found mixed evidence that trade increases formality by these measures (reviews in Engel and Kokas 2021; Ulyssea 2020).<sup>59</sup> One way to reconcile our results with these studies is to note that our focus is on the share of output produced in larger and formal firms: Output expansion in these firms may occur without changes to the number of formal or informal firms and does not imply an increase in the number of formal workers, since informal workers may work in formal firms and contribute to their output (Ulyssea 2018). In Section VD, we also show that openness' impact on our formal-outcomes depends on the nature of the trade shock, consistent with recent theoretical work in trade (Dix-Carneiro, Goldberg, Meghir, and Ulyssea 2024).

<sup>59</sup> See Goldberg and Pavcnik (2003); Bosch, Goñi-Pacchioni, and Maloney (2012); Cruces, Porto, and Violaz (2018); Dix-Carneiro and Kovak (2019).

#### D. Sources of Heterogeneity in Trade's Pro-tax Impacts

We return to the country-level IV (equation (5)) to study sources of heterogeneity in trade's pro-tax impacts on the tax capacity mechanism and  $ETR$ .

*Heterogeneity: Domestic Enforcement Reforms.*—Over our sample period, LMICs have implemented tax enforcement policies. A challenge for the mechanism interpretation is that trade, potentially due to revenue concerns, may have prompted governments to implement these policies that increase  $ETR^K$ . To investigate this, we measure the year of adoption (if any) in LMICs of four policies that increase domestic tax enforcement: (i) large taxpayer unit, (ii) organizational integration of customs and domestic tax authorities, (iii) VAT, and (iv) international accounting standards (IAS).<sup>60</sup> We estimate heterogeneous IV effects by including an interaction term between trade and the policy adoption variable in (5).<sup>61</sup> Supplemental Appendix Table A5 shows a positive effect of trade on  $ETR^K$  without these policies, though the effect is larger following their adoption. Trade has a similar impact on the corporate income share ( $\mu_C$ ) with and without the enforcement policies, but trade's positive impact on  $\overline{ETR}_C^K$  is significantly amplified when enforcement policies are in place. That is, the trade-induced expansion of the corporate sector seems to occur regardless of enforcement policies, but the extent to which the additional corporate output translates into higher effective corporate taxation is reinforced when such policies have been enacted.<sup>62</sup>

Governments in LMICs may have sought to raise domestic revenue, possibly in response to openness, through other channels apart from these specific enforcement policies. We investigate this in Supplemental Appendix Table A6, finding that trade's positive impact on the tax capacity mechanism and  $ETR^K$  holds outside of periods of significant revenue loss when defined in various ways, including the episodes of trade revenue loss in Cagé and Gadenne (2018). Thus, trade's pro-tax impacts appear to be broadly present in the globalization process in LMICs and do not hinge on government's revenue need or enforcement investments.

*Heterogeneity: Nature of Trade Shock.*—Trade theories highlight that the impacts of trade on formality-related outcomes depend on the nature of the trade shock. In Supplemental Appendix D.3, we use both instruments and equation (5) in LMICs to investigate whether the  $ETR$  and mechanism impacts differ along two dimensions (Dix-Carneiro et al. 2024): imports versus exports and trade in intermediate versus final goods and services (G-S). We find that *exports* increase  $ETR^K$  and the corporate income share ( $\mu_C$ ), while *imports* decrease both outcomes. These results

<sup>60</sup>The enforcement focus on large firms increases collection (Almunia and Lopez-Rodriguez 2018; Basri, Felix, Hanna, and Olken 2021). The customs-tax unification improves domestic audit capacity (Pérez Azcárraga 2022). The VAT creates information trails (Almunia et al. 2023; Waseem 2020). IAS deepen accounting requirements for tax reporting (Barth, Landman, and Lang 2008).

<sup>61</sup>The timing of adoption for each reform is endogenous; however, our focus is on the trade coefficients with and without these reforms in place, which are identified (Bun and Harrison 2019).

<sup>62</sup>Intuitively, the enforcement policies all disproportionately raise enforcement on larger firms, thereby further increasing the slope of the  $ETR^K$ -size gradient inside the corporate sector. Whether these enforcement policies are themselves driven by globalization is a topic for future research.

are consistent with “Melitz-type” demand effects, whereby increased exports represent a “pure” positive demand shock for export-oriented firms, while increased imports may constitute a negative demand shock for domestic firms, disproportionately affecting larger ones. In additional IV regressions, trade in *intermediate G-S* increases  $ETR^K$  and  $\mu_C$ , while trade in *final G-S* decreases both outcomes.<sup>63</sup> Results are similar for  $\overline{ETR}_C^K$ . These results are consistent with the increased availability of intermediate goods benefiting larger firms; by contrast, the increased availability of final goods may constitute a negative domestic demand shock, particularly for larger firms. These results suggest that trade’s pro-tax impacts depend on the nature of the trade shock.

*Heterogeneity: Developing versus Developed Countries.*—We investigate whether trade’s impacts on mechanisms and  $ETR$  differ across development levels by expanding our sample to include HICs. We expect that the tax capacity mechanism is less likely to operate in HICs, where enforcement constraints on effective taxation are less binding and the corporate sector’s size has been stable since the 1970s (Figure 1). On the other hand, the race to the bottom is likely to be active in HICs, given previous research (Section I). Supplemental Appendix Table A7 reports heterogeneous IV effects by augmenting (5) with an interaction between trade and a dummy for high-income countries.<sup>64</sup> Trade only raises  $ETR^K$  in LMICs but raises  $ETR^L$  everywhere. The negative race-to-the-bottom effect on the CIT rate is much stronger in HICs than in LMICs. The positive impact of trade on tax capacity outcomes ( $\mu_C$ ,  $\overline{ETR}_C^K$ ) is limited to LMICs.<sup>65</sup> These results suggest countervailing mechanisms that differ by development level, through which trade may have contributed to the asymmetric trends in  $ETR^K$  between HICs and LMICs documented in Figure 2.

We study additional country characteristics in the Supplemental Appendix. We find that trade’s negative impact on the CIT rate is larger in countries that are smaller and have fewer capital restrictions—two settings where capital flight concerns are more pronounced (Hines 2006). Mirroring this result, trade’s positive impact on  $ETR^K$  occurs in larger countries and with more capital restrictions. The tax capacity and race-to-the-bottom mechanisms therefore appear to occur simultaneously: Countries with larger markets and lower capital mobility reap more of the tax-capacity benefits of trade.

*Extension: Capital Openness.*—We have focused on trade openness, but another relevant dimension of globalization is capital openness (Ilizetzi, Reinhart, and Rogoff 2019; Van Patten 2022). Due to differences in reporting requirements, data on capital openness are not as available and comparable as trade data, and finding credible exogenous variation for capital openness is challenging. Notwithstanding, we try to investigate the impacts of capital openness in Supplemental Appendix E.

<sup>63</sup> Which suggests that imports of intermediate (final) G-S increases (decreases)  $ETR_K$  and  $\mu_C$ .

<sup>64</sup> We note these results should be interpreted with caution, given the econometric challenges of estimating IV effects with multiple endogenous regressors (Andrews, Stock, and Sun 2019).

<sup>65</sup> The IV coefficients for developing countries differ qualitatively between Supplemental Appendix Table A7 and Tables 1–3. This is because the two instruments’ strength changes in the first-stage regression (Supplemental Appendix Table A2).

We rely on the capital inflow liberalization events for 25 developing countries from Chari, Henry, and Sasson (2012), which capture the first time that foreign investment in the domestic stock market is allowed. Employing the event-study design of Section IVA, we find that capital liberalization events raise capital openness and positively impact  $ETR^K$  and the tax capacity mechanism ( $\mu_C$ ,  $\overline{ETR}_C^K$ ). The pro-tax impacts of globalization in LMICs may be robust to using capital instead of trade openness.

## VI. Conclusion

This paper provides evidence on long-run trends in capital taxation and the causal effects of globalization on tax structures. Based on a new macrohistorical database, we document that effective capital tax rates increased in developing countries in the post-1990 era of hyperglobalization. By expanding the share of economic activity in incorporated and larger firms, trade improves the effective collection of taxes, particularly on corporate income. We provide evidence on this tax capacity effect across multiple research designs and at the country, corporate sector, and firm levels. Despite a simultaneous negative effect on corporate statutory tax rates induced by international tax competition, the positive tax capacity effect is sufficiently large that trade raises the effective tax rate on capital as well as overall government revenues (percent of GDP) in developing countries.

Due to limited data, the revenue consequences of globalization in developing countries had not been systematically investigated and policy concerns over revenue losses have persisted in a context of uncertainty surrounding the future of globalization (Goldberg and Reed 2023). We find that globalization has pro-tax impacts that have supported the effective taxation of capital and overall revenue collection in many countries.

If cross-border integration were to further deepen, should we expect a further rise of effective capital taxation in developing countries? It is possible that a large share of trade's pro-tax impacts have already accrued in these countries. Indeed, mixed income as a share of GDP has shrunk considerably at the expense of the corporate sector, such that the gap to developed countries is now moderate (Figure 1). Of course, this aggregate trend may mask substantial heterogeneity, and specific countries' tax revenue could still benefit from further openness. We also note that the evolution of  $ETR^K$  in HICs versus LMICs can be interpreted as a convergence result: In a globalized world, the effective taxation of capital has risen in places where it started from lower levels, and vice versa.

Our results show that openness increased the share of market income going to corporations, profits, and capital. Simultaneously, trade's pro-tax impacts mean that developing countries raised more taxes from capital. As a result, openness is likely to have widened pretax income inequality, but its effect on posttax income inequality is more nuanced. We adopted a macro focus, but a next step could be to combine the  $ETRs$  with individual-level estimates of the progressivity of capital (and labor) taxes. This would allow a comparison of the distributional effects of globalization on pre- versus posttax income, raising empirical questions for future research (Goldberg 2023; Pavcnik 2017).

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