Taxing for Growth: Revisiting the 15 Percent Threshold

July 10, 2024

Rishabh Choudhary, Franz U Ruch, and Emilia Skrok[1]

Abstract: Tax revenue collection is essential to the state's ability to address market failures, provide goods and services such as health and education, invest in infrastructure, stabilize the economy in response to shocks, and maintain sustainable debt dynamics. Using a regression discontinuity design, we demonstrate that there is a tax threshold around 15 percent of GDP where future inclusive growth significantly improves. This may be due to increased productive spending, more progressive taxes, and lower output volatility. We also show that low-income countries graduate to middle-income status around the same threshold.

Keywords: Tax threshold; inclusive growth; health and education.

JEL codes: H21; O11.

[1] Rishabh Choudhary: Fiscal Policy and Sustainable Growth, World Bank. Email: rchoudhary@worldbank.org
Franz U Ruch: Fiscal Policy and Sustainable Growth, World Bank. Email: fruch@worldbank.org
Emilia Skrok: Fiscal Policy and Sustainable Growth, World Bank. Email: eskrok@worldbank.org

This paper was funded by the KDI School of Public Policy and Management. We benefitted from valuable comments and suggestions from Aart Kraay, Suhyun Lee, Mario Mansour, Silver Namunane, and Dario Tortarolo. The findings, interpretations and conclusions expressed in this paper are entirely those of the authors and should not be attributed to the World Bank, its Executive Directors, or the countries they represent.

1. Introduction

How much countries collect in taxes relative to the size of their economies varies widely. This variation, measured by the tax-to-GDP ratio, suggests that some countries might have maximized their tax potential, while others have not. While the median tax revenue is around 22 percent of GDP, many middle- and low-income economies have very low levels of tax revenue. This prompts a critical question: Is falling below this median indicative of suboptimal tax collection, or does exceeding it suggest an excessive tax burden? This paper delves into the experience of countries at the lower end of the spectrum, assessing whether raising tax revenues to meet development needs also has the potential to raise inclusive growth.

Insufficient tax revenue hampers economic growth by limiting infrastructure investment, underfunding public services, increasing income inequality, and causing an overreliance on debt. Investments in infrastructure, such as roads, schools, and hospitals, are essential for productivity and growth (Bom and Ligthart, 2014). Equally important are investments in human capital, yet low tax collection can lead to insufficient funding for education and healthcare. The shortfall in tax revenue can exacerbate income inequality (Ostry, Berg, and Tsangarides, 2014). Progressive taxation and adequate social spending, which are contingent upon sufficient tax revenue collection, play a critical role in reducing inequality and promoting inclusive economic growth. Countries with inadequate tax revenue also tend to over-rely on foreign aid and external debt to cover public expenditures (Gupta et al., 2004). The reliance on debt becomes particularly problematic during economic downturns, as reduced tax revenues may compel governments to borrow more, thus escalating public debt (Baum and Koester, 2011).

Enhanced tax revenue is vital for developing economies to support public sector growth and crisis response while maintaining fiscal sustainability. As countries develop, the public sector's size and role typically expand, reflecting a relationship between development levels and spending. This is closely tied to Wagner's Law, which highlights the natural tendency for government spending to increase as a country develops. For developing countries, navigating this trend requires a careful balance between meeting growing public demands and maintaining fiscal sustainability by focusing on increasing tax collection, diversifying revenue sources, and spending efficiently. Thus, insufficient tax collection can severely limit a country's development potential. Recent global crises, such as the COVID-19 pandemic and Russia's invasion of Ukraine, alongside pressing climate change challenges, have increased the need for public investment in health care, social protection, climate action, and infrastructure to foster economic and climate resilience, thus demanding higher revenue streams. Moreover, the elevated public debt from the crises underscores the need for additional revenue to manage debt sustainably. Inclusive growth, which aims to boost GDP, create jobs, reduce inequality, and provide equitable access to opportunities and services, may necessitate an even higher threshold of tax revenue than non-inclusive growth to achieve sustainable development.

This paper assesses the sufficiency of tax collection in countries with low tax revenues and explores the potential for development gains via enhanced tax efforts. Specifically, we answer the following questions:

- Is there a specific threshold of tax revenue that enables stronger and more inclusive economic growth?

- What are the channels through which higher tax revenue impact economic growth?
- What happens to countries tax collection as they move up income status?

The paper contributes to the existing literature by studying the impact of tax revenue on inclusive growth and development, as well as the channels for revenue-driven prosperity using a comprehensive model and updated data. First, this paper enriches the literature on the interplay between taxation and economic growth (Acosta-Ormaechea, Sola, and Yoo 2019; Jaimovich and Rebelo 2017; and Lee and Gordon 2005). It specifically builds upon the research of Gaspar, Jaramillo, and Wingender (2016) by further examining the critical tipping point in the relationship between tax collection and economic growth.[2] Second, we adopt a more robust approach to identifying a threshold by accounting for factors that may affect growth and ensure that we are consistent with the government's budget constraint. Third, we use more contemporary data by expanding the dataset used in Gaspar, Jaramillo, and Wingender (2016) from 2010 to 2021, to identify a relevant threshold that is reflective of more recent fiscal and economic changes. Fourth, our research probes the relevance of the tax threshold identified on inclusive growth (measured by prosperity gap[3]), offering a broader understanding of the tax-to-GDP ratio's impact on growth. Finally, we explore potential channels through which higher revenue collection may be associated with future inclusive growth through economic volatility, progressivity, and productive spending such as health and education.

A tax revenue of 15 percent of GDP enhances economic growth through higher public spending on health and education, promotes economic stability, and reduces inequality via progressive taxation. Our study employs a regression discontinuity design using a fixed effects model which identifies the level of tax (including social security contributions) to GDP where there is a discontinuity in the rate of future economic and inclusive growth, as measured by the prosperity gap[4]. We find that a tax-to-GDP ratio of 12.5 percent is associated with a significant acceleration in future economic growth (the 10-year ahead cumulative real GDP growth per capita). We also find that the threshold for future inclusive growth lies at about 13 percent. We then look at possible channels through which this level of tax may empower government to systematically improve growth including through productive spending on health and education to raise productivity and human capital, and lower growth and spending volatility. Our research suggests that increased tax revenue, particularly between 7 percent to 15 percent of GDP, leads to more investment in health and education, enhancing productivity and human capital, reducing government consumption volatility and hence, economic volatility. Higher-income countries with greater tax capacity often have more progressive tax systems, characterized by a higher share of direct taxes. Progressive tax systems, especially those with a higher proportion of direct taxes, are linked to lower inequality and smaller prosperity gaps. We find that a 50 percent direct tax share of total tax is optimal for minimizing the prosperity gap.

[2] Another prominent example of a related tipping point in fiscal policy is between debt and growth in Chudik et al (2017), Eberhardt and Presbitero (2015), and Reinhart and Rogoff (2010).

[3] We define inclusive growth as growth that improves the material wellbeing of the less well off in society and is pro-poor; specifically, we use a new measure of inclusive growth called the "prosperity gap" by Kraay et al. (2023).

[4] The prosperity gap is defined as the average factor by which an individuals' income must be multiplied to get to an income of $25 per day—the typical poverty line in high-income countries.

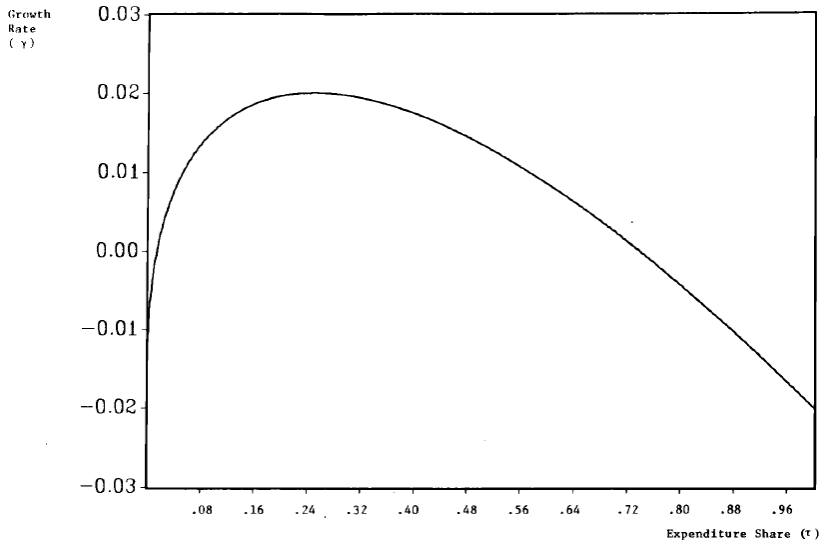
The 15 percent of GDP tax threshold is crucial for countries graduating from low-income status. In an event study, we show that countries that graduate from low to middle-income status do so at an average tax level of 15 percent to GDP (median of 12.9 percent). In the ten years prior to moving to middle income status countries experience a 3-4 percent of GDP increase in tax collection. In contrast, when countries transition from lower-middle income status to upper-middle income there is no notable increase in tax collection in the ten years preceding that transition.

While mobilizing tax revenues can contribute to economic and inclusive growth, significantly increasing tax collection is hard and it is not a panacea. The implications of these thresholds are that countries that have low levels of tax revenue could significantly increase inclusive growth if they effectively mobilize tax revenues. Moving from a tax threshold of 7 percent of GDP (typical of worst performing economies) to 15 percent of GDP is associated with an additional 10 percentage points of cumulative growth over the next ten years. In the case of inclusive growth, the same increase in tax to GDP ratio results in the reduction of the prosperity gap by about half in ten years; that is, the factor by which the average individual in a country has to multiply their income to get to $25 per day which is "the income of a typical person living in a country that moves from middle income to high income status" (Prinsloo et al. 2023). While we acknowledge that increasing taxes may lead to better and more inclusive growth, it is not a cure-all solution. It simply creates the fiscal space for development outcomes, and the effective deployment of these resources is just as crucial in determining the success of developmental outcomes. Also, with countries that were able to increase tax revenue only achieving a 3 percentage point increase in tax-to-GDP on average over a ten-year period, boosting tax collection by 8 percent of GDP requires a mammoth effort.

2. The case for a tax threshold and previous evidence

Seminal papers linking taxes to long-run growth using endogenous growth theory show that taxes can impact choices on (human and physical) capital accumulation, labor-leisure tradeoffs, and savings (Barro 1990; King and Rebelo 1990; and Jones, Manuelli, and Rossi 1993). This leads to a trade-off between growth and the size of government (and the type of taxes used to finance its spending) where low levels of tax can be detrimental to growth. A simple example of this tradeoff is provided in Barro (1990), replicated below in figure 1, which shows the growth rate against the expenditure (and tax) share in income. The trade-off is a consequence of two opposing forces. First, higher government spending (and taxes to finance that spending) raises the marginal product of (human and physical) capital. Second, and in opposition, a higher tax rate implies that households keep a smaller fraction of that income. Therefore, at low levels of spending the first effect dominates as the marginal product of capital increases. Barro (1990) quips "anarchy is very unproductive". Another way to state this is that governments spend on many things that can boost investment and productivity. As the tax rate increases the second effect starts to dominate, with taxes negatively affecting growth.

Figure 1: Growth rate and the size of government



Source: Barro (1990).

The main objective of taxation is to provide resources to finance government spending (Burgess and Stern 1993). Despite criticisms of inefficiency and corruption, government spending is essential for market economies. It promotes growth and reduces poverty through redistribution, creates public goods like infrastructure, ensures safety through law enforcement, stabilizes the business cycle, responds to disasters, and provides social safety nets for vulnerable populations. An obvious fact is that although governments can finance that spending in many ways—including through debt, or official aid and grants—that at a fundamental level the ability to spend depends on the ability to collect taxes. Countries that have lower tax revenue in general spend less then countries with higher tax revenue. A simple scatterplot of the relationship between tax revenue (including social security contributions) to GDP and total expenditure to GDP (figure 2.A) shows this. To estimate the basic relationship between expenditure and taxes we fit a fractional polynomial regression.[5] At very low levels of taxation there seems to be a strong pick-up in total spending likely reflecting resource rich countries that are relatively wealthy and can afford to spend despite collecting little, and low-income countries that can finance spending thanks to significant international support through grants. Beyond this exceptionally low tax level the relationship between tax revenue and spending is positive and linear.

Economies that have higher tax levels also tend to spend significantly more on health and education. The increase in productive spending can be seen in figure 2.B which plots public health and education spending against tax revenue. Higher tax collection allows governments to fund public services without compromising other areas of the budget. Efficient and well-managed public spending on health and education leads to higher productivity and economic growth (Herrera, 2015).

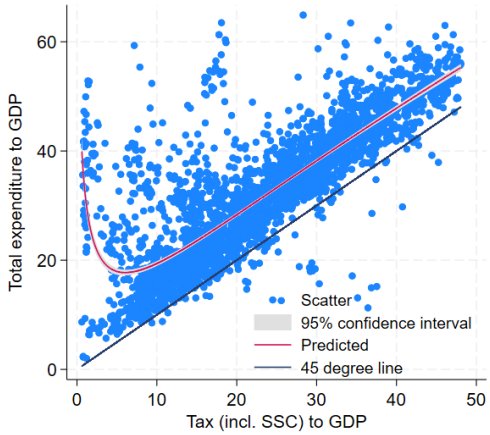
Low tax revenue, hence, may be detrimental to economic development and future inclusive economic growth (Gaspar, Jaramillo, and Wingender 2016). Figure 2.C and D plots the relationship between taxes and future inclusive growth, and taxes and future growth over the next ten years (and

[5] The fractional polynomial model is a flexible way to fit several functional forms including non-linearities.

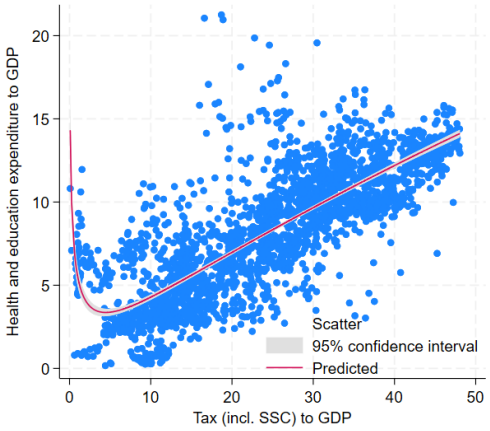
again fits a fractional polynomial regression). The scatterplots suggest that there is a level of taxes that may raise both future growth and inclusive growth. Low levels of tax to GDP are associated with low levels of development and only few countries have reached a high level of development alongside low tax collection (for example, oil-rich middle eastern economies). However, as taxes rise, the prosperity gap narrows. There is a similar association with taxes and future growth in figure 2.D and remarkably like that suggested by theory in figure 1. At low levels of tax, future growth seems to be significantly undermined. As taxes rise so does future growth, and rapidly so. At some point of tax-to-GDP the marginal increase in taxes becomes less supportive to future growth or even leading to its slow down. At any point of taxation level, it is especially important how revenue is used.

Figure 2 Taxes and development

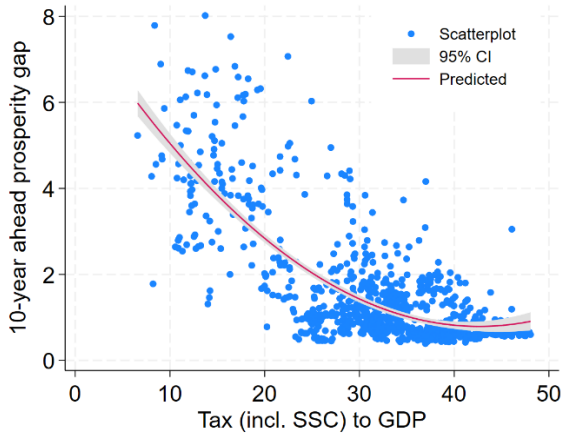
A. Taxes and total government spending



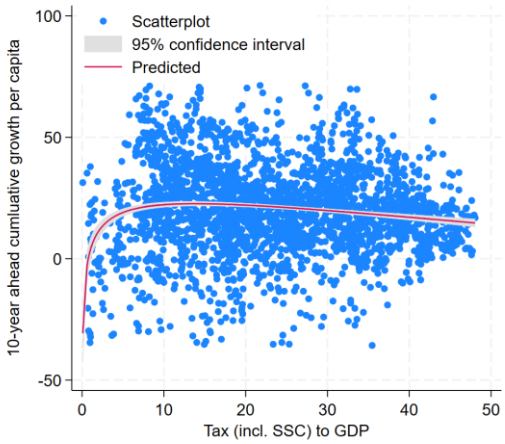
B. Taxes and productive spending



C. Taxes and inclusive growth



D. Taxes and growth



Source: International Monetary Fund, Kraay et al. (2023), Authors' calculations.
Note: Scatterplots reflect country-year pairs. "Predicted" based on a fractional polynomial regression.
B. "Productive spending" is classified as health and education spending.

The relationship between taxation and economic development is nuanced and multifaceted, influenced by a range of factors including economic constraints, the informal sector, and state capacity. Research by Tanzi (1992) and Burgess and Stern (1993) indicates that countries with a higher agricultural dependency and lower import-to-GDP ratios often exhibit lower taxation levels. Gordon and Li (2009) underline the connection between taxation and formal finance, while Kleven,

Kreiner, and Saez (2009) demonstrate the efficacy of third-party tax enforcement in developed nations. Conversely, Jensen (2011) and Benedek et al. (2014) associate diversified revenue sources with reduced tax burdens. Meanwhile, Barro (1990) and Barro and Sala-i-Martin (1992) argue for the productivity-boosting potential of well-designed tax systems. Besley and Persson (2011, 2013, 2014a, 2014b) stress the pivotal role of state capacity—embracing fiscal, legal, and collective dimensions—in fostering economic growth. The dynamics of tax compliance, influenced by social norms and governance, further shape growth outcomes (Kiser and Levi, 2015; Levi, 1988).

The idea that tax revenue can play a key role in future growth is explored in Gaspar, Jaramillo, and Wingender (2016, henceforth GJW). They employ a regression discontinuity design (RDD), akin to Card, Mas, and Rothstein (2008), to explore the point where there is a tipping point (or discontinuity) at which tax-to-GDP ratios' impact on GDP growth. They model the cumulative GDP per capita growth rate over a specific horizon as a function of tax-to-GDP levels, allowing for discontinuities at an unknown threshold. Specifically, they adopt a two-step method. First, they identify the tipping point where tax-to-GDP ratio causes a discontinuous change in GDP growth by maximizing R-squared of the model (through a grid-search). While locating the tipping point, they omit covariates and fixed effects to improve statistical power of the model. The author's note that the full model performs poorly across various growth horizons, prompting them to approximate the functional relationship between tax threshold and economic growth with a constant function. Second, they estimate the marginal effect using an RDD estimator, assuming the threshold is known. We follow the approach in GJW, however, modify it by using a comprehensive model with fixed effects, recent data, and focusing on inclusive growth. The next section discusses this approach.

3. Methodology: Identifying a tax threshold

In this section, we examine the possibility of a tax-to-GDP ratio threshold that delineates a transition to higher sustained GDP growth rates and more inclusive growth. Building on the premise outlined in the preceding section, we posit that once a tax-to-GDP threshold is achieved economic growth increases sharply and in a sustained manner over the following decade. The growth acceleration is supported through various mechanisms including creation of fiscal space to finance growth enhancing spending that boost investment and productivity, and lowering economic volatility and uncertainty. We use a regression discontinuity design following Card, Mas, and Rothstein (2008) and implemented for tax in GJW. They find 12.75% threshold and advocate for a 15 percent tax-to-GDP threshold as a needed minimum. Their methodology hinges on pinpointing a discontinuity in GDP growth rates and selecting a threshold that optimizes the model's explanatory power. Initially, they determine a structural break in the relationship between the tax-to-GDP ratio and subsequent GDP growth, effectively identifying a tax level at which growth shifts in a discontinuous manner. This potential tipping point is determined by calibrating a threshold dummy variable to maximize the R-squared of the model, which includes only the tax threshold dummy as the explanatory variable. Upon confirming the statistical significance of this tipping point, the subsequent phase involves deriving the estimate for the coefficient on tax threshold dummy using the conventional Regression Discontinuity Design (RDD) estimator, treating the threshold value as a known quantity from the first step.

Our study enhances the approach used in GJW in three ways. First, we adopt a more robust model that accounts for other possible drivers of growth including investment, population growth, and

country and year fixed effects. We also ensure that we account for the budget constraint by including debt and other revenue components (Adam and Bevan 2005). This comprehensive approach mitigates the risk of spurious results that could arise from omitted variable bias affecting the tax-to-GDP ratio, and subsequently, economic growth. Second, we extend the dataset to 2021, providing a more contemporary analysis. While we exclude pre-1980 historical data, we posit that focusing on more recent data, with sufficient temporal coverage, is crucial to identify a relevant threshold reflective of the modern economic landscape's structural shifts. Third, our research probes the relevance of the identified threshold by examining its influence on alternative dependent variables, specifically the prosperity gap, thereby offering a more nuanced understanding of the tax-to-GDP ratio's impact on inclusive growth.

The econometric specification is as follows:

$$y_{c,t+j} - y_{c,t} = \beta_0 + \beta_1 \mathbb{I}\left(Tax_{c,t} > \gamma\right)_{c,t} + \beta_2 \mathbb{I}\left(Tax_{c,t} > \gamma\right)_{c,t} * Tax_{c,t} + \beta_3 Tax_{c,t} + \boldsymbol{\beta X_{c,t}} + \kappa_c + \kappa_t + \epsilon_{c,t} \quad (1)$$

In equation (1), the dependent variable represents the j-period ahead cumulative growth rate. Here, $y_{c,t}$ signifies the logarithm of real GDP per capita for country c in period t. The indicator function $I\left(Tax_{c,t} > \gamma\right)_{c,t}$ represents the tax threshold dummy, which assumes a value of 1 if the tax-to-GDP ratio exceeds the threshold γ , and 0 otherwise. $Tax_{c,t}$ denotes the tax-to-GDP ratio for country *c* in period t. The vector $\boldsymbol{X_{c,t}}$ includes covariates from growth theory and the government's budget constraint, including the investment-to-GDP ratio, debt-to-GDP ratio, per capita income, and the revenue generated from other sources. We include the interaction between debt to GDP and tax threshold to allow for potential non-linearities in the impact of debt on growth. The terms κ_c and κ_t represent country and year fixed effects, respectively. We employ this model to analyze the j-period ahead prosperity gap as an alternative dependent variable.

GJW methodology recommends choosing the threshold to maximize the R-squared of the model via a grid search across potential threshold values, but this method may present certain drawbacks. For example, the incremental increase in R-squared might lack statistical significance suggesting an inability to meaningfully choose across threshold outcomes. Moreover, the maximized R-squared does not necessarily mean that the coefficient of interest which reflects the magnitude of the discontinuous jump in the growth rate, will be at its optimal value at the same threshold. To address these concerns, our approach focuses solely on the coefficient of the tax dummy threshold, as it is more relevant for capturing any discontinuous jumps in the effect on growth or the dependent variable of interest.

4. Data

The main variables used in this paper are described in table 1 and their descriptive statistics in table 2. The revenue-based indicators are from the International Monetary Fund's Government Statistics Finance (GFS) database. We select the level of government for each country (that is, general, central, or budgetary central government) to maximize the number of non-missing observations in a set of spending and revenue categories over the sample. There is likely a vital role that fiscal decentralization can play in the relationship between tax and growth, however, given data limitations, we use aggregated data focusing on general where data is available or central government in the remaining countries. We also focus on tax revenue including social security contributions to GDP

and use this definition of tax revenue throughout the paper. Since coverage of government debt data on GFS is limited, we instead use gross debt from World Economic Outlook (WEO). All government variables are as a ratio to GDP.

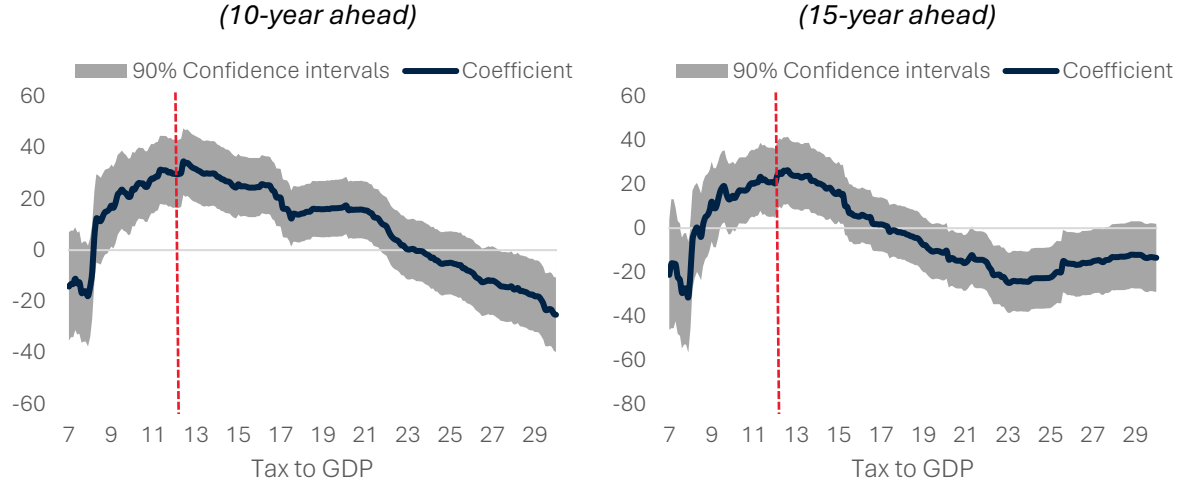
This paper focuses on the impact of tax on two measures of economic output. First, we calculate 10- and 15-year ahead growth as the log change in real GDP per capita from the World Bank's World Development Indicators (WDI). To measure inclusive growth, we use the recently created "prosperity gap" by Kraay *et al.* (2023) and again look at the 10- and 15-year ahead level of the prosperity gap. The prosperity gap is defined as the average factor by which incomes need to be multiplied to bring everyone in a country to an income of $25 per day.

5. Results

5.1 Identifying the threshold

We find that the optimal tax-to-GDP ratio for maximizing future cumulative GDP growth varies is about 12.5 percent (figure 3). This threshold is determined by excluding resource-rich economies[6], which often exhibit lower tax revenues[7] but higher and volatile growth outcomes. For the optimal threshold, we conduct a grid search, commencing from 7 percent (the 5th percentile of the tax-to-GDP ratio) to 30 percent, with intervals of 0.1. The results are in line with those presented in GJW. Interestingly, the threshold has not moved up despite the significant growth in spending needs since the previous empirical work was conducted.

Figure 3: The growth maximizing tax to GDP ratio hovers around 12.5 percent



Source: Authors' calculations.
Note: The depicted figure provides an estimation of the coefficient on the tax-to-GDP threshold dummy in Equation 1. The sequence of the figures represents the impact on cumulative growth rates over different time horizons: the left figure pertains to a 10-year period, and the right figure to a 15-year period. Dashed red line indicates the optimal threshold value.

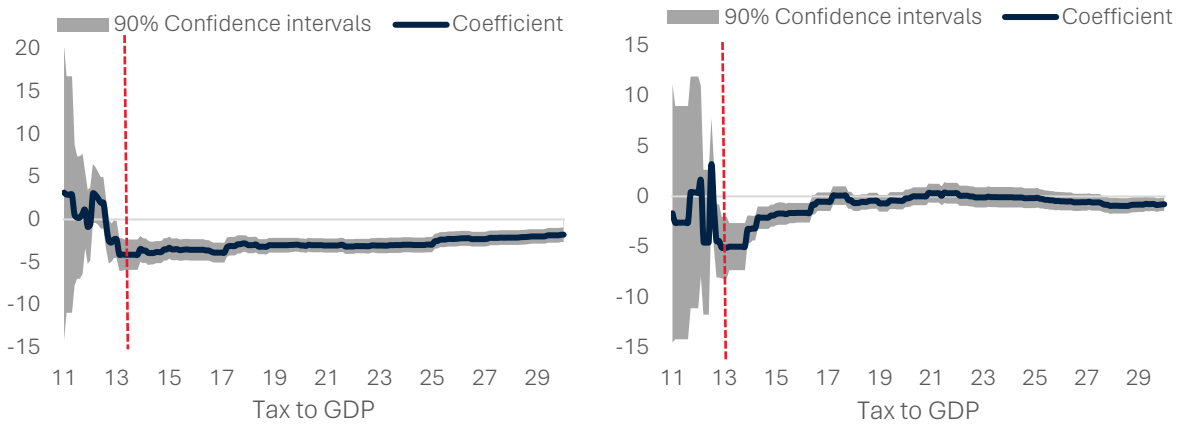
[6] The resource rich economies are identified as those with natural resource rent to GDP ratio exceeding 19.4 percent.

[7] Resource-rich countries often have lower tax collection due to significant revenues from natural resources, which are used to attract investment and foster economic growth.

The optimal tax-to-GDP ratio that narrows the prosperity gap differs over various horizons, yet it consistently shows a statistically significant effect when exceeding a 12.5 percent threshold. For a ten-year ahead horizon, the optimal ratio is at 13.3 percent, while the prosperity gap for a fifteen-year ahead horizon is minimized at 12.9 percent, as illustrated in figure 4.

Figure 4: The long run impact on prosperity gap is materialized around 13 percent threshold.

(10-year ahead) *(15-year ahead)*



Source: Authors' calculations.

Note: The depicted figure provides an estimation of the coefficient on the tax-to-GDP threshold dummy in Equation 1 but with prosperity gap as the dependent variable. The sequence of the figures represents the impact on prosperity n-period ahead: the left figure pertains to 10-year ahead, and the right figure to 15-year ahead. Dashed red line indicates the optimal threshold value.

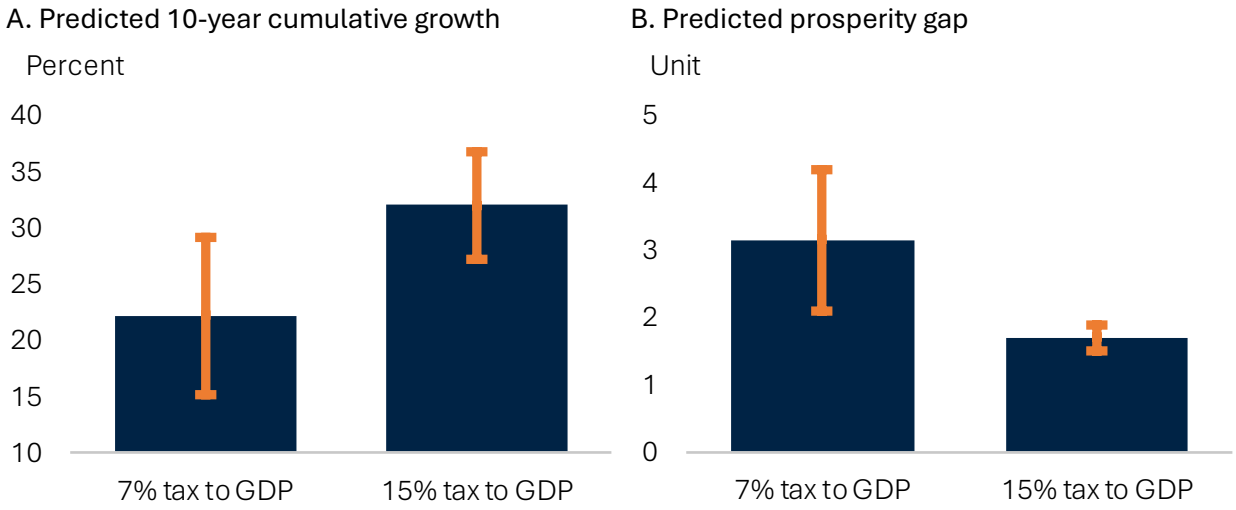
5.2 Implications for growth and inclusive growth

In this section we present the results for the ten-year-ahead growth outcomes and the prosperity gap at the optimal threshold and show the consequences of increased tax collection for growth and inclusive growth. We use a 10-year horizon for the tax impact on growth that gives us a 12.4 percent threshold for growth and 13.3 percent threshold for the prosperity gap. The regressions are as described in equation (1) and presented in table 3. The first three columns are related to cumulative real GDP growth per capita over the next ten years, and the last three columns to the prosperity gap in ten years. Column 3 and 6 which exclude resource rich economies (those with resource rents above about 19 percent of GDP) show that the threshold term is positive and statistically significant for future cumulative growth, and negative and significant for the future prosperity gap (smaller numbers indicate closer to the $25 a day level of income for all individuals).[8] The marginal impact of an additional increase in tax-to-GDP below the threshold is also statistically significant for all measures suggesting a 1 percentage point of GDP increase in taxes is associated with a 3.6 percentage point increase in cumulative future growth and a 0.3 unit decline in the future prosperity gap.

[8] Resource rich economies are defined as those with resource rents to GDP in the top 10th percentile of the distribution. Our results are robust to changing this threshold to the top 5th percentile of the distribution.

For the increase in tax collection (including social security contributions) from the level of 7 percent of GDP (which responds to the 5th percentile of the country-year tax-to-GDP distribution) to above the 15 percent threshold for GDP growth, the cumulative future growth is higher by over 10 percentage points (figure 5).[9] The prosperity gap—our measure of inclusive growth—also declined by about half, to below 2, when tax collections rose from 7 and 15 percent of GDP. There is some uncertainty, however, in the size of the improvements in future growth as tax revenue increases as the regression is subject large standard errors for lower tax revenue. The relationship between taxes and (inclusive) growth is also complex and these regressions are still subject to endogeneity issues and the results cannot be treated as causal. Therefore, raising tax revenue cannot be seen as a panacea for boosting economic growth. Moreover, achieving such an increase in tax revenue is challenging requiring a mammoth effort from policy makers. The average increase in tax over a ten-year period in our sample was about 3 percent of GDP (looking only at those who increased taxes). An 8 percent of GDP increase, from 7 to 15 percent, falls above the 90th percentile.

Figure 5 Impact of taxes on growth and inclusive growth



Source: Authors' calculations.
Note: Orange whiskers reflect 90 percent confidence intervals.

6. Potential channels through which taxes affect growth

Once the threshold for tax collection that affects future growth has been identified, it is worth analyzing the possible channels through which higher taxes may impact growth. In this section we look at several possible explanations of tax and growth relation focusing on the possible ways of using tax revenue by governments. Our analysis is motivated by two main questions. First, do governments spend more on health and education as they have more resources available? Second, are higher taxes associated with lower government consumption and real GDP growth volaility?

[9] The negative slope on future growth above the threshold (table 3, column 3) suggests that as tax to GDP increases, future growth slows. This is not the case in the prosperity gap; that is, future prosperity gap does not decrease as tax revenue increases above the identified threshold.

6.1 Health and education spending

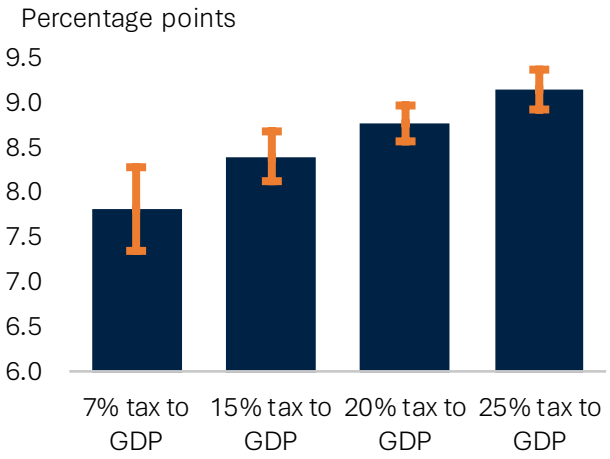
Collecting higher tax revenues allows governments to spend more on health and education, which is related to better growth outcomes and higher productivity (Baldacci et al. 2008). EMDEs spent about 7 percent of GDP on average on health and education per year well below the 11.1 perent spent in advanced economies. Figure 9A plots a simple binned scatterplot (where observations along the vertical and horizontal axis are partitioned and then binned into one single point). The scatterplot shows that there is a generally positive relationship between government's future health and education spending. In addition, there seems to be some evidince of a discontinutity in average future government spending on education and health around the 15 percent of GDP threshold, which underscores the likelihood that low tax revenue undermines spending.

We use the same threshold methodology as above but here looking at whether there is a threshold at which tax revenue affects spending on health and education. We find a tax to GDP threshold over 30 percent of GDP. While the threshold dynamics are less important at over 30 percent of GDP, the regression indicates that below the threshold higher tax revenue is associated with higher future spending on health and education (figure 6B). A country with tax to GDP of 7 percent is predicted to spend 7.8 percent of GDP every year for the next ten years. This rises to 8.4 percent at 15 percent of GDP. Over a ten-year period, this is an additional 6.0 percentage points of GDP in cumulative spending on health and education.

Figure 6 Impact of taxes on future health and education spending

A. Scatterplot of tax revenue on future health and education spending

B. Predicted average ten-year future spending on health and education



Sources: International Monetary Fund; Authors' calculations.
Note: A. Average 10-year ahead health and education spending relative to GDP. Binscatter with 50 bins where observations along the vertical and horizontal axis are partitioned and then binned into one single point. Vertical line reflects 15 percent tax to GDP.
B. Orange whiskers reflect 90 percent confidence intervals.

6.2 Progressivity and equity

The composition of taxation is as significant as its level when addressing economic inequality. Taxation is a potent tool for promoting a more equitable income distribution. Piketty (2014) underscores that progressive taxation is a critical element of the social state. He asserts that it was central to the development of the social state and the transformation of inequality structures in the

twentieth century, and it remains important for ensuring the viability of the social state in the future. Similarly, Atkinson (2015) advocates for increased taxation, including progressive taxes, as an essential strategy to mitigate inequality. These perspectives highlight that not only the amount of tax collected but also the way it is structured plays a crucial role in shaping economic equity.

Tax systems in low-income countries are not sufficiently progressive and may be detrimental to the poor. Thus, better inclusive growth outcomes can be achieved by enhancing the quality of the tax structure. A World Bank report (2022) highlights that, in most low and middle-income countries, fiscal policy does not support poor households. In these countries, consumable income (income after direct and indirect taxes have been paid and cash transfers and subsidies have been received) is often less than market income (income before any taxes have been paid or transfers or subsidies received), whereas in high-income countries, the poorest households have 60 percent more consumable income than market income. Richer countries can manage to collect more revenue (as a share of GDP) and support poorer households by using a mix of fiscal instruments. They rely heavily on direct income taxes, which place a greater burden on wealthier households, and support poorer households through well-targeted transfers. Indeed, Jensen (2022) shows that the modern tax system arises over development with the income tax threshold shifting down the income distribution as countries develop. In contrast, non-OECD countries predominantly use indirect taxes on consumption—such as value-added taxes and good and services taxes—which burden everyone and often fail to adequately support the poor. Indeed, countries with higher tax capacity (proxied by higher tax to GDP ratio), tend to have higher share of direct taxes (figure 7A). Regional studies on Latin American economies demonstrate that progressive taxation, through increased direct taxes, leads to better equality outcomes (Martorano, 2018; Tsounta and Osueke, 2014; Cornia et al., 2011) while noting that the effectiveness in promoting equity is limited due to lower tax capacity (Martorano, 2018).

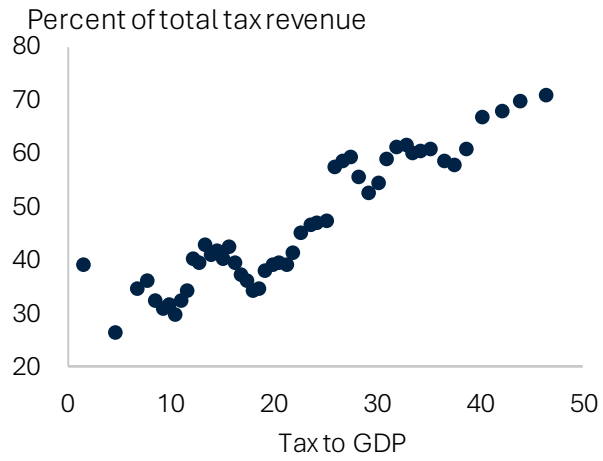
A progressive tax system can also promote growth through reduced inequality. The impact of tax progressivity on economic growth depends on how tax revenues are used and the economic context. Potential downsides, such as reduced work and investment incentives, can be mitigated by funding productive public investments and reducing inequality. Theory suggests that reducing inequality fosters economic growth by mitigating under-investment in human capital because of credit market imperfections (Galor and Zeira, 1993) and by lowering high fertility rates among the poor, which hinders human capital accumulation (de la Croix and Doepke, 2003). Conversely, some argue that inequality can spur growth by fostering innovation and entrepreneurship (Lazear and Rosen, 1981), increasing savings and investments (Kaldor, 1957), and creating business and education opportunities (Barro, 2000). While theoretical perspectives vary, empirical research supports the notion that lower inequality is associated with faster and more durable growth (Berg et al., 2018). Banerjee and Duflo (2003), while inconclusive about the negative impact of inequality on growth based on macro data, advocate for micro studies; for instance, Banerjee et al. (2001) show evidence from Indian cooperatives that those with the highest inequality in land ownership are the least productive.

Aligned with existing literature, we find progressive taxation measured by the share of direct taxes in total taxes correlates with reduced inequality. The choice of the progressivity measure results from data availability and ability to measure progressivity of the tax system that requires details on a tax incidence by tax type and micro data at household and firm level. Thus, the measure should be

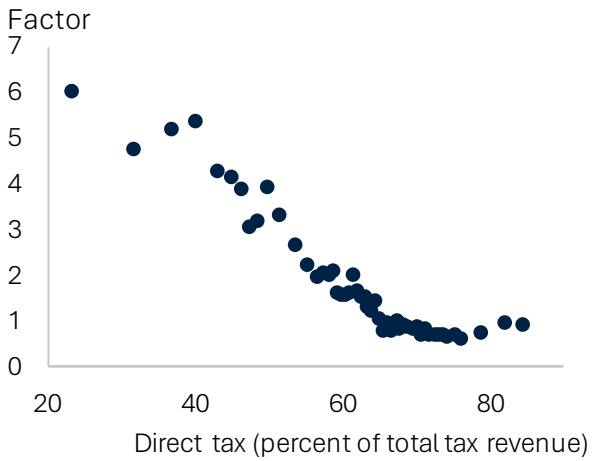
treated as a proxy of progressivity only. Nations with higher direct tax revenue show a narrower prosperity gap (Figure 7B). Empirical validation, controlling for confounding factors, confirms this trend: a greater proportion of direct taxes correlates with reduced prosperity gap (Figure 7C). To address potential endogeneity, our threshold model examines if a critical level of direct tax share significantly reduces the prosperity gap. We identify a potential tipping point around a 50 percent direct tax share, minimizing the prosperity gap (See Annexure A). However, this does not guarantee equitable tax incidence, as the design of tax systems can vary significantly. For example, existing labor taxes may lack progressivity, leading to reduced redistributive capacity and insufficient incentives to participate in the job market (Jousten et al., 2022). Additionally, arbitrage opportunities arising from disparities between labor and capital income taxation can further undermine their progressivity. The same could apply to corporate income tax where incidence could fall on small and medium size companies because of tax avoidance schemes. In contrast, the VAT system can be progressive, as evidence by countries with high informality (Bachas, Gadenne, and Jensen 2023).

Figure 7 Impact of taxes on progressivity

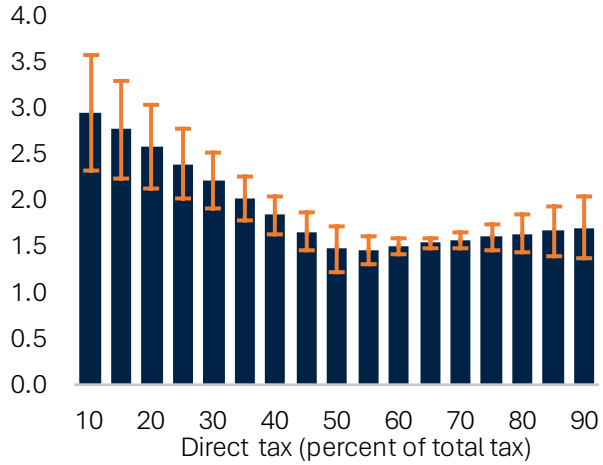
A. Scatterplot of tax revenue on the share of direct taxes in total taxes



B. Scatterplot of direct tax share on prosperity gap



C. Predicted prosperity gap and progressivity



Sources: International Monetary Fund; Authors' calculations
Note: A.B. Binscatter with 50 bins where observations along the vertical and horizontal axis are partitioned and then binned into one single point.
C. Orange whiskers reflect 90 percent confidence intervals.

6.3 Government spending volatility and uncertainty

Government contributes significantly to economic activity and can play a stabilization role in an economy or contribute to higher growth volatility. Government spending may be more volatile in countries with lower tax revenue. These economies may also have less opportunity to borrow undermining their ability to stabilize the business cycle and implement effective countercyclical policy.

The literature on economic and policy volatility and growth presents a compelling case for the negative impact of volatility on economic growth. Ramey and Ramey (1995) demonstrated through data from 92 countries that higher volatility is correlated with lower growth rates. Their findings

suggest that the investment share of GDP is not a significant factor in this relationship, and that the negative effects of volatility are primarily due to the uncertainty it causes, which leads to planning errors by firms. Badinger (2010) contributes to the discourse by introducing a novel instrument to identify the causal effect of output volatility on growth, using exogenous volatility spillovers from abroad. The cross-sectional analysis of 128 countries confirms the negative relationship between volatility and growth, even when institutional quality is controlled for. The link between policy volatility and growth is shown in Fatas and Mihov (2013) who show that an increase in government spending volatility reduces long-term economic growth. More recently, Mumtaz and Ruch (2023), show that fiscal policy uncertainty decreases output, private consumption, fixed investment, and raises prices.

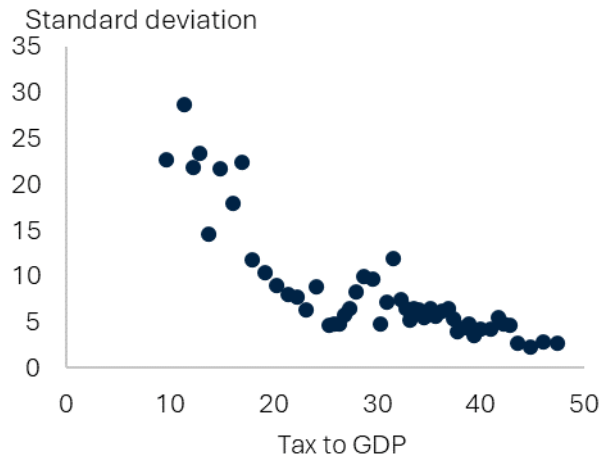
To test the hypothesis that tax revenue levels may affect government consumption volatility and hence output growth volatility, we identify time-varying volatility using quarterly data on real GDP growth and real government consumption (both seasonally adjusted) from Haver Analytics and calculate 10-year ahead standard deviations of the quarter-on-quarter (annualized) growth rate. We then convert these quarterly observations into annual observations (using the first quarter observation of each year). Figure 8A provides a binned scatterplot (where observations along the vertical and horizontal axis are partitioned and then binned into one single point) of the relationship between 10-year ahead average government consumption volatility to the level of tax to GDP. Higher levels of tax revenue are associated with lower levels of government spending volatility. Similarly, figure 8B shows that higher government spending growth volatility is associated with higher real GDP growth volatility.

We use the same methodology as above to identify the potential of a tax threshold on government consumption volatility. Figure 8C shows the coefficient on the tax threshold dummy for various values of tax to GDP. The coefficient on the tax threshold reaches a nadir at 13.5 percent of GDP and is negative (decreasing volatility above the threshold) between 13 and 23 percent.

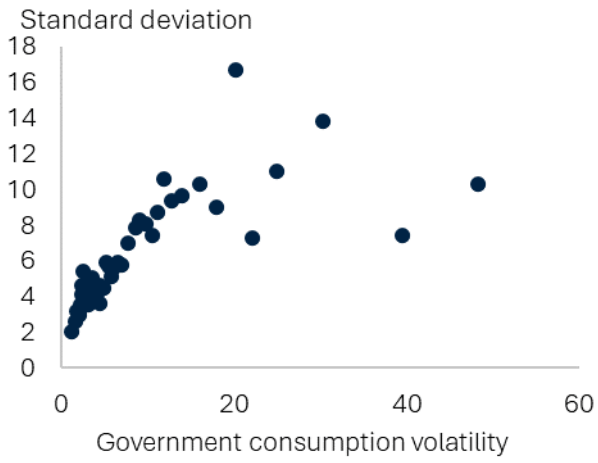
We then use these thresholds and estimate a regression using the identified optimal threshold with ten-year-ahead government consumption volatility as the dependent variable. The predicted volatility is shown in figure 8D. The predicted future standard deviation of government consumption is about 19 percent at 7 percent tax to GDP and declines to about 5 percent at 15 percent tax to GDP.

Figure 8 Impact of taxes on future growth volatility

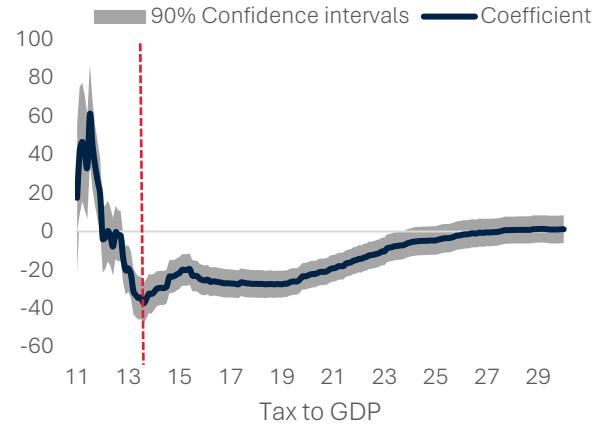
A. Scatterplot of tax revenue on future government consumption volatility



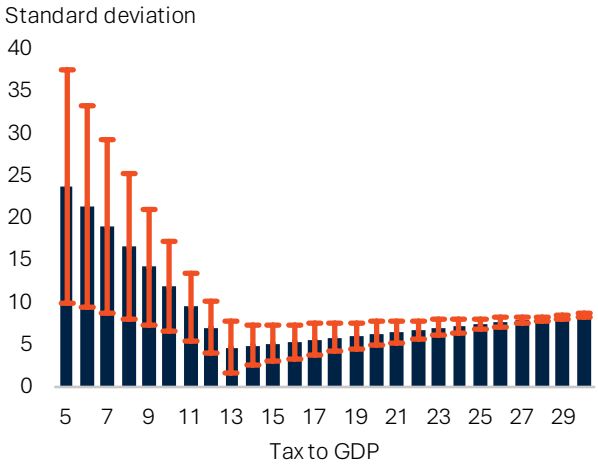
B. Scatterplot of future government consumption volatility on future GDP volatility



C. Tax threshold coefficient across tax to GDP, government consumption volatility



D. Predicted average 10-year future government consumption volatility



Sources: International Monetary Fund; Authors' calculations.
Note: A.B. Average 10-year ahead standard deviation of real government consumption growth and real GDP growth. Binscatter with 50 bins where observations along the vertical and horizontal axis are partitioned and then binned into one single point.
C.D. Based on equation (1) with 10-year-ahead government consumption volatility as the dependent variable. Threshold for government consumption volatility is 13.6 percent.

7. Transitioning from low-income status: an event study

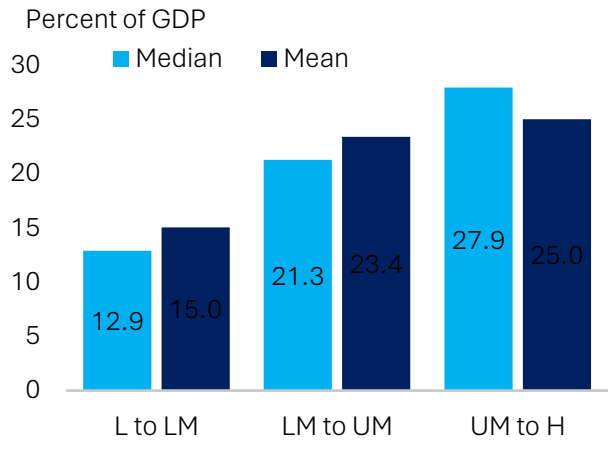
This section compliments the formal modeling work to look at whether the transition to a higher income group is preceded by an expansion in the tax-to-GDP ratio of a country. We employ an event study methodology to validate the findings of our econometric exercise, which identifies a critical tipping point in the tax-to-GDP ratio. Our analysis suggests that a threshold closer to 15 percent is pivotal for countries in transitioning to middle income status; those with a tax-to-GDP ratio below this benchmark appear to have significant room to enhance inclusive growth by surpassing this target.

We analyze the tax-to-GDP ratios of 27 economies during the period surrounding their transition from a low-income to a lower-middle-income status. To conduct this study, we utilize the World Bank income group classification to identify countries that have changed their status from one income group to another based on data from 1987 to 2021. We identify 53 countries that transitioned from low to lower-middle-income status, 67 countries from lower-middle to upper-middle-income status, and 41 observations from upper-middle to high-income status (table B1).[10] However, due to constraints in the availability of tax-to-GDP data, we track only a subset of these transitioning countries: 27 from low-income to lower-middle income (L to LM), 45 from lower-middle to upper-middle income (LM to UM), and 29 from upper-middle income to high income (UM to H), with additional limitations in temporal coverage.

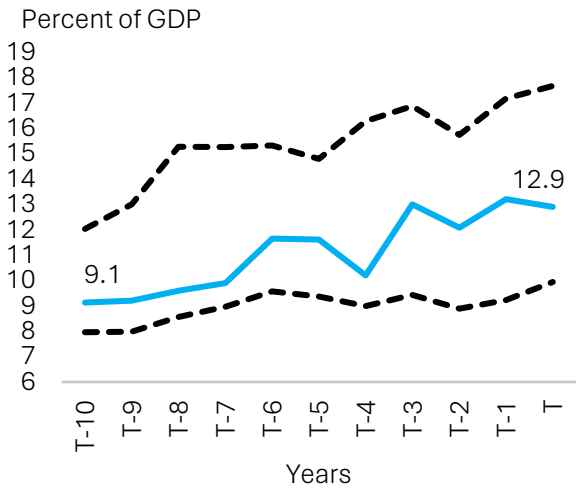
Economies rising from low to lower-middle income status achieve a critical tax-to-GDP ratio of 15 percent, reflecting a 3-4 percentage point or GDP increase over the decade before transitioning. Our analysis indicates that the average tax-to-GDP ratio is 15 percent when countries shift from a low-income to a lower-middle-income category (figure 9A). This average increases to 23.4 percent and 25 percent when transitioning from lower-middle-income to upper-middle-income and from upper-middle-income to high-income groups, respectively. Notably, as countries progress from low to lower-middle income status, we observe that their median tax capacity in the ten years preceding the transition expands by about 4 percentage points (figure 9B). In contrast, when countries transition within middle income status to upper middle income there is no notable increase in tax collection in the ten years preceding that transition.

Figure 9 Taxes during income group transitions

A. Tax-to-GDP at transition point



B. Tax-to-GDP prior to transition to middle income status, median



Sources: International Monetary Fund; Authors' calculations.
A. "L" denotes low income, "LM" denotes lower-middle income. "UM" denotes upper-middle income, and "H" denotes high income based on World Bank income classification.
B. T denotes the year of transition from low to lower-middle income group. Dashed line denotes the inter-quartile range.

[10] Some countries have transitioned more than once, likely due to volatility in estimated per capita income levels. To address this, we consider only the most recent year in which a country transitioned.

8. Conclusion

Governments with sufficient resources are better able to solve market failures and provide the right environment for growth to thrive. The tax level (and its structure), are hence, crucial for inclusive growth**.** In this paper we revisit the relationship between taxes and growth but extend it to study the implications for inclusive growth measured by the prosperity gap. We then look at potential channels through which taxes may impact growth outcomes.

We find there is a non-linear relationship between tax revenue and growth, including inclusive growth. Future growth and inclusive growth are subject to a threshold around 13 percent of tax to GDP after which future (inclusive) growth rises. Countries also transition from low-income to middle-income status around this threshold. The implications of these thresholds are that countries that have low levels of tax revenue could significantly increase inclusive growth if they effectively mobilize tax revenues. Moving from a tax threshold of 7 percent of GDP (the level of tax is some of the worst performing economies) to 15 percent of GDP is associated with an additional 10 percentage points of cumulative growth over the next ten years. In the case of inclusive growth, the same increase in tax to GDP ratio results in the reduction of the prosperity gap by about half in ten years; that is, the factor by which the average individual in a country has to multiply their income to get to 25 per day which is “the income of a typical person living in a country that moves from middle income to high income status” (Prinsloo et al. 2023). Given that tax-to-GDP ratios are volatile and evidence from an event study, it is reasonable to interpret our findings as in line with the standard recommendation for countries with low tax-to-GDP levels to aim for levels around 15 percent. Three channels may explain why this threshold exist: increased spending on health and education, lower government spending and growth volatility, and more progressive taxes.

References

Acosta-Ormaechea, Santiago, S. Sola, and J. Yoo. "Tax Composition and Growth: A Broad Cross-Country Perspective." German Economic Review 20, no. 4 (2019): e70-e106.

Abdel-Kader, Khaled and De Mooij, Ruud A., Tax Policy and Inclusive Growth (December 2020). IMF Working Paper No. 2020/271, Available at SSRN: https://ssrn.com/abstract=3772475

Adam, Christopher S., and David L. Bevan. "Fiscal Deficits and Growth in Developing Countries." Journal of Public Economics 89, no. 4 (2005): 571-597.

Bachas, Pierre, Lucie Gadenne, and Anders Jensen. "Informality, consumption taxes, and redistribution." *Review of Economic Studies* (2023): rdad095.

Badinger, Harald. "Output Volatility and Economic Growth." Economics Letters 106, no. 1 (2010): 15-18.

Baldacci, Emanuele, Benedict Clements, Sanjeev Gupta, and Qiang Cui. "Social Spending, Human Capital, and Growth in Developing Countries." World Development 36, no. 8 (2008): 1317-1341.

Banerjee, Abhijit V., and Esther Duflo. "Inequality and Growth: What Can the Data Say?" Journal of Economic Growth 8 (2003): 267–299. https://doi.org/10.1023/A:1026205114860.

Banerjee, Abhijit V., et al. "Inequality, Control Rights and Rent Seeking: Sugar Cooperatives in Maharashtra." Journal of Political Economy 109, no. 1 (2001): 138-190.

Barro, Robert J. "Government Spending in a Simple Model of Endogenous Growth." Journal of Political Economy 98, no. S5 (1990): S103-S125.

Barro, Robert J. "Inequality and Growth in a Panel of Countries." Journal of Economic Growth 5 (2000): 5–32. https://doi.org/10.1023/A:1009850119329.

Barro, Robert J., and Xavier Sala-i-Martin. "Public Finance Models of Economic Growth." Review of Economic Studies 59 (1992): 645-661.

Benedek, Dora, Ernesto Crivelli, Sanjeev Gupta, and Pranvera Muthoora. "Foreign Aid and Revenue: Still a Crowding Out Effect?" Public Finance Analysis 70, no. 1 (2014).

Berg, Andrew, Jonathan D. Ostry, Charalambos G. Tsangarides, et al. "Redistribution, Inequality, and Growth: New Evidence." Journal of Economic Growth 23 (2018): 259–305. https://doi.org/10.1007/s10887-017-9150-2.

Besley, Timothy, and Torsten Persson. "The Origins of State Capacity: Property Rights, Taxation, and Politics." American Economic Review 99, no. 4 (2009): 1218-1244.

Besley, Timothy, and Torsten Persson. Pillars of Prosperity: The Political Economics of Development Clusters. Princeton: Princeton University Press, 2011.

Besley, Timothy, and Torsten Persson. "Taxation and Development." In Handbook of Public Economics, Vol. 5, edited by Alan J. Auerbach, Raj Chetty, Martin Feldstein, and Emmanuel Saez. North Holland, 2013.

Besley, Timothy, and Torsten Persson. "Why Do Developing Countries Tax So Little?" Journal of Economic Perspectives 28, no. 4 (2014a): 99-120.

Besley, Timothy, and Torsten Persson. "The Causes and Consequences of Development Clusters: State Capacity, Peace, and Income." Annual Review of Economics 6 (2014b): 927-49.

Burgess, Robin, and Nicholas Stern. "Taxation and Development." Journal of Economic Literature 31, no. 2 (1993): 762-830.

Card, David, Alexandre Mas, and Jesse Rothstein. "Tipping and the Dynamics of Segregation." The Quarterly Journal of Economics 123, no. 1 (2008): 177-218.

Chudik, Alexander, Kamiar Mohaddes, M. Hashem Pesaran, and Mehdi Raissi. "Is There a Debt-Threshold Effect on Output Growth?" Review of Economics and Statistics 99, no. 1 (2017): 135-150.

Cornia, Giovanni Andrea, Juan Carlos Gómez-Sabaíni, and Bruno Martorano. "A New Fiscal Pact, Tax Policy Changes and Income Inequality." WIDER Working Paper 2011/70. Helsinki: UNU-WIDER, 2011.

de la Croix, David, and Matthias Doepke. "Inequality and Growth: Why Differential Fertility Matters." American Economic Review 93, no. 4 (2003): 1091-1113.

Eberhardt, Markus, and Andrea F. Presbitero. "Public Debt and Growth: Heterogeneity and Non-Linearity." Journal of International Economics 97, no. 1 (2015): 45-58.

Fatás, Antonio, and Ilian Mihov. "Policy Volatility, Institutions, and Economic Growth." The Review of Economics and Statistics 95, no. 2 (2013): 362-376.

Galor, Oded, and Joseph Zeira. "Income Distribution and Macroeconomics." The Review of Economic Studies 60, no. 1 (1993): 35-52. https://doi.org/10.2307/2297811.

Gaspar, Vitor, Laura Jaramillo, and Philippe Wingender. "Tax Capacity and Growth: Is There a Tipping Point?" Working Paper 16/234, International Monetary Fund, Washington, DC, 2016.

Gordon, Roger, and Wei Li. "Tax Structures in Developing Countries: Many Puzzles and a Possible Explanation." *Journal of Public Economics* 93, no. 7 (2009): 855-866.

Jaimovich, Nir, and Sergio Rebelo. "Nonlinear Effects of Taxation on Growth." Journal of Political Economy 125, no. 1 (2017): 265-291.

Jensen, Anders Ditlev. "State-Building in Resource-Rich Economies." Atlantic Journal of Economics 39 (2011): 171-193.

Jensen, Anders. “Employment structure and the rise of the modern tax system.” *American Economic Review* 112, no. 1 (2022): 213-234.

Jones, Larry E., Rodolfo E. Manuelli, and Peter E. Rossi. "Optimal Taxation in Models of Endogenous Growth." *The Journal of Political Economy* 101, no. 3 (1993): 485-517.

Jousten, Alain; Mansour, Mario; Jankulov Suljagic, Irena; Vellutini, Charles. "Labor Taxation in the Western Balkan: Looking Back and Forward." Working Paper 2022/239, International Monetary Fund, Washington, DC, 2022.

Kaldor, Nicholas. "A Model of Economic Growth." The Economic Journal 67, no. 268 (1957): 591-624. https://doi.org/10.2307/2227704.

Kharroubi, Enisse. "Crises, Volatility, and Growth." The World Bank Economic Review 21, no. 3 (2007): 439-460.

King, Robert G., and Sergio Rebelo. "Public Policy and Economic Growth: Developing Neoclassical Implications." Journal of Political Economy 98, no. 5 (1990): S126-S150.

Kiser, Edgar, and Margaret Levi. "Interpreting the Comparative History of Fiscal Regimes." In Fiscal Regimes and the Political Economy of Premodern States, edited by Andrew Monson and Walter Scheidel, 557-571. Cambridge, UK; New York, NY: Cambridge University Press, 2015.

Kleven, Henrik, Claus Thustrup Kreiner, and Emmanuel Saez. "Why Can Modern Governments Tax So Much? An Agency Model of Firms as Fiscal Intermediaries." NBER Working Paper No. 15218, 2009.

Kraay, Aart, Benoît Decerf, Dean Jolliffe, Christoph Lakner, Berk Özler, Olivier Sterck, and Nandini Yonzan. "A New Distribution Sensitive Index for Measuring Welfare, Poverty, and Inequality." Washington DC: World Bank, 2023.

Lazear, Edward P., and Sherwin Rosen. "Rank-Order Tournaments as Optimum Labor Contracts." Journal of Political Economy 89, no. 5 (1981): 841-864. http://www.jstor.org/stable/1830810.

Lee, Young, and Roger H. Gordon. "Tax Structure and Economic Growth." Journal of Public Economics 89, no. 5-6 (2005): 1027-1043.

Levi, Margaret. Of Rule and Revenue. Berkeley and Los Angeles, CA: University of California Press, 1988.

Martorano, Bruno. "Taxation and Inequality in Developing Countries: Lessons from the Recent Experience of Latin America." Journal of International Development 30, no. 2 (2018): 256-273. https://doi.org/10.1002/jid.3350.

Mumtaz, Haroon, and Florian U. Ruch. "Policy Uncertainty and Aggregate Fluctuations: Evidence from Emerging and Developed Economies." World Bank Policy Research Working Paper 10564. Washington, DC: World Bank, 2023.

Piketty, Thomas. Capital in the Twenty-First Century. Cambridge, MA: The Belknap Press of Harvard University Press, 2014.

Prinsloo, Z., Aart Kraay, Christoph Lakner, Benoît Decerf, Dean M. Jolliffe, Olivier Sterck, and Nandini Yonzan. "Updated Estimates of the Prosperity Gap." World Bank Data Blog. Washington, DC: World Bank, 2023.

Ramey, Garey, and Valerie A. Ramey. "Cross-Country Evidence on the Link Between Volatility and Growth." The American Economic Review 85, no. 5 (1995): 1138-1151.

Reinhart, Carmen M., and Kenneth S. Rogoff. "Growth in a Time of Debt." American Economic Review 100, no. 2 (2010): 573-578.

Tanzi, Vito. "Structural Factors and Tax Revenue in Developing Countries: A Decade of Evidence." In Open Economies: Structural Adjustment and Agriculture, edited by Ian Goldin and L. Alan Winters. Cambridge: Cambridge University Press, 1992.

Tsounta, Evridiki, and Anayochukwu Osueke. "What is Behind Latin America's Declining Income Inequality?" IMF Working Paper No. 14/124, 2014. Available at SSRN: https://ssrn.com/abstract=2480273.

World Bank. *Poverty and Shared Prosperity 2022: Correcting Course*. Washington, DC: World Bank, 2022.

Table 1 Data

Variable	Description	Source
Tax to GDP	Tax revenue including social security contributions as a percent of GDP	Government Finance Statistics, IMF
Grants revenue to GDP	Revenue received under a grant agreement as a percent of GDP	Government Finance Statistics, IMF
Other revenue to GDP	Non-tax revenue as a percent of GDP	Government Finance Statistics, IMF
Debt to GDP	General government gross debt to GDP as a percent of GDP	World Economic Outlook, IMF
Education and health spending to GDP	Expenditure on health and education as a percent of GDP	Government Finance Statistics, IMF
Real GDP per capita	Gross domestic product (per capita) in USD using 2015 prices and market exchange rates	World Development Indicators, World Bank
Prosperity gap	Average factor by which individuals' incomes must be multiplied to attain a prosperity standard of $25 per day for all.	Kraay et al (2023)
Investment to GDP	Gross fixed capital formation as a percent of GDP	World Development Indicators, World Bank
Resource rich dummy	Dummy equal to 1 for resource rent to GDP above 90th percentile (i.e., natural resource rent to GDP above 19.4 percent)	World Development Indicators and authors calculations
Output volatility	Average standard deviation of quarterly real GDP growth, year-on-year	Haver Analytics
Annual population growth (%)	Population growth	World Development Indicators, World Bank

Source: Authors' calculations.

Table 2 Descriptive Statistics

Variable	Mean	Median	Interquartile range	Standard deviation	Minimum	Maximum	Number of observations
10-year ahead cumulative real GDP growth per capita	19.9	19.7	22.8	20.5	-102.8	98.2	2619
15-year ahead cumulative real GDP growth per capita	31.0	30.0	28.7	25.1	-85.8	111.7	1939
10-year ahead prosperity gap	1.6	1.1	1.1	1.4	0.4	8.0	877
15-year ahead prosperity gap	1.5	1.0	1.0	1.3	0.4	8.0	740
Tax (including social security contributions) to GDP	23.3	22.4	18.3	11.2	0.1	48.1	4085
Grant revenue to GDP	1.8	0.2	1.2	5.5	-0.7	126.6	3578
Non-tax revenue to GDP	5.9	3.9	4.0	8.2	0.0	100.6	3604
Government debt to GDP	55.5	47.6	39.7	38.9	0.0	488.5	3355
log real GDP per capita	8.9	9.0	2.2	1.4	5.4	11.6	3986
Health and education spending to GDP	8.3	8.4	6.2	4.2	0.2	31.1	2332
Prosperity gap	1.9	1.2	1.6	1.9	0.4	18.5	1066
Fixed investment to GDP	23.3	22.5	6.9	6.9	-2.4	78.0	3521
Direct tax share of total taxes	46.8	47.4	31.6	20.0	0	95.9	3545
10-year ahead growth volatility	6.5	4.8	4.9	5.3	0.8	55.2	1494
10-year ahead government consumption volatility	8.7	4.6	7.5	9.7	0.8	68.1	1195

Source: Authors' calculations.

Note: For comparability with the main results of this paper we remove the 99th percentile from tax (including social security contributions) to GDP.

Table 3 Growth and tax threshold

	10-year ahead cumulative growth 12.4% threshold			10-year ahead prosperity gap 13.3% threshold		
	OLS	TWFE	TWFE excluding resource rich	OLS	TWFE	TWFE excluding resource rich
Tax threshold	27.54***	47.76***	56.46***	-1.695	-3.947***	-3.947***
	[3.067]	[8.952]	[11.64]	[1.547]	[1.468]	[1.468]
Tax to GDP	2.600***	3.152***	3.580***	-0.178	-0.269**	-0.269**
	[0.285]	[0.576]	[0.827]	[0.131]	[0.113]	[0.113]
Tax threshold * Tax to GDP	-0.199***	-0.905***	-1.085***	-0.0987***	-0.0110	-0.0110
	[0.0419]	[0.253]	[0.283]	[0.00609]	[0.00696]	[0.00696]
Other revenue to GDP		-0.0389	-0.0509		-0.0386***	-0.0386***
		[0.155]	[0.189]		[0.0144]	[0.0144]
Grants revenue to GDP		-0.0717	-0.0526		-0.0587	-0.0587
		[0.210]	[0.250]		[0.0372]	[0.0372]
Debt to GDP		0.168***	0.194***		-0.0161*	-0.0161*
		[0.0251]	[0.0274]		[0.00882]	[0.00882]
Tax threshold * Debt to GDP		0.0851***	0.0940***		-0.000867	-0.000867
		[0.0184]	[0.0197]		[0.00125]	[0.00125]
Investment to GDP		-0.117	-0.0260		0.0204***	0.0204***
		[0.0865]	[0.0986]		[0.00706]	[0.00706]
Population growth		-0.635*	-0.764*		0.210***	0.210***
		[0.334]	[0.421]		[0.0434]	[0.0434]
GDP per capita		-57.11***	-54.03***		-1.371***	-1.371***
		[6.091]	[6.452]		[0.241]	[0.241]
Constant	-2.046	506.9***	477.2***	6.378***	18.97***	18.97***
	[2.766]	[54.52]	[57.39]	[1.531]	[2.748]	[2.748]
Observations	2,619	1,449	1,334	877	486	486
R-squared	0.037	0.841	0.827	0.521	0.976	0.976
F stat	36.29	30.71	22.65	204.4	14.12	14.12
Number of countries	154	116	104	57	40	40

Source: Authors' calculations.

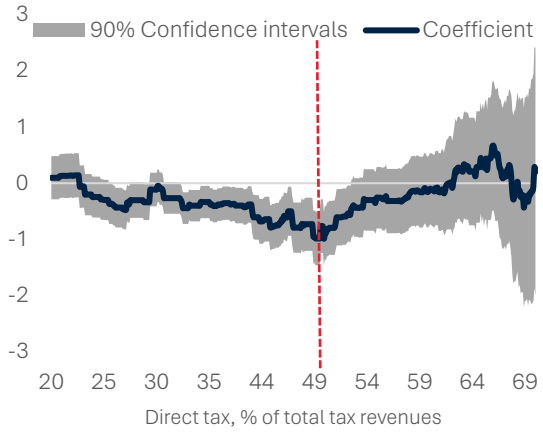
Note: OLS = ordinary least squares; TWFE = two-way fixed effects. Tax includes social security contributions. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Annex A: Threshold model results on progressivity, prosperity gap.

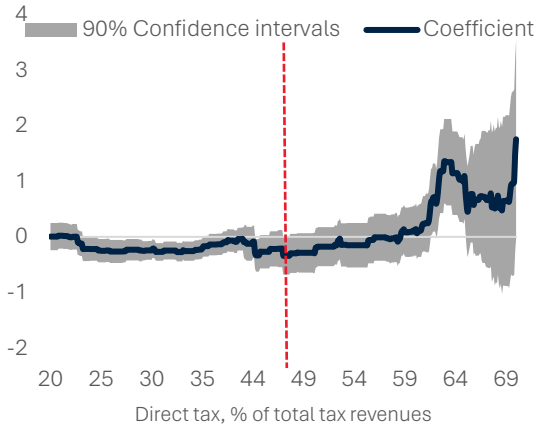
We examine the impact of progressivity, measured by the share of direct tax in total tax revenues, on the prosperity gap. This analysis employs the threshold regression model as outlined in equation 1, with a key modification: we replace the cutoff based on the overall tax ratio with the direct tax share. In this modified model, the direct tax share serves as the explanatory variable, replacing tax to GDP. The results suggest that when the share of direct tax in total tax revenues exceeds 40 percent, its impact on the prosperity gap begins to materialize, with the optimal threshold hovering around 50 percent. Specifically, for the 10-year-ahead prosperity gap, the threshold dummy coefficient is minimized at 49.9 percent (Figure A1).

Figure A1: Progressivity tipping point with prosperity gap

A.10-year ahead prosperity gap



B. 15-year ahead prosperity gap



Sources: Authors' calculations.

Note: The figure provides an estimation of the coefficient on the direct tax to total tax share threshold dummy as described in Annex A. The sequence of the figures represents the impact on n-year ahead prosperity gap: the left figure pertains to a 10-year period, and the right figure to a 15-year period. Dashed red line indicates the optimal threshold value.

Annex B: Event study

Table B1: Country-year list of change in income status

From low to lower middle-income group		From lower-middle to upper-middle income group		From upper-middle income to high income group	
Country	**Year**	**Country**	**Year**	**Country**	**Year**
AGO	2004	AGO	2011	ABW	1994
ALB	1998	ALB	2012	ANT	1994
ARM	2002	ARG	1991	ARG	2017
AZE	2003	ARM	2017	ATG	2012
BEN	2019	AZE	2009	BHR	2001
BGD	2014	BGR	2006	BRB	2006
BIH	1998	BIH	2008	CHL	2012
BTN	2006	BLR	2007	CYP	1988
CHN	1999	BLZ	2021	CZE	2006
CIV	2008	BRA	2006	EST	2006
CMR	2005	BWA	1997	GNQ	2007
COG	2005	CHL	1993	GRC	1996
COM	2018	CHN	2010	GUM	1995
EGY	1995	COL	2008	HRV	2017
GEO	2003	CRI	2000	HUN	2014
GHA	2010	CUB	2007	IMN	2002
GNQ	1997	CZE	1994	KNA	2011
GUY	1997	DMA	1999	KOR	2001
HND	1999	DOM	2008	LTU	2012
HTI	2020	DZA	2008	LVA	2012
IDN	2003	ECU	2010	MAC	1994
IND	2007	EST	1997	MLT	2002
KEN	2014	FJI	2012	MNP	2007
KGZ	2013	GEO	2018	MUS	2019
KHM	2015	GRD	1997	NCL	1995
LAO	2010	GTM	2017	NRU	2019
LKA	1997	GUY	2015	OMN	2007
LSO	2005	HRV	1995	PAN	2021
MDA	2005	IDN	2019	PLW	2016
MDV	1993	IRN	2009	POL	2009
MMR	2014	IRQ	2012	PRI	2002
MNG	2007	JAM	2007	PRT	1994
MRT	2012	JOR	2017	ROU	2021
NGA	2008	KAZ	2006	RUS	2012
NIC	2005	LBN	1997	SAU	2004
NPL	2019	LCA	1992	SVK	2007
PAK	2008	LKA	2018	SVN	1997

PNG	2008	LTU	2001	SYC	2014
SDN	2007	LVA	2001	TTO	2006
SEN	2018	MDA	2020	URY	2012
SLB	2010	MDV	2010	VEN	2014
SSD	2013	MEX	1990		
STP	2008	MHL	2012		
TJK	2020	MKD	2008		
TKM	2000	MNG	2014		
TLS	2007	MUS	1992		
TZA	2019	MYS	1992		
UKR	2002	NAM	2008		
UZB	2009	PAN	1998		
VNM	2009	PER	2008		
YEM	2009	POL	1996		
ZMB	2010	PRY	2014		
ZWE	2018	ROU	2005		
		RUS	2004		
		SUR	2007		
		SVK	1996		
		THA	2010		
		TKM	2011		
		TON	2016		
		TUN	2010		
		TUR	2004		
		TUV	2011		
		VCT	2003		
		VEN	1997		
		WSM	2016		
		XKX	2018		
		ZAF	2004		

Source: Authors' calculations.

Note: Due to limited data availability on tax ratios, we only consider following economies: **For low to lower-middle income transition**: AGO, BGD, BTN, COG, GEO, GHA, IND, KEN, KHM, LAO, LKA, LSO, MDA, MDV, MMR, MNG, NGA, NIC, NPL, PAK, SEN, STP, UKR, VNM, YEM, ZMB, ZWE; **for lower-middle to upper-middle income transition**: AGO, ALB, ARG, ARM, AZE, BGR, BIH, BLR, CHL, CHN, COL, DOM, DZA, EST, FJI, GEO, GTM, HRV, IDN, JAM, JOR, LBN, LKA, LTU, LVA, MDA, MDV, MEX, MHL, MNG, NAM, PER, POL, PRY, ROU, RUS, SUR, SVK, THA, TON, TUN, VCT, WSM, XKX, ZAF; **for upper-middle income to high transition**: ARG, ATG, BHR, BRB, CHL, CZE, EST, GNQ, GRC, HRV, HUN, KNA, LTU, LVA, MLT, MUS, NRU, OMN, PAN, PLW, POL, PRT, ROU, RUS, SVK, SVN, SYC, TTO, URY.