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Progress of the Personal Income Tax in Emerging and Developing Countries

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ABSTRACT: Personal Income Tax (PIT) is one of the key sources of revenues in Advanced Economies (AEs) but plays a much more limited role in Low-Income Developing Countries (LIDCs) and Emerging Market Economies (EMEs), both in terms of revenue and redistributive impact. Notwithstanding, this paper shows that LIDCs and EMEs increased their PIT-to-GDP revenue by 110 and 48 percent, respectively, during the 1990-2019 period, a marked improvement in the PIT revenue performance. We find that this rise was driven primarily by economic developments and to a lesser extent by changes in the design of PIT systems. We also find that LIDCs that improved their tax-to-GDP ratios relied on a broader set of tax instruments and not exclusively on the PIT, suggesting that a successful revenue mobilization strategy of developing countries requires a comprehensive approach covering a wider range of taxes. Finally, using a newly assembled dataset of PIT characteristics of 157 countries over the 2006-2018 period, we estimate a novel redistribution index of the PIT in LIDCs. We show that the contribution of the PIT to inequality reductions has been significant.

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WORKING PAPERS

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Contents

I. Introduction

In Advanced Economies (AEs), the personal income tax (PIT) raised revenue averaging 8.6 percent of GDP in 2019 and plays an important role in income redistribution. In Low-Income Developing Countries (LIDCs) the role of the PIT remains modest, with an average revenue of 2.1 percent of GDP in 2019 and a limited redistributive impact. This is largely because in LIDCs, the PIT has been narrowly focused on a relatively small segment of the population, usually employees in the public sector or working for a limited number of large multinational businesses. A large share of self-employed, often operating in agriculture or the informal sector, is often not taxed under the PIT in these countries. In Emerging Market Economies (EMEs), the PIT is also relatively modest, with average revenue at just 3.1 percent of GDP.

Against this backdrop, however, the dynamics of the PIT in LIDCs and EMEs over the last decades have been remarkable. The revenue growth of the PIT in these country groups has outpaced that of AEs in a period which was characterized by important developments, chief among them, improved economic growth. PIT revenue in LIDCs grew on average from 1 percent of GDP in 1990 to 2.1 percent in 2019; in EMEs, this ratio grew from 1.9 to 3.1 percent of GDP in the same period; the revenue ratio of PIT in AEs, in contrast, fell from 9.6 to 8.6 percent of GDP. Interestingly, this evolution in LIDCs and EMEs is reminiscent of the PIT's historical trend in AEs: after a slow uptake in the 19th century as an essentially low-rate flat tax, the PIT there grew considerably over the 20th century, both in terms of revenue and progressivity.

This paper analyzes three related issues associated with the growth in PIT revenue in LIDCs and EMEs. First, it examines the main drivers of PIT growth, distinguishing between structural economic factors and policy changes, focusing on the period 2006–2018. Second, the paper explores whether a higher PIT share in total revenue is positively associated with overall revenue performance, which reflects the extent to which additional revenue is due to improvements in PIT. Finally, the paper assesses the extent to which the growth of PIT revenue has contributed to combating inequality, given the generally progressive nature of the tax. To that end, we use a novel index of redistributive capacity.

Our findings are threefold. First, we find that the rise in PIT revenue in LIDCs and EMEs is largely associated with endogenous changes in the economy such as the increase in GDP per capita (a measurement of the development of countries which is also strongly correlated with the quality of institutions), a growing size of the public sector wage bill, and a decreasing size of the agriculture and self-employment, both measures that are associated with the size of the informal sector. Together, these factors are associated with a sizable net positive impact on PIT revenue in LIDCs and EMEs between 2006 and 2018. But policy changes, such as the PIT's liability threshold, the lowest non-zero marginal rate, and the top PIT rate also explain a statistically significant but negative variation of PIT revenue in LIDCs and EMEs, which would be expected given the observed reductions in the PIT lowest non-zero and top marginal rates.

The second finding is that there is generally a positive association between the share of PIT within the tax structure and the level of total tax revenue collection. Hence, revenue increases are more than proportional due to improvements in PIT collection. However, this positive association is weaker in LIDCs than in EMEs and AEs, suggesting that revenue gains in LIDCs have relied relatively more on other taxes than on PIT. Hence, developing countries will initially rely on other taxes (such as indirect taxes and trade taxes) as their main source of additional revenue and, as they develop, gradually expand reliance on the PIT. Again, this is reminiscent of the development of the PIT in AEs, which reached prominence as a revenue provider only in the later phases of economic development.

The third result is that the redistributive power of the PIT, while non-negligible, is lower than in AEs and comparable to that of EMEs. This is because the *size* of the PIT in these countries (as measured by the ratio of revenue over GDP) is still much smaller than in AEs. In terms of policy design, however, the PIT is relatively progressive in LIDCs, contrary to common belief and in contrast to many EMEs where this is not the case.

Throughout the paper we use an assembled dataset of PIT characteristics of 157 countries over the 2006–2018 period, covering revenue data and tax design data (inter alia, rates, thresholds, deductions, and tax credits).

The rest of the paper is structured as follows. Section II reviews PIT design issues in the context of LIDCs and EMEs. Section III analyzes the main economic and policy determinants of PIT revenue performance across various country groups, and the correlation of tax structures and tax revenue performance. Section IV examines the redistributive effect of the PIT in LIDCs and EMEs using a novel index of redistributive capacity based on simulated microdata. Section V offers concluding remarks.

II. The PIT in LIDCs and EMEs

The PIT is levied on individual or household income. The primary forms of taxable income are earnings from employment, income from self-employment, profits from unincorporated businesses (sole proprietors) and returns to capital (interest, dividends, rents, royalties, or capital gains). Importantly, the PIT not only raises revenue to finance the government -- it is also a key instrument in addressing equity concerns through income redistribution. On the other hand, by taxing income, the PIT creates efficiency costs by distorting individuals' decisions: it influences incentives to work, avoid or evade taxes; invest in skills, save; and it can also affect how individuals decide to invest, if returns from different sources of income are treated differently for tax purposes. These responses can vary across countries depending on the quality of the institutions and their capacity to enforce taxes. This is of particular importance in LIDCs, where avoidance and evasion responses by high earners might be of greater concern given the institutional difficulties to enforce the PIT (Saez, Slemrod, and Giertz 2012). Importantly, PIT can be designed to be progressive to serve equity. But high tax rates also create distortions and such efficiency concerns put a limit on design features of the PIT. The task for governments is to find the right balance of this trade-off.

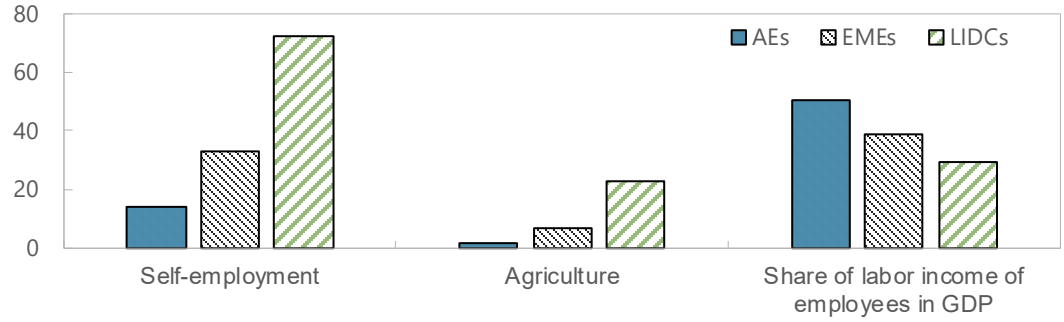
What PIT design for LIDCs and EMEs?

The capacity of the tax administration to enforce tax rules and the underlying economic structure are critical considerations for the design of the PIT. LIDCs and EMEs are markedly different from AEs, and these differences go beyond the levels of per capita income. LIDCs and EMEs are characterized by a larger share of self-employment, agricultural sector, and a smaller share of labor income earned by employees (Figure 1). LIDCs are also characterized by lower literacy levels and less developed institutional arrangements to measure income and enforce taxes (Ahmad and Stern 1989). These characteristics are also prevalent in EMEs, although to a lesser extent than in LIDCs. Regarding administrative capacity in LIDCs, the International Survey on Revenue Administration (ISORA)[2] provides a qualitative and thorough depiction of how revenue administrations are organized, distinguished by development groups. The evidence gathered by that survey shows that higher-income countries have the lowest cost of collection (0.89 currency units to collect 100 currency units, versus 1.10 for lower-income countries) as they are better able to take advantage of automation and economies of scale (Crandall, Gavin, and Masters 2019).

[2] See: https://data.imf.org/?sk=BA91013D-3261-42F8-A931-A829A78CB1EC

Figure 1. Self-employment, Agriculture and Urbanization (2019)

(As a share of total employment, GDP and total population respectively)



Source: IMF staff calculations based on WEO and ILO data

The economic characteristics of developing countries are associated with a higher level of a parallel, low productivity sector also known as the informal economy, which potentially affects the compliance behavior of individuals and the ability of governments to collect PIT (Kanbur 2014; Joshi, Prichard, and Heady 2014, Slemrod and Kopczuk 2002). In this regard, for instance, it is not uncommon for many governments in LIDCs to exempt income from agriculture, thereby limiting the PIT's coverage.

Revenue enhancing tax mix

A related question is about which tax structure mobilizes revenue the most efficiently. All taxes generate distortions but in a context of limited institutional capacity, income taxes could have higher efficiency costs and be more easily evaded and avoided, making other tax instruments more desirable on efficiency grounds (Gordon and Li 2009; Boadway, Marchand, and Pestieau 1994). Indeed, some empirical studies have ranked taxes relative to their effects on growth[3] and found that consumption taxes tend to be more growth friendly, a consideration that can be particularly important for LIDCs. We address this question quantitatively below (Section III.D), but a general lesson from the international policy experience is that a properly designed PIT can help to raise additional revenue and can benefit progressivity while minimizing efficiency impacts hampering growth. In some AEs the PIT's growth-friendliness has been shown to be on par with that of the VAT, indicating that when adequately designed and enforced, the PIT's negative effects on growth can be managed (IMF 2021a).

A particularly important policy lesson for LIDCs is that the economic and institutional structure of a country largely constrains the design and role of the PIT. An assumption consistent with the international experience is that as countries develop,[4] the tax base on which the PIT is levied increases, with technological[5] and institutional advancements enabling tax administrations to better monitor the tax base, particularly of self-

[3] In this ranking, property taxes are the most growth-friendly taxes, but these require heavy upfront investments and a strong institutional framework. For further reference see: (Acosta-Ormaechea and Yoo 2012; Arnold et al. 2011)

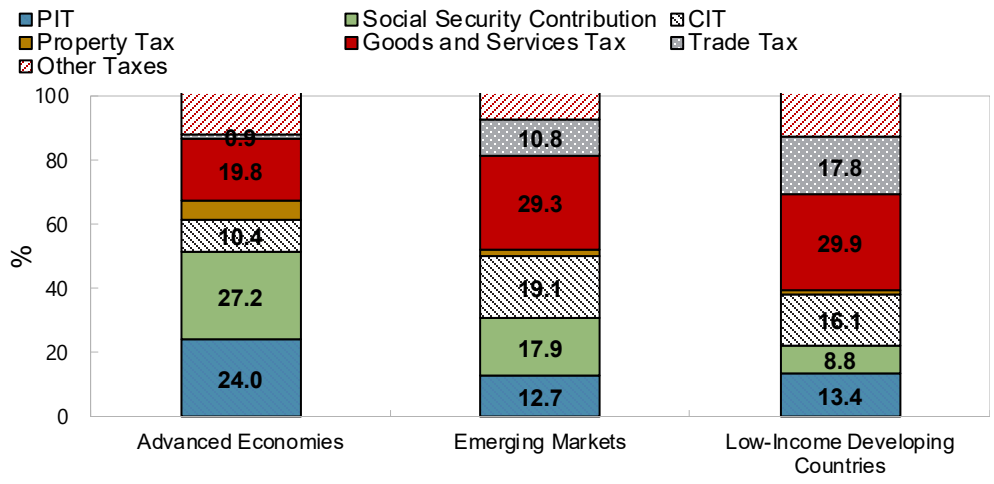
[4] Besley and Persson 2014 argue that current developing countries are not so different, in terms of tax-to-GDP ratios and tax structures, from advanced economies at a similar stage of development.

[5] In particular, digitalization can help overcome information constraints to verify the true economic outcomes of taxpayers (earnings, capital income, consumption expenditures, gifts, and bequests) by linking existing information in various parts of the tax system to third-party reporters. This would allow for better detection of evasion or avoidance. Digitalization can also allow governments to implement more sophisticated tax systems that improve the equity-efficiency trade-offs by improving distributional outcomes and foster more efficient tax systems (Gupta et al. 2017).

employed which represent a large share of total employment in developing countries. This leads to improved compliance which, if accompanied by better-quality policy design, can lead to improved revenue performance and progressivity. This view of the PIT across time reflects the historical account of its development in AEs, where the PIT was introduced as a permanent major tax instrument only once the required, relatively costly, conditions for adequate administration and compliance were fulfilled (Box 1). From that perspective, LIDCs and EMEs seem to be following the same sequence of, first, relying on indirect taxation, and, next, only gradually developing the PIT. This is consistent with the current structure of revenue collection, where indirect taxes raised 47.7 (LIDCs) and 40.1 (EMEs) percent, and PIT raised 13.4 (LIDCs) and 12.7 (EMEs) percent of total tax and social security contribution (SSCs) revenues in 2019 (Figure 2). It should be noted, however, that the progression of the PIT has not always been straightforward across groups. Some EMEs feature single flat rate PITs (and some resource rich countries have yet to levy a PIT) as did AEs in the early stages of their PIT implementation, while several LIDCs leapfrogged towards progressive PIT designs from the start.

Figure 2. Average Tax Revenue Mix by Development Group, 2019 or Latest Year Available

(As a share of total tax and social security contribution revenue)



Source: IMF staff calculation based on WoRLD

Box 1. Brief History of the PIT in Advanced Economies

The history and context in which the PIT was first implemented in present-day AEs offers valuable insights. The mid-nineteenth century saw the gradual introduction of the income tax as a permanent addition to Europe and the United States' tax system. Until then, tax revenue was predominantly sourced from indirect taxes on domestic and international trade. In 1842 the UK was the first industrialized nation to consolidate the PIT into its fiscal arsenal. Switzerland was the last to follow suit in 1939. This initial wave of income tax reforms primarily responded to mounting public spending pressure (not least as a result of late nineteenth century wars and World War I) but it was made possible by declining costs of collection, thanks to the introduction of modern accounting, improved public administration, urbanization and better education (Aidt and Jensen 2009; Colliard and Montialoux 2007).

These first-generation income taxes placed little emphasis on redistribution. The British income tax, for instance, remained a flat rate tax for 65 years after its introduction. That changed dramatically in the early twentieth century, with a sharp increase in income tax progressivity in most developed nations. In 1920, France adopted a top marginal income tax rate of 50 percent (from 2 percent in 1915); in the United States, the top marginal tax reached 67 percent in 1917 (from 7 percent in 1913). Similar increases in progressivity were introduced in Germany, Sweden and the UK at the turn of the century.

On the eve of World War II, the PIT had become the predominant tax in many advanced economies. In 1939, it contributed 44 percent of tax revenue in the US and 47 percent in Germany. It was also a key contributor to the tax system's progressivity in most countries. In parallel, the development of the welfare state in many industrialized countries during this period (the French and British universal health care systems, for instance, were developed after 1945) can be viewed as an additional component of a more comprehensive approach to progressivity. In fact, social spending programs in advanced economies played a key role in the success of the PIT as they provided incentives to non-salaried workers to comply with, and be included in, the formal system. Today, the role of social spending continues to loom large in AEs.

The PIT in EMEs and LIDCs came later. It was not until 1950 that two thirds of countries considered EMEs had introduced the PIT as part of their tax system. An equivalent share was not reached by LIDCs until 1990 (Seelkopf et al. 2019). Moreover, the role of the PIT within the broader tax system was viewed differently in EMEs and LIDCs relative to AEs, with a greater emphasis on neutrality as opposed to progressivity (Goode 1993; Rom and Miller 2018) and in many cases in response to fiscal crises and the need to raise revenue quickly (Bahl and Bird 2008; Bird and Zolt 2005).

III. The Economic and Policy Drivers of PIT Revenue

A. The Revenue Trends of the PIT (1990-2019)

The role of the PIT has been steadily increasing in LIDCs and EMEs. In LIDCs, the PIT to GDP ratio doubled in two decades, from 1 percent in 2000 to 2.1 percent in 2019. In EMEs it increased by almost half from 2.1 percent to 3.1 percent of GDP over the same period. In other words, the PIT plays a modest role in LIDCs and EMEs compared to AEs, but the difference in collection has been narrowing. The PIT is also less prominent within the tax mix relative to indirect taxes in developing countries, compared to AEs, where it represents about one third of the total tax revenue, excluding SSCs[6] (Figure 3 and Figure 4).

Two opposite trends have contributed to the narrowing differences relative to AEs. On the one hand, PIT revenue to GDP decreased slightly in AEs since 1990. On the other, it steadily improved in EMEs and LIDCs (Figure 3). Moreover, the relative importance of the PIT in the tax structure in developing and emerging

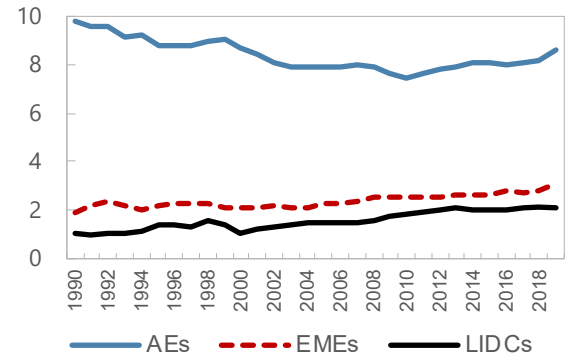
[6] SSCs are typically levied on labor income. Ordinarily, SSCs are earmarked toward financing individual benefits in old-age, sickness, unemployment, and family assistance. However, in some countries with developed safety nets, SSCs can in practice be indistinguishable from PIT if they are not associated with individual benefits. While in others, future benefits derived from SSCs are linked to individual lifetime contributions.

countries also increased during the last three decades, from 5 to 13 percent of total tax revenues in LIDCs (Figure 4) and from 14 to 16 percent in EMEs.

Interestingly, the PIT to GDP ratio growth in LIDCs has outpaced that of EMEs and AEs (Figure 5). Indeed, in 2019 LIDCs collected double the amount of PIT revenue collected in 1990, moreover, a sharp increase in the PIT's rate of growth is observed starting in 2007. The factors associated with this increase are the topic of Section III.C.

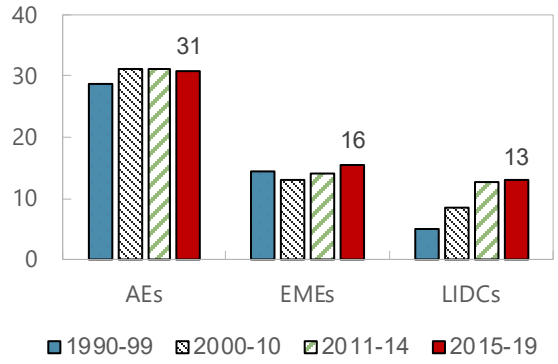
Figure 3. PIT Revenue (1990–2019)

(as a share of GDP)



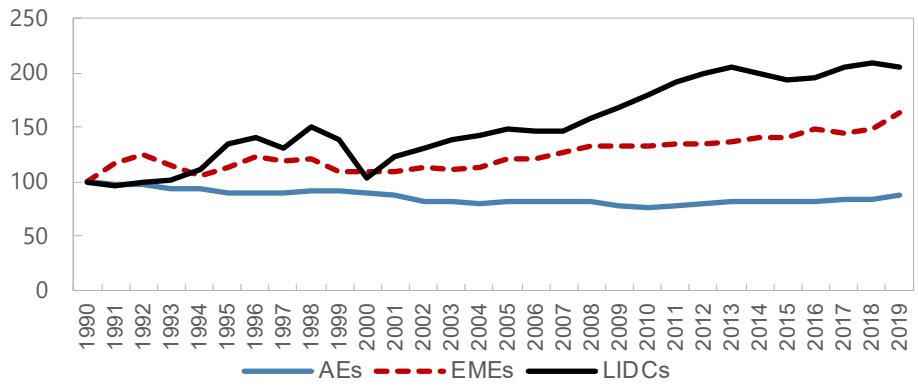
Source: IMF staff calculations based on WoRLD

Figure 4. PIT Revenue as a Share of Tax Revenue, Excluding SSCs



Source: IMF staff calculations based on WoRLD

Figure 5. PIT Revenue Growth Index 1990–2019 (1990=100)



Source: IMF staff calculations based on WoRLD

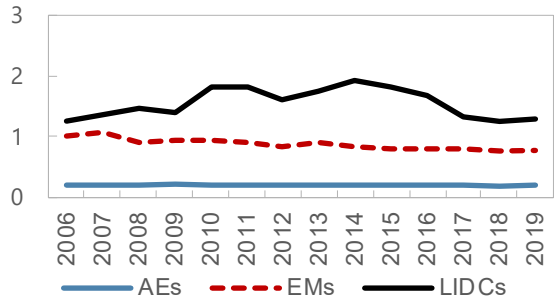
B. Key Changes in Measurable PIT Policy Variables

The PIT is levied on taxable income, that is, gross income adjusted for allowances. The standard or basic allowance exempts a certain level of income for all individuals, irrespective of their individual characteristics or family situation. It is also referred to as the PIT liability threshold and serves two important goals. First, it allows for a basic level of consumption to be income tax-free. Second, it excludes low-income individuals from the PIT. The basic allowance also lends some level of basic progressivity to the PIT, even in countries where the PIT only has a single rate (a "flat" rate), as is the case in 15 percent of sampled EMEs in 2020. In practice, other allowances of various kinds, generally justified on equity or efficiency grounds, can be found in most PITs

around the world. From a design perspective, all allowances can be given either as a deduction from taxable income or as a credit against PIT liability (Zee 2005).

The PIT liability threshold exhibits important differences among country groups (Figure 6). The threshold plays an important role of relieving the poorest individuals from PIT. On average, in LIDCs, an individual needs to earn at least 1.3 times GDP per capita to be liable for PIT (2019), contrasting with 0.8 in EMEs and 0.2 in AEs. In LIDCs, this threshold shows a higher degree of variation relative to the other two groups during the 2006-2019 period,[7] first increasing from 1.4 times GDP per capita in 2006 to a 1.9 maximum in 2014 and decreasing subsequently to 1.3 in 2019. The trend for the other two groups is more stable: for EME's it decreased gradually from 1.0 to 0.77. The effect of these changes on PIT revenue[8] is appraised in the following section.

Figure 6. Evolution of the PIT's Liability Threshold *(in multiples of GDP per capita)*



Source: IMF staff calculation based on EY and IBFD tax guides.

The PIT rates[9] also show a higher degree of variation in LIDCs. The average lowest non-zero marginal PIT rate declined during the last decade, going from approximately 12.8 percent in 2006 to 10.4 percent in 2019, as opposed to EMEs and AEs, where it was relatively stable (Figure 7). During the same period the top marginal rate slightly increased in AEs by 0.5 percentage points but declined for LIDCs and EMEs by 3.4 and one percentage point respectively (Figure 8).[10] Yet, AEs still levy the highest marginal PIT rates (39 percent), followed by LIDCs (29 percent) and EMEs (24 percent), where there has been an uptick in these rates during the last years.

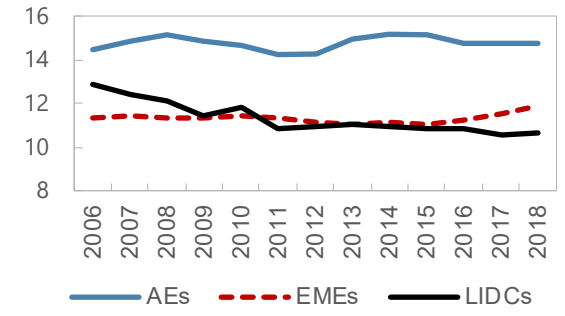
[7] In contrast to economic variables for which a longer period is available, the coverage of the policy variables spans from 2006 to 2019.

[8] A lower liability threshold is expected to be associated with more revenue, *ceteris paribus.*

[9] These are the marginal rates levied on labor income,

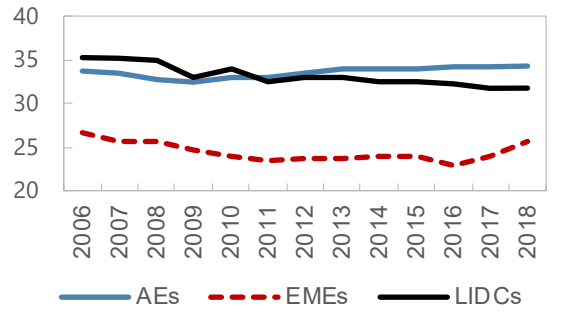
[10] (Klemm et al. 2018) explore the possible explanation for the global downward trend in top personal income tax rates over the last decades.

Figure 7. Average Non-zero Lowest Marginal PIT Rate
(in percent)



Source: IMF Staff calculation based on EY and IBFD Tax Guides.

Figure 8. Top Marginal PIT Rate
(in percent)



Source: IMF staff calculation based on WoRLD.

C. Disentangling the Economic from the Design Drivers of the PIT Revenue Performance

Specification and estimation

We study the drivers of PIT revenue with a focus on LIDCs and EMEs. PIT revenue is assumed to be a function of both variables depicting the economic characteristics (GDP per capita, share of agriculture in total GDP, etc.) and policy, or design, variables (thresholds, rates, definition of base, treatment of incomes, etc.) Consistent with data availability on the PIT design variables, we analyze the PIT revenue growth shown in Figure 5, statistically disentangling whether improvements in PIT revenue performance are associated with economic or policy changes, focusing on the 2006-2018 period.

To formally address this question, we use specification in Eq.1 to explain PIT-to-GDP ratios.

$$pit_{it} = \alpha_0 + \beta.\varepsilon_{it} + \beta.\varepsilon_{it} * eme_i + \beta.\varepsilon_{it} * lidc_i + \gamma.\tau_{it} + \gamma.\tau_{it} * eme_i + \gamma.\tau_{it} * lidc_i + eme_i + lidc_i + u_{it} \quad \text{(Eq.1)}$$

where pit_{it} is PIT revenue as a share of GDP (the PIT to GDP ratio) in year t and in country i and ε_{it} is a (column) vector of economic variables that influence the PIT's taxable base. The selection of the economic variables draws on theoretical factors that are expected to expand or hinder the PIT's revenue potential in emerging markets and developing countries.[11] Our choice of economic determinants are the natural logarithm of GDP per capita,[12] as it measures the general level of development (for example, it is correlated with better

[11] The selection of economic determinants is also informed by a large set of empirical studies that have focused on the determinants of tax revenue in developed and developing countries. These studies have used a wide array of economic, institutional, political, demographic, and cultural variables to assess a country's tax revenue capacity through regression and stochastic frontier analysis. The most often used economic variables are GDP or GNI per capita, trade, the share of agriculture in GDP, the share of urban population, rate of growth of the population, rate of change in prices, level of foreign debt, perception of corruption and other variables that measure the strength of government institutions, political preferences, and individuals' attitudes towards taxation (Lotz and Morss 1967; Stotsky and WoldeMariam 1997; Gupta 2007; Fenochietto and Pessino 2013; Bird, Martinez-Vazquez, and Torgler 2008; Caldeira et al. 2020)

[12] Logs are used to reflect the potential non-linearity of the effect of GDP per capita. A level specification combined with a quadratic term yields similar results.

institutions, higher efficiency in tax collection, lower levels of corruption) and income within a country; public wage bill as a share of GDP,[13] which represents an easy to tax sector; inflation, as it can be a source of "bracket creep", whereby taxpayers are pushed into higher income tax brackets without an increase in real wages or income if the average wage rises with inflation and the PIT's nominal schedule remains unchanged. These variables are expected to positively influence the levels of PIT revenue as a share of GDP. On the other hand, the share of agriculture and the size of self-employment attempt to capture hard to tax, low productivity sectors. These variables are expected to negatively affect PIT revenue. We include a dummy variable to account for natural resource producing countries as a robustness check. Previous studies have found a statistically significant and negative relationship between resource revenue and total domestic (non-resource) revenues (Crivelli and Gupta 2014). Hence, we would expect to find a negative relationship between PIT revenue and the resource-rich-countries.

Addressing next the influence of policy changes, τ_{it} is a column vector of exogenous design characteristics of the PIT such as the PIT's liability threshold (in multiples of GDP per capita), the PIT's minimum non-zero marginal rate, the PIT maximum marginal rate, and the income required to pay the maximum rate (in multiples of GDP per capita). We also include a dummy variable indicating whether countries allow SSC to be deducted from the PIT's base or not. The liability threshold, the top threshold (the income required to pay the top marginal rate), the SSC deduction dummy, are expected to have negative signs: the increase in the liability threshold exempts a larger share of the population from the tax; raising the top threshold lessens the tax burden for better-off individuals; SSC deduction reduces taxable income when income is earned.[14] Other included PIT design variables (minimum non-zero rate and the PIT maximum rate) are expected to exhibit a positive relation with PIT revenue.

Control variables included in the analysis are the collection levels of the CIT and VAT, both in percentage of GDP. Two opposite effects can be captured by these variables. The first is a substitution effect, i.e., higher revenue from these sources would reduce PIT revenue. For instance, countries could give greater prominence to taxing business income through the corporate tax instead of the PIT[15] (e.g., by applying CIT to partnerships or by favoring businesses organized as closely-held corporations). Similarly, countries may induce revenue-neutral reforms (perhaps using policies not captured by our policy variables above, such as itemized deductions or credits) by shifting the tax burden from the VAT towards PIT, for example. The second effect may point to complementarities in revenue collection. For instance, general improvements in tax administration can boost collections from CIT, VAT and PIT. These variables might thus capture variations in administrative capacity and information that determine the enforcement of the PIT. If this is the case, a positive relationship with the PIT would ensue. We include a government effectiveness estimate.[16] Typically, these types of measurements are strongly correlated with GDP per capita, as noted, therefore we include it as a robustness check of our main specification. We expect higher scores of government effectiveness to be associated with higher PIT to GDP ratios.

Finally, u_{it} is an idiosyncratic random and uncorrelated error term. We employ a lagged instrumental variable (IV) two stage least squares (2SLS) empirical strategy to address the simultaneity problem. The underlying argument is that the exclusion restriction is achieved since x_{it-1} precedes x_{it}, thus the relationship should run from x_{it-1} to the latter, which coupled with a high degree of autocorrelation in the covariates provides a basis to

[13] The share of income earned by employees was also tested in our initial specification. However, it was dropped due to the low level of variation that resulted from imputed values which were especially prevalent in LIDCs.

[14] This income could be taxed in the future as pension income.

[15] It should be noted that the differences in the integration of the CIT and PIT makes cross country comparisons of PIT challenging.

[16] This is a composite index measuring the quality of public services, the quality of the civil service, the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to policies. See http://info.worldbank.org/governance/wgi/ for more details.

consider the lagged IVs as valid. We use robust errors to correct for heteroskedasticity and serial autocorrelation.[17] We also include interacted group dummy variables with the economic and policy vectors to estimate the specific marginal effects per group on each of the included covariates. These dummies are: eme_i indicating that a country is EME; and $lidc_i$ is a dummy variable indicating that a country is LIDC. These country group dummies capture unobservable time-invariant characteristics relative to the benchmark or base, which is the AEs. They are included in levels (modifying the intercept) as well as interacted with other explanatory variables.

Our panel dataset covers the 2006-2018 period and it was constructed using the IMF World Revenue Longitudinal Database (WoRLD); the World Economic Outlook dataset (WEO); the World Development Indicators (WDI); the Penn World Tables 9.1 (Feenstra, Inklaar, and Timmer 2015); and the Standardized World Income Inequality Database (Solt 2020). These data are complemented with PIT rates and thresholds derived from country income tax summaries compiled by EY (EY Personal Tax Guides) and the International Bureau of Fiscal Documentation (IBFD). This dataset is used throughout the paper. Summary statistics are presented in Appendix 1.

Results

The main regression results are reported in Table 1. Column 1 presents our main specification. Columns 2-6 are robustness checks. Column 2 drops the share of agriculture (which is correlated with the share of self-employment), while Column 3 does the opposite: it drops the share of self-employment. Column 4 adds the natural resource dummy. Column 5 controls for the government effectiveness estimate. Finally, Column 6 adds year dummies to the specification in Column 1 to control for any common occurrence in time affecting PIT revenue. In all specifications, interactions with country groups dummies are read as follows: the net effect of each coefficient is given by the sum of the base coefficient (the AE coefficient) and the interacted country group coefficients for each of the included covariates. The net effect of each coefficient represents the change of the PIT to GDP ratio from an increase in one unit of the explanatory variables.

We focus on the findings in Column 1, as results from other specifications do not vary significantly, including the inclusion of year dummies,[18] unless otherwise indicated below. First, the coefficient for the natural logarithm of GDP per capita is positive and statistically significant, consistent with expectations. For EMEs and LIDCs, the coefficient is smaller, as reflected by the interaction with their respective dummies (a one percent increase in GDP per capita is associated with an increase of the PIT revenue ratio of 0.001 percentage points of GDP in EMEs and 0.002 percentage points of GDP in LIDCs). This remains robust throughout the specifications in Columns 1–6.

The coefficient for the share of agriculture is negative but not statistically significant in the base estimate (AEs). For EMEs, this effect is more than offset, however, by the specific interaction with the EME dummy. Yet, the net impact remains statistically insignificant. For LIDCs, the negative base estimate is offset by the interaction with the LIDC dummy, resulting in a small positive net coefficient which is, however, statistically insignificant. This holds throughout most of the different specifications presented in Columns 1–6. The sole exception is Column 3, where all coefficients exhibit the expected negative signs, although they do not appear to be statistically significant.

[17] In dynamic models, the inclusion of one or more lagged dependent variables can take on strongly significant coefficients which substantially improve the fit of the model but diminish the effects of other covariates. This anomaly has been attributed to cases where a combination of high serial correlation and high correlation among covariates can produce dominating autoregressive terms even when they have little or real explanatory power (For a detailed discussion on the benefits and caveats of dynamic models see: (Achen 2000; Keele and Kelly 2006; Wilkins 2018).

[18] The specification in Column 6 reveals that year dummies are jointly not statistically different from zero.

The base coefficient (AEs) for the share of self-employment is positive and significant, which is unexpected. For EMEs and LIDCs, however, this effect is more than offset by the respective interaction term with the specific dummies by country group, i.e., it is a negative and statistically significant effect for LIDCs, as we expected: a decrease of one percentage points in the share of self-employment is associated with a PIT revenue ratio increase of approximately 0.07 percentage points of GDP. Similarly, in EMEs, a decrease in the share of self-employment is also predicted to improve PIT revenue: a 1 percentage point decrease is associated with an increase of 0.02 percentage points of GDP, a smaller effect relative to LIDCs.

The size of the public sector wage bill is positively and statistically significantly associated with the PIT for the base (AEs), consistent with our expectations. This effect is, however, mitigated in LIDCs and EMEs compared with AEs. On balance, the estimates suggest that an increase in one percentage point of GDP of the public wage bill, all else equal, yields a 0.15 increase in the PIT revenue ratio in LIDCs, and 0.3 percentage points of GDP in EMEs.

The marginal effect of inflation is negative, although statistically insignificant, for the base coefficient (AEs), contrary to our expectations. However, this is more than offset for EMEs and LIDCs, resulting in a positive net effect for them. This points to the existence of bracket creep in these country groups.

Turning to policy variables, the coefficient for the tax threshold is negative in the base regression (AEs) but is more than offset by a positive coefficient for interactions with the LIDC and EME dummies. Hence, the net effect of an increase in the tax liability threshold is positive and statistically significant on PIT revenue, which is counterintuitive. In particular, an increase in the threshold equal to one time the GDP per capita will, all else equal, increases the PIT revenue ratio by 0.02 percentage points of GDP in LIDCs and by 0.04 in EMEs. A potential explanation is that as LIDC and EME countries increase their exemption thresholds, they also reduce other deductions and exemptions which on a net basis cause PIT revenue to increase. Further research could shed light on this question, e.g., by incorporating information about PIT tax expenditures.

In line with expectations, the marginal effect of the lowest non-zero PIT rate on PIT revenue is positive and significant. All else equal, a one percentage point increase in this rate increases the PIT revenue ratio by 0.05 and 0.09 percentage points of GPD in LIDCs and EMEs respectively.

The top marginal PIT rate, surprisingly, has a negative coefficient that is statistically significant at the 1 percent level. It may be consistent with top rates being beyond the top of the Laffer curve in AEs. However, such a conclusion might also be premature, as the regression might suffer from omitted variable that determine the tax base which could be highly correlated with the top PIT rate (e.g., if countries pursued a policy of cuts in the top PIT rate and base broadening measures). In contrast to AEs, for EMEs the coefficient of the top marginal PIT rate is positive and significant. Specifically, a 1 percentage point increase in the top PIT rate comes along with an increase in the PIT revenue ratio of 0.08 percentage points. For LIDCs, the net impact of base coefficient and the interaction with the dummy variable suggest a statistically significant small positive net effect of 0.01.

The coefficient for the deductibility of SSCs from the PIT base is negative and statistically significant, as expected. This effect is smaller for EMEs, while, interestingly, the net effect for LIDCs appears to be positive and statistically significant.

The coefficient for the threshold of the top PIT rate (that is, where an individual would start to pay the maximum marginal PIT rate) is not statistically different from zero. This holds irrespective of whether a country is AE, EME or LIDC and throughout the different specifications.

The coefficient for CIT revenue is negative and statistically significant for the base regression (AEs). Hence, higher CIT revenues tend to come with lower PIT revenues in AEs, pointing to substitution of revenue between CIT and PIT. This effect is somewhat mitigated for EMEs, where the interaction term is positive but small. For LIDCs, however, the net effect of the CIT is positive, significant and relatively large: a 1 percentage point rise in

CIT revenue is associated with an increase by 0.14 percentage points of GDP. This may indicate that administrative improvements that foster CIT revenue might simultaneously promote PIT revenue collection.

The coefficient for VAT revenue is positive and significant for AEs and LIDCs, indicating that rising VAT is also associated with rising PIT, possibly again reflecting general improvements in revenue administration capacity. In EMEs, however, the VAT net coefficient is negative, potentially indicating substitution effects.

A natural resource producer dummy is included in Column 4. The results are positive for AEs and LIDCs, contrary to expectations, and negative for EMEs. In all cases, however, the coefficients are not statistically different from zero.

The effectiveness of government estimate is included as a robustness test in Column 5. The coefficient is positive and statistically significant for the base (AEs). In EMEs and LIDCs, the interaction yields smaller coefficients which are positive and statistically significant. Overall, these results indicate that improvements in the government quality of services are associated with improved PIT revenue. Another point to note is that most of the coefficients remain robust in sign and size with the inclusion of the government effectiveness estimate as a covariate, except for the coefficients for the natural logarithm of GDP per capita, which are of a smaller magnitude in this specification (Table 1, Column 5). This is not surprising, since GDP per capita is generally associated with better institutions and government capacity.

Table 1. PIT Revenue and its Economic and Policy Determinants (2006–2018)

	PIT-to-GDP ratio					
	(1)	(2)	(3)	(4)	(5)	(6)
Economic variables						
Natural logarithm of GDP per capita (constant 2010 US$)	5.722***	5.758***	4.926***	5.610***	4.572***	5.733***
EMEs#c.Natural logarithm of GDP per capita (constant 2010 US$)	-5.626***	-5.501***	-4.720***	-5.494***	-4.562***	-5.628***
LIDCs#c.Natural logarithm of GDP per capita (constant 2010 US$)	-5.506***	-5.705***	-4.170***	-5.488***	-4.421***	-5.484***
Agriculture, forestry, and fishing, value added (% of GDP)	-0.0626		-0.0274	-0.0783	-0.0766	-0.0692
EMEs#c.Agriculture, forestry, and fishing, value added (% of GDP)	0.0312		-0.0740	0.0618	0.0371	0.0332
LIDCs#c.Agriculture, forestry, and fishing, value added (% of GDP)	0.0717		-0.0216	0.101	0.0836	0.0772
Self-employed, total (% of total employment)	0.124***	0.120***		0.125***	0.176***	0.121***
EMEs#c.Self-employed, total (% of total employment)	-0.144***	-0.141***		-0.147***	-0.190***	-0.141***
LIDCs#c.Self-employed, total (% of total employment)	-0.197***	-0.192***		-0.215***	-0.248***	-0.193***
Public sector wage bill (% of GDP)	0.891***	0.892***	0.894***	0.853***	0.949***	0.900***
EMEs#c.Public sector wage bill	-0.591***	-0.589***	-0.558***	-0.550***	-0.644***	-0.596***
LIDCs#c.Public sector wage bill	-0.742***	-0.749***	-0.729***	-0.724***	-0.800***	-0.753***
Inflation, consumer prices (annual %)	-0.339	-0.355	-0.296	-0.354	-0.503**	-0.292
EMEs#c.Inflation, consumer prices (annual %)	0.446*	0.461**	0.409*	0.449**	0.615**	0.417*
LIDCs#c.Inflation, consumer prices (annual %)	0.445*	0.461**	0.477**	0.482**	0.603**	0.415*
Policy variables						
Tax liability threshold (multiples of GDP per capita)	-6.062***	-5.991***	-6.060***	-5.991***	-6.465***	-5.991***
EMEs#c.Tax liability threshold (multiples of GDP per capita)	6.106***	6.038***	6.075***	6.020***	6.500***	6.041***
LIDCs#c.Tax liability threshold (multiples of GDP per capita)	6.083***	5.997***	5.850***	5.973***	6.494***	6.005***
Lowest non-zero marginal PIT rate	0.126***	0.125***	0.119***	0.121***	0.134***	0.124***
EMEs#c.Lowest non-zero marginal PIT rate	-0.0354*	-0.0334	-0.0340*	-0.0300	-0.0386*	-0.0373*
LIDCs#c.Lowest non-zero marginal PIT rate	-0.0772***	-0.0765***	-0.0463**	-0.0806***	-0.0857***	-0.0724***
Maximum marginal PIT rate	-0.143***	-0.141***	-0.131***	-0.144***	-0.121***	-0.142***
EMEs#c.Maximum marginal PIT rate	0.223***	0.219***	0.199***	0.220***	0.192***	0.225***
LIDCs#c.Maximum marginal PIT rate	0.156***	0.155***	0.149***	0.132***	0.138***	0.157***
Corporate Income Tax (CIT) Revenue as a % of GDP	-0.638***	-0.637***	-0.645***	-0.684***	-0.563***	-0.662***

EMEs#c.Corporate Income Tax (CIT) Revenue as a % of GDP	0.670***	0.675***	0.675***	0.689***	0.599***	0.684***
LIDCs#c.Corporate Income Tax (CIT) Revenue as a % of GDP	0.777***	0.798***	0.892***	0.756***	0.713***	0.803***
VAT Revenue as a % of GDP	0.419***	0.403***	0.271**	0.480***	0.390***	0.404***
EMEs#c.VAT Revenue as a % of GDP	-0.435***	-0.421***	-0.254**	-0.492***	-0.418***	-0.422***
LIDCs#c.VAT Revenue as a % of GDP	-0.317**	-0.320**	0.0857	-0.436***	-0.296**	-0.299*
PIT threshold to pay highest marginal rate (multiples of GDP per capita)	-0.0151	-0.0138	-0.0254	-0.0212	-0.0334	-0.0157
EMEs#c.PIT threshold to pay highest marginal rate	0.0140	0.0127	0.0247	0.0198	0.0325	0.0145
LIDCs#c.PIT threshold to pay highest marginal rate	0.0145	0.0138	0.0349	0.0284	0.0311	0.0158
SSC deduction	-1.958***	-1.954***	-1.627***	-1.876***	-1.525***	-1.941***
EMEs#c.sscdeduction	1.086***	1.050***	0.767**	1.081***	0.775**	1.051***
LIDCs#c.sscdeduction	2.084***	2.114***	1.216***	1.838***	1.712***	2.073***
Robustness checks						
Natural resource producer dummy				0.565		
EMEs#c.Natural resource producer				-0.286		
LIDCs#c.Natural resource producer				0.273		
Government effectiviness estimate					2.230***	
EMEs#c.Government effectiviness estimate					-1.901***	
LIDCs#c.Government effectiviness estimate					-2.004***	
Development groups = 2, EMs	54.21***	53.01***	41.95***	52.71***	48.20***	54.09***
Development groups = 3, LIDCs	59.77***	61.46***	38.39***	61.05***	53.50***	59.28***
Constant	-57.15***	-57.55***	-46.61***	-55.78***	-50.49***	-57.18***
Observations	839	841	846	839	839	839
R-squared	0.870	0.870	0.874	0.881	0.881	0.871
Fixed effects	YES	YES	YES	YES	YES	YES
Time effects	NO	NO	NO	NO	NO	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: The dependent variable is the natural logarithm of PIT revenue in percentage of GDP. *LIDCs#*c.X and EME#c.X are interaction terms between the group dummy variables and explanatory variables. AE is used as the base. IV (2SLS) regressions are used to address endogeneity in all of the regressions using economic variables (i.e., GDP per capita, agriculture, share of self-employment, inflation, and their interactions), which are instrumented with their first lags. The performed endogeneity tests fail to reject the hypothesis that our instrumented variables are exogenous, we thus accept them as exogenous. The Durbin and Wu-Hausman p-value is 0.3192.

Beyond marginal effects, it is interesting to use our results to compute the total contribution of each explanatory variable to the observed change in the PIT to GDP ratio over the period and by country group. This will reflect marginal effects as well as the magnitude of the observed change in each explanatory variable. During the 2006-2018 period, the PIT to GDP ratio increased by 3.6, 24.3 and 46.5 percent in AEs, EMEs and LIDCs (equivalent to 0.30, 0.55 and 0.67 percentage points of GDP respectively).[19] The total increase can be decomposed to economic and policy variables using our preferred specification (Table 1, Column 1), as presented in Table 2. The column "percent change for the period" shows the percent change experienced by the main variables included in the model. The column "percent of PIT revenue changes associated to each

[19] The increases in PIT-to-GDP ratios are larger during the 1990-2019 period for LIDCs and EMEs. In the former, PIT revenue, as a share of GDP, grew, on average, from 1 percent of GDP in 1990 to 2.1 percent in 2019; in EMEs, this ratio grew from 1.9 to 3.1 percent of GDP in the same period.

covariate" reflects the total increase in PIT to GDP ratio observed for each group decomposed by the individual contribution of each variable.

This analysis shows that GDP per capita is associated with positive increases in PIT revenue ratios in the amount of 0.12 percentage points of GDP in AEs, and 0.11 in EMEs and LIDCs. Consonantly, the size of the public wage bill, in percent of GDP, has increased across groups and is associated with important increases in the PIT revenue ratio: 0.35 and 1.9 percentage points of GDP in LIDCs and EMEs.

Changes in the explanatory variables can also negatively impact PIT revenue, as is the case with inflation in LIDCs and EMEs where the greater inflation is associated with a PIT revenue ratio reduction of 1.3 and 0.3 in EMEs and LIDCs. Similarly, self-employment, as a share of total employment decreased across groups accounting for an associated 0.7 percentage points of GDP increase in the PIT revenue ratio in LIDCs and 1.06 percentage point increase in EMEs, suggesting that there could be large potential gains from larger formalization in LIDCs and EMEs. This point is supported by the change in the share of agriculture in GDP in EMEs, which experienced a 6.4 percent decrease, and it is associated with a 0.06 percentage points of GDP increase in PIT revenue. However, this does not seem to be the case in LIDCs, where a 16.2 percent reduction in the share of agriculture in the economy is associated with 0.06 percentage points of GDP decrease in PIT revenue.

Table 2. Accounting for the Increase in PIT Revenue in 2006–2018

	Percent change for the period 2006 - 2018			PIT to GDP ratio changes associated to each covariate during the 2006 - 2018 period (Percentage points of GDP)		
Variables	AEs	EMEs	LIDCs	AEs	EMEs	LIDCs
PIT revenue	3.6	24.3	46.5			
GDP per capita (constant 2010 US$)	12.1	21.2	31.2	0.12	0.11	0.11
Agriculture, forestry, and fishing, value added (% of GDP)	-6.3	-6.4	-16.2	0.00	0.06	-0.06
Self-employed, total (% of total employment)	-7.9	-10.2	-7.5	-0.03	1.06	0.72
Wage Bill as a Percentage Of GDP	5.1	17.4	29.7	0.08	1.97	0.35
Inflation, consumer prices (annual %)	-41.9	-46.5	-32.2	0.06	-1.26	-0.34
Tax liability threshold (multiples of GDP per capita)	-0.2	-24.1	-1.5	0.00	-0.06	0.00
Lowest non-zero marginal PIT rate (percent)	1.9	4.7	-17.3	0.01	0.25	-0.19
Maximum marginal PIT rate (percent)	1.0	-13.1	-15.6	-0.01	-1.50	-0.12
CIT revenue as a % of GDP	-10.7	9.2	30.5	0.04	0.04	0.11
VAT Revenue as a % of GDP	4.7	7.9	21.8	0.02	-0.04	0.11
PIT threshold to pay highest marginal rate (multiples of GDP per capita)	44.7	-24.2	-14.8	0.00	0.01	0.00
SSC deduction	-2.9	4.2	-10.6	0.01	-0.11	-0.02
			Total	0.30	0.55	0.67

Source: Authors' calculations based on coefficients from Table 1, Column 1.

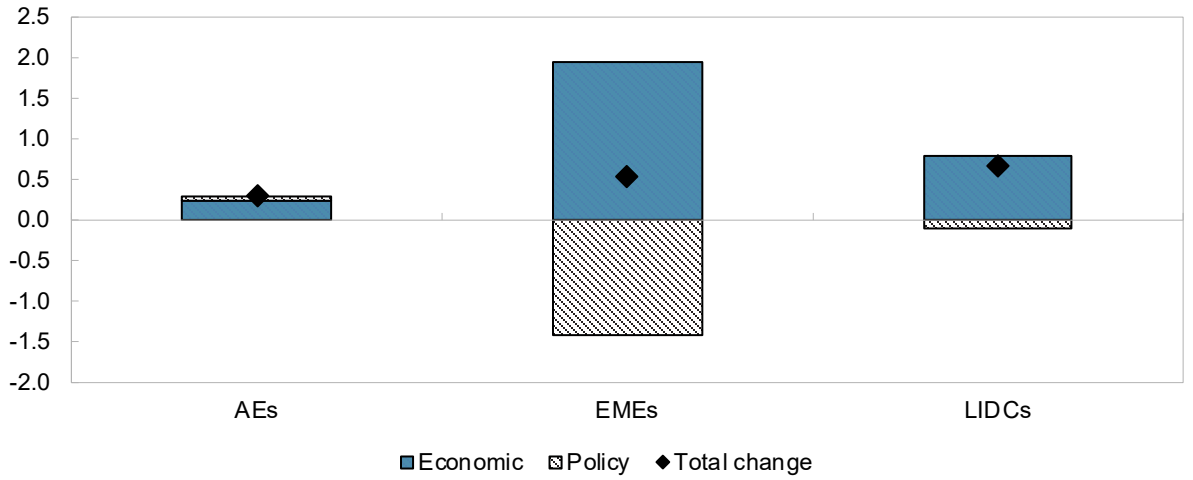
Note: We estimate the differences of the covariates in 2006 and 2018 and estimate the predicted effect of each on total PIT revenue using the coefficients specification in Table 1, Column 1. We then estimate how each of these covariates is predicted to have contributed to the observed differences between PIT revenue in 2006 and 2018.

In LIDCs, most of the observed changes in the PIT design variables are associated with negative changes in the PIT to GDP ratio. The lowest non-zero marginal PIT rate in LIDCS, which fell from 12 in 2006 to 10 percent in 2018, is associated with a 0.19 percentage points of GDP reduction in PIT revenue, while the top marginal PIT rate, which decreased by 15.6 percent, is associated with an overall reduction of the PIT of 0.12 percentage points of GDP. The tax liability threshold was reduced in all three groups but was not found to explain substantial shares of the change of the PIT revenue in LIDCs. While the reduction of the income to start paying the top PIT rate has been substantial in EMEs and LIDCs, it does not explain significant changes in PIT revenue. In EMEs, changes in the PIT design are associated with a net reduction in PIT revenue, with the reduction in the top marginal rate being associated with a 1.5 percentage points of GDP decline in PIT revenue.

Overall, changes in economic variables explain most of the positive yields in the PIT revenue ratio across development groups. The observed changes in PIT design variables account for a negative share in the variation of PIT revenue, a circumstance that might reflect that these changes did not intend to increase PIT revenue (Figure 9). Notably, the composition of these effects differs across groups. While in AEs economic variables are associated with an increase in the PIT revenue ratio of 0.23 percentage points of GDP (78 percent of the total observed change), policy changes have continued to affect PIT revenue in a net positive

manner (9 percent). In EMEs, changes in economic variables would have led to greater increases in PIT revenue (2.0 percentage points of GDP) had it not been for policy changes which, according to the results from the model, mitigated the potential growth in the PIT revenue ratio in -1.4 percentage points of GDP. Finally, in LIDCs, policy changes had an associated negative effect on PIT revenue growth (-0.1 percentage points of GDP), while most of the increase in PIT revenue are accounted for by changes in economic variables: 0.8 percentage points of GDP or 117 percent of the total observed change.

Figure 9. PIT Revenue Growth Explained by Policy and Economic Variables (2006–2018) in percentage points of GDP



Note: The economic variables include GDP per capita, agriculture as a share of GDP, self-employment as a share of total employment, the public sector wage bill as a share of GDP and annual inflation. Included policy variables: PIT threshold, the minimum non-zero PIT marginal rate, the maximum marginal PIT rate, the top threshold to pay the maximum marginal PIT rate, and CIT and VAT revenue as a share of PIT.
Source: IMF calculations based on Table 2.

Overall, these results are consistent with the PIT's historical development in AEs, in the sense that the PIT increased its importance as a tax as countries developed and its economic structure reflected such changes. In LIDCs, the results suggests that changes in economic variables are linked to important improvements in PIT revenue, thus as these countries continue to develop, PIT revenue will follow. Yet, policy changes in PIT design also matter, as shown in the EME country group, where rapid growth in PIT revenue was contained, as suggested by the model, by policy decisions. The extent to which it is advisable to expand the role of the PIT as a revenue provider in the short-term in LIDCs is the focus of the next section.

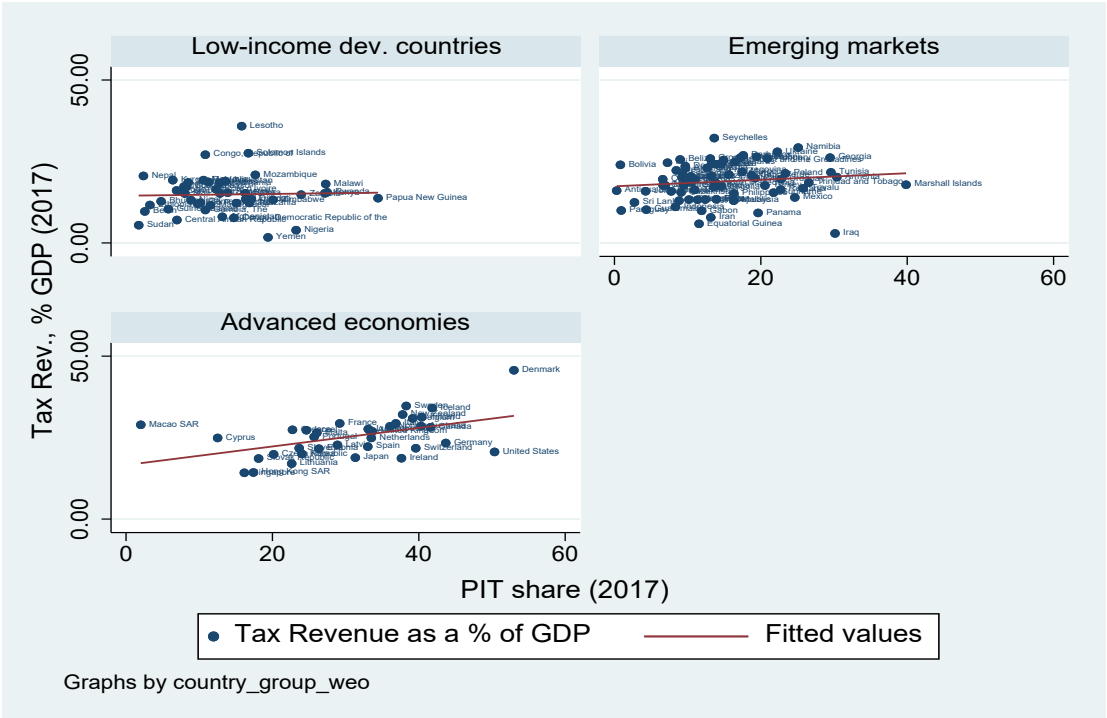
D. The PIT in the Context of the Broader Tax Structure

What has been the PIT's contribution to revenue in the broader tax policy mix alongside other tax instruments? As shown in Figure 2 above, as countries develop, a larger share of tax revenue comes from the PIT. We can further examine the importance of the PIT within a tax system by analyzing the relationship of the share of the PIT in tax revenue with the revenue performance (measured as total tax revenue in percent of GDP) within each country group to measure the main tax source of additional revenue at the margin.

An interesting finding is that in LIDCs revenue performance, as measured by total tax revenue, is not strongly associated with larger shares of the PIT. This is illustrated in the upper left panel of Figure 10, where a

relatively flat association is visible between the PIT share in tax revenue and tax revenue as a percentage of GDP. This is in contrast with the same graph in EMEs (top right panel) and AEs (lower left panel), where a positive association is markedly stronger.

Figure 10. Share of PIT in Revenue and Revenue Performance by Development Group



Sources: IMF staff based on WoRLD, World Economic Outlook

This issue is studied formally in the following setup:

$$rev_{it} = \alpha + \beta.PIT\_share_{it} + \gamma.PIT\_share_{it} * lidc_i + \lambda.PIT\_share_{it} * eme_i + u_{it} \quad \text{(Eq.2)}$$

where rev_{it} is total tax revenue as a share of GDP in year t and in country i, PIT_share_{it} is the share of PIT revenue in total tax revenue. The dummies are treated as in Eq.1, where the AEs coefficient is the base. u_{it} is a random and uncorrelated error term. $PIT\_share_{it} * lidc_i$ and $PIT\_share_{it} * eme_i$ are interaction terms of PIT_share_{it} with the two development group dummies. As above, these common group dummies and their interactions capture unobservable time-invariant characteristics. As above, an instrumental variable 2SLS estimation is used to address possible endogeneity of PIT_share (and its interactions). These variables are instrumented with their first lags.[20]

Results using equation (Eq. 2) and the same dataset as above are presented in Table 3, Column (1). The influence of PIT_share on total tax revenue in AEs (AE being the base, this is the coefficient on PIT_share) is positive and strongly significant. Interestingly and confirming our visual analysis above, the interaction of PIT_share at the LIDC level is negative (also strongly significant), suggesting on balance a still positive but

[20] Endogeneity could stem here from reverse causation, as PIT_share may be influenced by rev. The first lag of PIT_share is likely to directly cause PIT_share and is a useful instrument. Tests not reported here show that it is a strong instrument, being strongly correlated with PIT_share. Simple OLS nevertheless produces very similar results, not reported here.

markedly weaker association of the PIT share with tax revenue in LIDCs. The contribution of the PIT share to tax revenue in EMEs lies at an intermediate value between those in LIDCs and AEs.

Column (2) of Table 3 reports the same regression where the share of VAT in total tax revenue, VAT_share, a critical source of revenue in all development groups, has been added. The nature of the results is unchanged: in AEs, the coefficient on PIT_share is still positive and significant; in LIDCs, it is still markedly lower and significant. Also notice that, with much smaller coefficients on the interaction terms, the VAT contribution does not vary across country groups like in the case of PIT, a fact consistent with the findings from the previous section where we found positive effects of VAT on PIT revenue that did not vary by country groups.

The third regression in Column (3) of Table 2 adds the share of revenue from trade taxes as another robustness test. The results are similar on the point of interest: the association of the PIT share of total revenue is weaker in LIDCs than it is in other country groups. Again, the association of the share of trade taxes with total revenue does not significantly vary across country groups.

Finally, we report in Appendix II regressions where the respective shares of the VAT, trade taxes, excise taxes, property taxes and the corporate income tax are individually tested in turn as explanatory variables of total revenue and are again interacted with development group dummies. We obtain similar results. In contrast to the PIT, the shares of trade taxes, excise taxes, property taxes and the CIT are reported as in fact relatively more conducive to total revenue in LIDCs than they are in AEs. When taken in isolation, the association of the share of the VAT with total revenue does not vary significantly across country groups.

A takeaway from this analysis is that as countries develop and mobilize higher levels of tax to GDP ratio, a larger fraction comes from the PIT. However, this relationship is much weaker within the LIDCs country group, suggesting a development threshold beyond which the PIT becomes an increasingly significant contributor of revenue. Put differently, for less developed countries, marginal tax revenue increase mainly comes from non-PIT taxes, which raise total revenue more than proportionally than the contribution made by the PIT. Whereas in AEs additional revenue is more than proportionally associated to the PIT, hence showing a strong and positive association with revenue performance. EMEs are in an intermediate situation relative to LIDCs and AEs.

Table 3. Tax Revenue and Tax Shares (2006–2017)

VARIABLES	(1) Tax Revenue as a % of GDP	(2) Tax Revenue as a % of GDP	(3) Tax Revenue as a % of GDP
PIT_share	0.288***	0.295***	0.284***
	(0.0178)	(0.0186)	(0.0197)
LIDC#c.PIT_share	-0.0629**	-0.0904***	-0.0964***
	(0.0253)	(0.0257)	(0.0268)
EME#c.PIT_share	-0.191***	-0.222***	-0.229***
	(0.0300)	(0.0304)	(0.0318)
VAT_share		0.0920***	0.0734***
		(0.0162)	(0.0196)
LIDC#c.VAT_share		-0.0473***	-0.0636***
		(0.0176)	(0.0213)
EME#c.VAT_share		-0.0412**	-0.0390*
		(0.0186)	(0.0215)
TradeTaxes_share			-0.100***
			(0.0305)
LIDC#c.TradeTaxes_share			0.0194
			(0.0318)
EME#c.TradeTaxes_share			-0.000534
			(0.0330)
LIDC	-0.763	1.003	2.282**
	(0.603)	(0.846)	(1.063)
EME	-3.834***	-1.986**	-0.380
	(0.611)	(0.846)	(1.078)
Constant (AE)	15.40***	13.17***	14.16***
	(0.554)	(0.804)	(0.982)
Observations	5,636	5,636	5,636
R-squared	0.326	0.334	0.362
Instrumented variables	YES	YES	YES
Interacted group variables	YES	YES	YES

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Sources: WoRLD, World Economic Outlook

Notes: The dependent variable is tax revenue in % of GDP. *PIT_share* is the share of PIT in tax revenue. *VAT_share* is the share of VAT in total tax revenue and *TradeTaxes_share* is the share of taxes from trade. *LIDCt#c.X_share* and *EME#c.X_share* are interaction terms between *PIT_share, VAT_share* and *TradeTaxes_share*, and a categorical variable taking values LIDC (Low-Income Dev. Countries), EME (Emerging Markets) and AE (Advanced Economies). AE is used as the base. IV (2SLS) regressions are used to address endogeneity of the respective tax shares (i.e., *PIT_share*, *VAT_share*, *TradeTaxes_share* and their interacted terms), which are instrumented with their first lags.

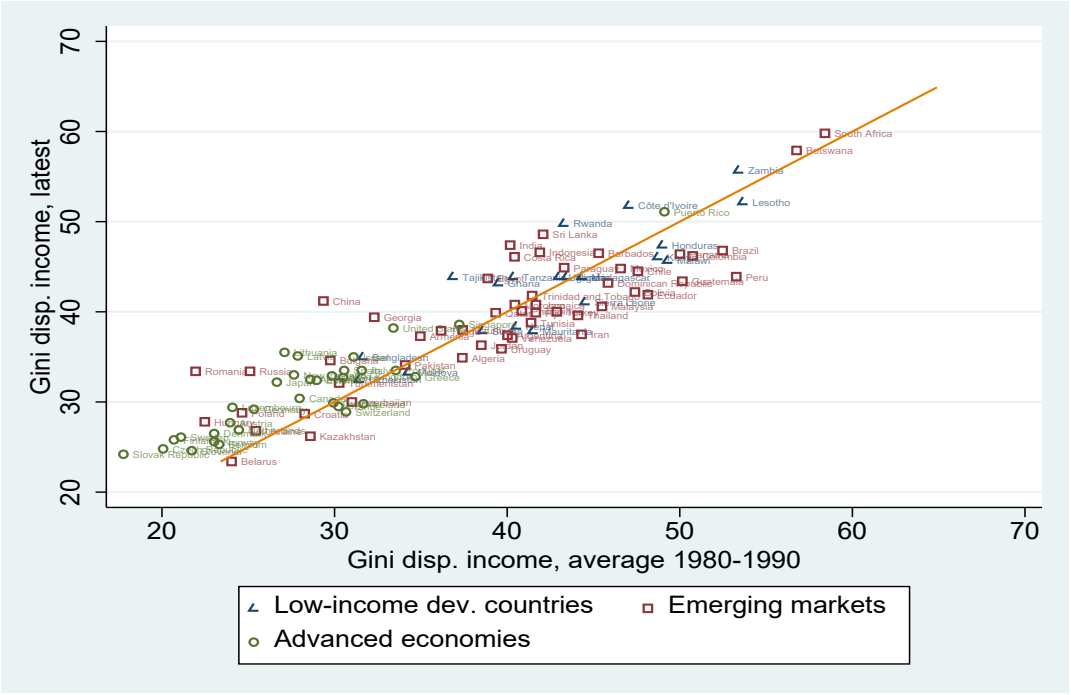
IV. How Progressive are PIT systems?

Market income tends to be distributed unequally. Tax policy can contribute to address this inequality, including through a progressive PIT design. Progressive taxes have an explicit redistributive effect as the after-tax income distribution is made less unequal than the before-tax income distribution.

Inequality remains a pressing issue in LIDCs

While global inequality has declined markedly over the last 40 years as a result of GDP per capita convergence among countries, within-country income inequality remains a key issue in LIDCs and emerging markets – including in the fast-growing economies that have contributed the most to global convergence (World Bank 2016). Figure 11 shows the Gini coefficient of disposable income for the 1980-1990 period and for the latest available year. It shows that that despite the reduction in within-country disposable income [21] inequality in some developing economies (those below the line, for instance Mauritania and Sierra Leone), the opposite trend occurred in other LIDCs (those above the line, for instance Rwanda and Côte d'Ivoire). On average, income inequality in LIDCs and EMEs (blue triangles and red squares in the figure) remains significantly higher than it is in AEs (green dots). Moreover, the effects of the COVID-19 health pandemic have had unequal effects across and within countries, potentially exacerbating inequalities (IMF 2021b), which are not considered in this analysis.

Figure 11. Evolution of Disposable Income Inequality



Source: SWIID Version 8.3, May 2020 (Solt 2020)

[21] Disposable income is defined as the income after PIT, social contributions, and transfers.

PIT progressivity in LIDCs

The PIT uniquely exploits individual income information and has a special role in providing equity to the tax system (Atkinson and Stiglitz 1976). As an economy develops, more formal and productive jobs are created, allowing for increasing PIT revenue and progressivity.

What has been the effective role of the PIT in reducing income inequality in LIDCs? A common measure of the redistributive effects of the PIT is the Musgrave-Thin index, which is calculated as the difference between the Gini coefficients of, respectively, before and after-tax income. This index can be decomposed into its progressivity and size components, reflecting the fact that the redistributive impact of taxation depends not only on how tax rates rise with income (progressivity), but also on total collected taxes as a proportion of aggregate income, referred to as the aggregate tax rate (see Box 2).

Box 2. Measures of Progressivity and Redistribution

As first introduced by Pigou (1928), progressivity has been traditionally measured, for a given level of taxable income, as the ratio of the change in the average tax rate to the change in taxable income. However, this simple measure does not reflect how progressivity varies across the income distribution. The measure used by Peter, Buttrick, and Duncan (2010) captures progressivity over the full distribution by calculating the average tax rate progression over 100 data points in the before-tax income distribution (estimated as the slope of a regression of the average tax rate on income).

Another approach, developed notably by Musgrave and Thin (1948) and Reynolds and Smolensky (1977), measures the redistributive effects of income tax as the difference between the Gini coefficients of respectively before-tax income and after-tax income. The Reynolds-Smolensky index is widely used and captures redistribution over the entire income range. In the same spirit, the progressivity index proposed by Kakwani (1977) is defined as the difference between the Gini coefficients of respectively before-tax income and the income tax. A critical contribution of Kakwani was to rigorously decompose the total redistributive effects of taxation (or transfers) into, on the one hand, progressivity and, on the other hand, the "size" of taxation in the aggregate, as measured by the aggregate tax rate (the average tax rate in the economy). This decomposition is used in Figure 12.

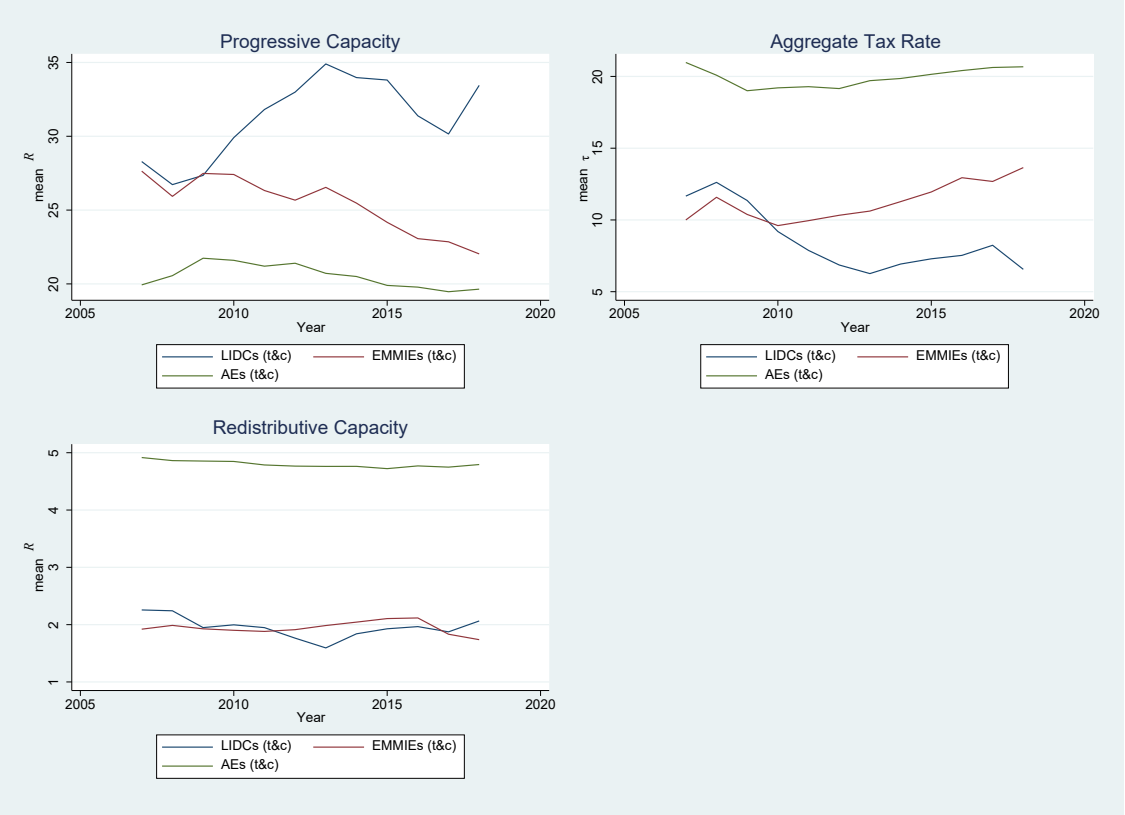
Like the Reynolds-Smolensky index, a limitation of the Kakwani index is that it is a function of the before-tax income distribution – therefore not truly reflecting the intrinsic progressivity of the tax system. The literature has proposed procedures that make redistribution indices comparable across countries and years, controlling for differences in pre-tax distributions. A key methodological contribution is Dardanoni and Lambert (2002), which propose to "transplant" tax (or transfer) regimes that need to be compared into a common base with an identical pre-tax distribution. This is the methodology implemented in Benítez and Vellutini (2021), thus estimating the progressive and redistributive *capacity* indices reported in Figure 12.

Interestingly, the progressive capacity, which measures how fast average tax rates change with taxable income, is often higher in LIDCs than it is in AEs (upper left panel of Figure 12). However, because the aggregate tax rate of the PIT is generally much lower in LIDCs (upper right panel), the resulting redistributive capacity (in terms of the difference in Gini coefficients before and after tax) is markedly lower in LIDCs (lower left panel). The median value of the redistributive capacity is 1.7 in LIDCs and 3.7 Gini points in AEs (2018). Still, it should be stressed that while lower than in AEs, a median capacity of PIT in LIDCs to reduce income inequality by about 1.7 Gini points is far from negligible.

The redistributive capacity of LIDCs is comparable to the redistributive capacity of EMEs, however, the progressive capacity is generally lower, while the aggregate tax rate is higher than in LIDCs, indicating that there is scope for improving progressivity and reducing inequality in EMEs. The comparably low progressivity

observed in EMEs could be explained by the important number of countries with a flat-rate PIT regime within this group of countries.

Figure 12. Progressive and Redistributive Capacities of the PIT by Country Groups (2006–2017)



Sources: IMF, EY, SWIID 9.0
Note: Lognormal before-tax distribution with normalized median Gini coefficient in all countries.

A caveat is that policy factors not or imperfectly captured here would typically erode the redistributive impact of the PIT in LIDCs. Importantly, capital income taxation is typically lower in LIDCs (Appendix 3); while widespread exemptions are commonplace in all development groups, they are likely to limit the effectiveness of PIT in LIDCs more than in other countries groups (Coady, Gupta, and Bastagli 2015).

V. Concluding Remarks

The PIT serves as an effective revenue and redistribution instrument in AEs. These two aspects of the PIT remain relatively modest in LIDCs and EMEs. However, some advances are evident over the last fifteen years, with a rise in PIT revenue markedly faster in LIDCs and EMEs than in AEs. Our analysis suggests that this improvement has been mostly associated and explained by changes in economic variables, as opposed to policy changes. Specifically, GDP per capita and the size of the public sector wage bill, which have grown in LIDCs and EMEs, have been key drivers of PIT revenue in those countries, while the decline in the share of self-employment has further supported PIT revenue. Policy changes have had weaker and often more complex effects across country groups. Overall, the observed changes in the PIT policy parameters during the 2006-

2018 period contributed negatively to PIT revenue in LIDCs and EMEs. Interestingly, improvements in CIT revenue go together with rising PIT in both EMEs and LIDCs, possibly reflecting improvements in the tax administration's capacity.

As economies grow and raise more tax revenue, a larger fraction comes from the PIT. This relationship is much weaker within LIDCs, suggesting that additional revenue does not predominantly comes from the PIT but from all revenue sources jointly. This is different in EMEs and especially in AEs, where a larger proportion of marginal revenue changes is due to changes in the PIT. This is consistent with the existence of a development threshold beyond which the PIT becomes an increasingly significant contributor of tax revenue.

Finally, the analysis shows that the redistributive capacity of the PIT in LIDCs is significant and important. This is due to a progressive design of the PIT in that country group -- but the overall redistributive capacity is constrained by the small size of the aggregate PIT rate. On balance, redistribution through the PIT in LIDCs is considerably smaller than it is in AEs but similar to that in EMEs This suggests that there is scope to raise revenue, improve progressivity and reduce inequality in EMEs through a better design of the PIT.

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Appendix 1. Summary Statistics

Summary Statistics: LIDCS (2006–2019)

Variable	Obs	Mean	Std. Dev.	Min	Max
PIT revenue % of GDP	594	1.91	1.47	0.03	7.68
GDP per capita in constant USD	729	1,091.53	631.55	208.07	3,712.39
Agriculture % of GDP	710	24.01	11.59	1.15	65.60
Share of labor income of employees	406	0.29	0.14	0.08	0.65
Self-employment (share of total employment)	756	74.64	15.11	28.93	95.10
Inflation, % changes in consumer prices	728	7.97	17.51	-8.97	380.00
Public sector wage bill (% of GDP)	642	6.11	2.90	0.77	19.37
Minimum non-zero PIT rate (percent)	498	11.00	6.72	0.20	30.00
Maximum marginal PIT rate (percent)	498	31.28	10.62	10.00	60.00
VAT revenue % of GDP	373	4.02	2.20	0.00	14.46
CIT % of GDP	594	2.29	1.68	0.16	11.23
Tax liability threshold (multiples of GDP per capita)	477	2.99	12.34	0.00	108.31
Income to pay maximum PIT rate (Multiples of GDP per capita)	477	34.13	141.15	0.09	1,237.87

Summary Statistics: EMEs (2006–2019)

Variable	Obs	Mean	Std. Dev.	Min	Max
PIT revenue % of GDP	1,060	2.63	1.88	0.00	10.39
GDP per capita in constant USD	1,348	8,807.24	8,992.05	762.52	69,679.09
Agriculture % of GDP	1,287	8.07	6.11	0.09	34.00
Share of labor income of employees	1,022	0.39	0.11	0.15	0.67
Self-employment (share of total employment)	1,218	34.68	17.88	0.41	88.41
Inflation, % changes in consumer prices	1,285	5.31	10.07	-10.07	254.95
Public sector wage bill (% of GDP)	1,104	8.79	4.05	0.57	45.10
Minimum non-zero PIT rate (percent)	1,026	11.43	6.12	0.15	30.00
Maximum marginal PIT rate (percent)	1,080	24.82	11.24	0.00	58.95
VAT revenue % of GDP	893	6.49	2.66	0.06	18.89
CIT % of GDP	1,122	3.62	3.39	0.00	41.53
Tax liability threshold (multiples of GDP per capita)	812	0.83	1.25	0.00	8.54
Income to pay maximum PIT rate (Multiples of GDP per capita)	812	10.39	30.14	0.05	492.82

Summary Statistics: AEs (2006–2019)

Variable	Obs	Mean	Std. Dev.	Min	Max
PIT revenue % of GDP	510	7.99	4.31	0.32	26.35
GDP per capita in constant USD	517	42,648.22	20,261.76	11,383.52	111,968.40
Agriculture % of GDP	481	1.84	1.24	0.03	7.04
Share of labor income of employees	518	0.51	0.06	0.30	0.66
Self-employment (share of total employment)	504	14.54	5.76	6.09	36.99
Inflation, % changes in consumer prices	535	1.87	1.91	-4.48	15.40
Public sector wage bill (% of GDP)	452	10.39	2.71	3.51	17.51
Minimum non-zero PIT rate (percent)	526	14.71	8.93	0.77	42.00
Maximum marginal PIT rate (percent)	526	34.15	11.65	12.00	55.00
VAT revenue % of GDP	465	6.72	1.90	1.68	10.91
CIT % of GDP	497	3.20	1.61	0.16	12.59
Tax liability threshold (multiples of GDP per capita)	471	0.22	0.23	0.00	1.10
Income to pay maximum PIT rate (Multiples of GDP per capita)	471	3.45	3.38	0.46	21.44

Total sample (2006–2019)

Variable	Obs	Mean	Std. Dev.	Min	Max
PIT revenue	2,164	3.70	3.53	0.00	26.35
GDP per capita in constant USD	2,608	13,528.00	18,710.09	208.07	111,968.40
Agriculture % of GDP	2,492	11.37	11.28	0.03	65.60
Share of labor income of employees	1,946	0.40	0.13	0.08	0.67
Self-employment (share of total employment)	2,492	42.56	27.24	0.41	95.10
Inflation, % changes in consumer prices	2,561	5.33	11.97	-10.07	380.00
Public sector wage bill (% of GDP)	2,198	8.34	3.82	0.57	45.10
Minimum non-zero PIT rate (percent)	2,063	12.09	7.28	0.00	42.00
Maximum marginal PIT rate (percent)	2,117	28.51	12.09	0.00	60.00
VAT revenue % of GDP	1,731	6.02	2.60	0.00	18.89
CIT % of GDP	2,227	3.16	2.74	0.00	41.53
Tax liability threshold (multiples of GDP per capita)	1,760	1.38	6.57	0.00	108.31
Income to pay maximum PIT rate (Multiples of GDP per capita)	1,760	14.97	77.19	0.05	1,237.87

Appendix 2. Tax Revenue and Tax Shares – Additional Regressions

VARIABLES	(1) Tax Revenue as a % of GDP	(2) Tax Revenue as a % of GDP	(3) Tax Revenue as a % of GDP	(4) Tax Revenue as a % of GDP	(5) Tax Revenue as a % of GDP	(6) Tax Revenue as a % of GDP
PIT_share	0.288***					
	(0.0178)					
LIDCs#c.PIT_share	-0.0629**					
	(0.0253)					
EMEs#c.PIT_share	-0.191***					
	(0.0300)					
VAT_share		0.0675***				
		(0.0155)				
LIDCs#c.VAT_share		0.00153				
		(0.0172)				
EMEs#c.VAT_share		-0.00744				
		(0.0177)				
TradeTaxes_share			-0.308***			
			(0.0308)			
LIDCs#c.TradeTaxes_share			0.208***			
			(0.0317)			
EMEs#c.TradeTaxes_share			0.198***			
			(0.0331)			
Excises_share				-0.277***		
				(0.0388)		
LIDCs#c.Excises_share				0.251***		
				(0.0421)		
EMEs#c Excises_share				0.399***		
				(0.0463)		
Propr_share					-0.227***	
					(0.0393)	
LIDCs#c.Propr_share					0.167**	
					(0.0687)	
EMEs#c.Propr_share					0.612***	
					(0.125)	
CIT_share						-0.254***
						(0.0294)
LIDCs#c.CIT_share						0.249***
						(0.0316)
EMEs#c.CIT_share						0.290***
						(0.0325)
LIDC	-0.763	-7.563***	-6.717***	-10.87***	-9.544***	-10.99***
	(0.603)	(0.457)	(0.288)	(0.559)	(0.433)	(0.493)
EME	-3.834***	-11.52***	-10.52***	-16.23***	-14.14***	-15.75***
	(0.611)	(0.469)	(0.395)	(0.560)	(0.438)	(0.522)
Constant (AE)	15.40***	23.24***	25.37***	27.75***	26.33***	27.75***
	(0.554)	(0.408)	(0.201)	(0.509)	(0.388)	(0.440)
Observations	5,636	5,636	5,636	5,636	5,636	5,636
R-squared	0.326	0.273	0.309	0.271	0.265	0.271

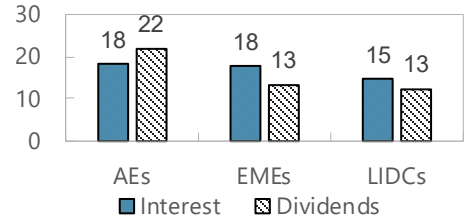
Appendix 3. Stylized Facts of the PIT's Treatment of Capital Income

Capital income arises from investment in the form of interest, dividends, capital gains, and others such as rents, annuities, royalties.[22] Taxation of capital income has received increased attention in recent years as more evidence has come to light documenting the decline in the share of labor income in advanced and emerging economies (IMF 2017; Bengtsson and Waldenström 2018; Karabarbounis and Neiman 2014) and the reduction in progressivity of tax systems (Gerber et al. 2018).

Interest

An analysis of the nominal PIT rates applied to interest shows that the interest rates are, on average, higher in more developed countries. In most cases, where income is taxed on a schedular basis, interest rates are lower than the top marginal PIT rates applied to employment income. In AEs, the average rate levied on returns to savings (interest income) is 18 percent, which, while above the lowest marginal rates on labor income (15 percent), is well below the top marginal rate (39 percent). This is also true for EMEs and LIDCs, where the average rates are 18 and 15 (Figure 12), below the top marginal rates levied on labor income (24 and 29 percent).

Figure A1. Average Withholding Rates on Interest and Dividend (2018)



Source: IMF Staff compilation.

Dividends

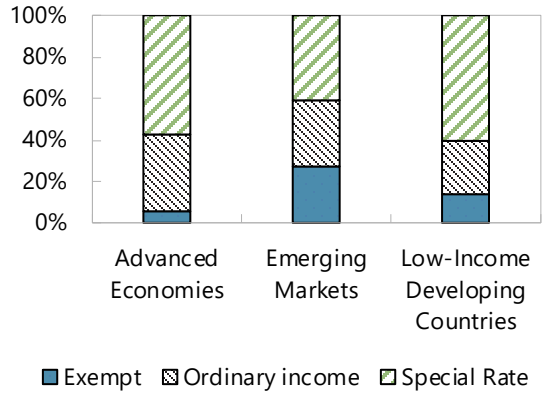
In most countries when corporate profits are distributed to shareholders in the form of dividends, a special dividend PIT rate is applied. Nominal dividend rates display a similar pattern to those on interest, PIT rates levied on dividends rise with the level of development (Figure 12). In 2019, AEs averaged 22 percent, this figure decreased to 13 percent in EMEs and LIDCs. It is important to acknowledge that dividends merit a special and thorough discussion since an investment made in shares of a corporation entitles the individual shareholder to partial ownership.

Capital gains

Capital gains, if taxed at all, may be taxed at the regular rate at which the overall income of the individual is or may be taxed separately at a special rate for capital gains. The survey of tax treatments of capital gains reveals that special rates are the predominant form to tax capital gains. Indeed, 57, 41 and 60 percent of countries in AEs, EMEs and LIDCs use a special rate, while 37, 31 and 26 percent tax capital gains as part of the ordinary income (Figure A1).

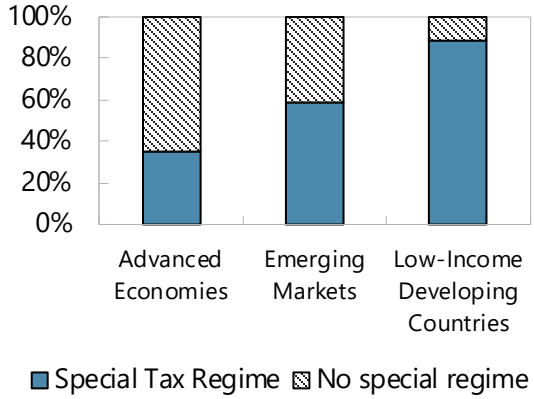
[22] Despite the different tax treatment afforded to capital and employment income, PIT revenue statistics rarely present this breakdown, making it difficult to provide an in-depth analysis

Figure A2. Taxation of capital gains (2018)



Source: IMF staff calculations based on IBFD tax country summaries.

Figure A3. Special tax regimes for unincorporated business income (2017)



Source: IMF staff calculations based on (Crandall, Gavin, and Masters 2019))

Business income

Business income is a complex concept as the income it generates is part labor and part return on investment.[23] Self-employed individuals, sole-proprietors or unincorporated business that carry out business activities are a challenge to revenue authorities everywhere, but especially in LIDCs and EMEs where they often operate in low-productivity activities and their numbers are large. Enforcing the PIT on these taxpayers would require extensive resources, most likely for a relatively low potential revenue. To cope with this sector, countries have implemented special tax regimes for small business taxpayers. Indeed, LIDCs and EMEs often have special presumptive tax regimes that replace the income taxes completely but there are also optional regimes that give the taxpayer an arbitrage opportunity. In LIDCs almost 90 percent of countries have some scheme to tax on a presumptive basis. In EMEs the share is 59 percent and the percentage of countries with this type of scheme falls to 35 in AEs (Figure A2).

[23] The PIT and the CIT are intrinsically related in this respect, since capital income can be taxed both at the corporate and the personal level, thus potentially inducing important behavioral responses. This is an important reason to aim at broadly harmonizing the rates of the PIT and the combined burden of CIT and dividend/capital gains taxation (IMF, 2014). In both EMEs and LIDCs, the CIT is relatively more important, representing 19 and 16 percent of total tax revenues respectively, a larger share when compared with the 10 percent in AEs (Figure 4).

PUBLICATIONS

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